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<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREDICTION OF OUTCOME AFTER GASTROPLASTY BY PSYCHOLOGICAL FACTORS AND DIET HISTORY</td>
<td>1</td>
</tr>
<tr>
<td>Victoria L. Valley and D. Michael Grace, M.D., Ph.D.</td>
<td></td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>4</td>
</tr>
<tr>
<td>PREDICTORS OF WEIGHT LOSS AFTER STAPLED GASTROPLASTY FOR MORBID OBESITY</td>
<td>5</td>
</tr>
<tr>
<td>Lynn P. Clemow; Ph.D.; Robert E. Brolin, M.D.;</td>
<td></td>
</tr>
<tr>
<td>Daniel P. Greenfield, M.D.; Karen A. Kasnetz, R.D.; and</td>
<td></td>
</tr>
<tr>
<td>Thomas M. Fynan, B.S.</td>
<td>11</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td></td>
</tr>
<tr>
<td>THE PREDICTION OF WEIGHT LOSS FOLLOWING BARIATRIC SURGERY</td>
<td>13</td>
</tr>
<tr>
<td>Joseph Barrash; Evelyn M. Rodriguez; David H. Scott;</td>
<td></td>
</tr>
<tr>
<td>Jacob O. Sines Ph.D.; and Edward E. Mason, M.D., Ph.D.</td>
<td>16</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td></td>
</tr>
<tr>
<td>PREOPERATIVE BASAL AND EXERCISE BMR AS PREDICTORS OF WEIGHT LOSS IN GASTRIC BARIATRIC SURGERY</td>
<td>18</td>
</tr>
<tr>
<td>Kenneth J. Printen, M.D. and Donald Zavala, M.D.</td>
<td></td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>23</td>
</tr>
<tr>
<td>STATISTICAL ANALYSIS OF WEIGHT LOSS AFTER GASTRIC BYPASS, PREDICTORS OF RESULTS</td>
<td>24</td>
</tr>
<tr>
<td>John D. Halverson, M.D.</td>
<td></td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>33</td>
</tr>
<tr>
<td>RADIONUCLIDE GASTRIC EMPTYING BEFORE AND AFTER TRANSVERSE GASTROPLASTY</td>
<td>34</td>
</tr>
<tr>
<td>D. Michael Grace, M.D. and W. C. Vezina, M.D.</td>
<td></td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>38</td>
</tr>
<tr>
<td>POUCH EMPTYING OF SOLID FOODS AFTER GASTROPLASTY FOR MORBID OBESITY</td>
<td>36</td>
</tr>
<tr>
<td>Teis Andersen, M.D.; B. Hojlund Pedersen; J. H. Henriksen; and A. Uhrenholdt</td>
<td></td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>38</td>
</tr>
<tr>
<td>PRESIDENTIAL ADDRESS</td>
<td>39</td>
</tr>
<tr>
<td>Edward E. Mason, M.D., Ph.D.</td>
<td></td>
</tr>
</tbody>
</table>
CHANGES IN MENSTRUAL CYCLE PATTERN AND SEX HORMONE BINDING AFTER GASTROPLASTY

D. Michael Grace M.D., Ph.D.; J. A. Nisker, M.D.;
and G. L. Hammond

DISCUSSION

OBSTRUCTIVE SLEEP APNEA IN THE MORBIDLY OBESE PATIENT:
CONSIDERATIONS AND THERAPY

Michael D. Poole, M.D. and Duncan S. Postma, M.D.

DISCUSSION

EFFECT OF GASTROPLASTY AND WEIGHT LOSS ON IMMUNE RESPONSE

D. M. Grace, M.D., Ph.D.; I. A. Harle, M.D.;
K. M. Rycroft, B.Sc.; and N. R. S. Sinclair, M.D., Ph.D.

PINK URINE IN MORBIDLY OBESE PATIENTS FOLLOWING GASTRIC PARTITIONING

Mervyn Deitel, M.D.; Douglas A. Thompson;
Colin F. Saldanha; and Max C. Patterson

DISCUSSION

THE FATE OF STOMAL SILASTIC RING SUPPORT IN ROUX-EN-Y GASTRIC BYPASS

John H. Linner, M.D. and Raymond L. Drew, M.D.

DISCUSSION

VERTICAL BANDED GASTROPLASTY AS AN ANTIREFLUX PROCEDURE

Mervyn Deitel, M.D.; John Hagen; Rokesh K. Khanna; and Riivo Ilves

DISCUSSION

WORKSHOP--STATISTICAL EVALUATION OF RESULTS

SURGICAL REVISION OF THE JEJUNOILEAL BYPASS

Mark E. Pessa, M.D.; John W. Robertson, M.D.; and Edward R. Woodward

DISCUSSION

LEAKS FOLLOWING GASTRIC BARIATRIC OPERATIONS

Joseph A. Buckwalter, M.D. and Charles A. Herbst, M.D.

DISCUSSION
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOMITING AFTER GASTROPLASTY</td>
<td>121</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>127</td>
</tr>
<tr>
<td>GASTROPLASTY REVISIONS AND THEIR ASSOCIATED COMPLICATIONS</td>
<td>128</td>
</tr>
<tr>
<td>Kenneth B. Jones, M.D.</td>
<td></td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>135</td>
</tr>
<tr>
<td>GASTRIC VOLUME IN BILIOPANCREATIC BYPASS</td>
<td>136</td>
</tr>
<tr>
<td>Nicola Scopinaro, M.D.; Ezio Gianetti, M.D.; D. Freedman; G. F. Adami; E. Traverso; and V. Bachi</td>
<td></td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>137</td>
</tr>
<tr>
<td>EFFECT OF BILIOPANCREATIC BYPASS ON HYPERCHOLESTEROLEMIA AND HYPERTRIGLYCERIDEMIA</td>
<td>138</td>
</tr>
<tr>
<td>Ezio Gianetti, M.D.; D. Friedman; G. F. Adami, M.D.; E. Traverso; M. Castagnola; and Nicola Scopinari, M.D.</td>
<td></td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>141</td>
</tr>
<tr>
<td>DISCUSSION OF POSTER SESSION</td>
<td>143</td>
</tr>
<tr>
<td>CONTINUOUS ABSORBABLE VS INTERRUPTED NONABSORBABLE SUTURE FOR MIDLINE FASCIAL CLOSURE</td>
<td>153</td>
</tr>
<tr>
<td>Paul W. McNeill, M.D. and Harvey J. Sugerman</td>
<td></td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>154</td>
</tr>
<tr>
<td>INTRAOPERATIVE GALLBLADDER EXAMINATION WITH MICROSCOPIC BILE ANALYSES</td>
<td>155</td>
</tr>
<tr>
<td>L. Michael Howell, M.D.</td>
<td></td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>163</td>
</tr>
<tr>
<td>GASTRIC BANDING VS VERTICAL BANDED GASTROPLASTY: A THREE-YEAR FOLLOW-UP STUDY</td>
<td>164</td>
</tr>
<tr>
<td>Lars Granström, M.D.</td>
<td></td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>168</td>
</tr>
<tr>
<td>BANDED FUNDAL EXCLUSION</td>
<td>169</td>
</tr>
<tr>
<td>Douglas S. Hess, M.D.</td>
<td></td>
</tr>
<tr>
<td>LONG-TERM RESULTS OF VERTICAL SILASTIC-BANDED GASTROPLASTY</td>
<td>179</td>
</tr>
<tr>
<td>Otto L. Willbanks, M.D.</td>
<td></td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>186</td>
</tr>
</tbody>
</table>
SECTION MODERATOR: John D. Halverson, M.D.

PREDICTION OF OUTCOME AFTER GASTROPLASTY BY PSYCHOLOGICAL FACTORS AND DIET HISTORY

Victoria L. Valley and D. Michael Grace, M.D., Ph.D.

INTRODUCTION

Better patient selection may help to achieve the best weight loss with the fewest complications after gastroplasty for morbid obesity. In an attempt to improve the selection process, we investigated the ability of psychological factors and diet history to determine postoperative results.

METHODS

Fifty-seven obese patients (6 men, 51 women) were studied. The operation was a transverse gastroplasty with Marlex support of a greater curve channel. Psychological assessment included preoperative psychiatric history, preoperative Minnesota Multiphasic Personality Inventory (MMPI) and major life events and quality of social support during the first postoperative year. Diet history assessed prior involvement in group plans, doctor-prescribed plans, diet pills, "crash" diets, fasting, and other diets such as acupuncture. Medical complications during the first postoperative year were rated blindly by the surgeon as none, mild (e.g. mild vomiting, abdominal pain), moderate (e.g. prolonged vomiting not requiring admission, peptic ulceration) and severe (any complication requiring hospital admission). Psychological complications included patients who were referred for or sought psychological treatment postoperatively. An MMPI score of 70 or more (2 or more standard deviations above the mean) was indicative of psychopathology.

RESULTS

A history of preoperative inpatient psychiatric admission was significantly related to medical and psychological complications (Table I). Twelve of 16 patients with this history had moderate to severe medical complications and 9 had psychological complications. Only 2 had neither problem. Of the 41 with no inpatient psychiatric history 33 had no complications, 6 had medical and 4 had psychological complications. Outpatient psychiatric history had no predictive value.
MMPI over 70, negative life events (e.g. divorce, financial problems) and poor social support also correlated with medical and psychological complications. None of these factors predicted weight loss. Preoperative history of group diet plans was inversely related to medical complications. Fasting and crash diets were positively related to medical and psychological complications. Other diets did not predict complications and no preoperative diet predicted weight loss.

CONCLUSIONS

Morbidly obese patients with a history of inpatient psychiatric admission have an increased risk of medical complications (usually vomiting) after gastroplasty. Abnormal preoperative MMPI, negative life events and reduced social support also have predictive value. It may be appropriate to postpone operation or plan alternative treatment for such patients. If gastroplasty is performed careful postoperative follow-up is essential. Medical complications may be reduced in patients who have had the discipline to accept a group diet plan and increased in the impulsive type of patients who briefly follow crash diets. Better methods are needed to select those patients who will be most successful in losing weight after gastroplasty. Longer follow-up is necessary to determine the final outcome.
TABLE I
RELATIONSHIP BETWEEN PSYCHOLOGICAL FACTORS, DIET HISTORY, AND RESULTS AFTER GASTROPLASTY (p values)

<table>
<thead>
<tr>
<th></th>
<th>MEDICAL COMPLICATIONS</th>
<th>PSYCHOLOGICAL COMPLICATIONS</th>
<th>WEIGHT LOSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychiatric History</td>
<td>0.001</td>
<td>0.02</td>
<td>--</td>
</tr>
<tr>
<td>MMPI 70</td>
<td>0.001</td>
<td>0.03</td>
<td>--</td>
</tr>
<tr>
<td>Negative Life Events</td>
<td>0.001</td>
<td>0.01</td>
<td>--</td>
</tr>
<tr>
<td>Social Support</td>
<td>0.005 (-)</td>
<td>0.02 (-)</td>
<td>--</td>
</tr>
<tr>
<td>Group Plans</td>
<td>0.01 (-)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Fasting</td>
<td>0.02</td>
<td>0.03</td>
<td>--</td>
</tr>
<tr>
<td>Crash Diets</td>
<td>0.04</td>
<td>0.03</td>
<td>--</td>
</tr>
<tr>
<td>Diet Pills</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Family Doctor Diet</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Other</td>
<td>--</td>
<td>--</td>
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</table>

NOTE: (-) indicates inverse relationships
HALVERSON: Are there questions?

QUESTION: Did the patients have a long medical history prior to being put into the study?

GRACE: No, they didn't.

COWAN: (George Cowan, Memphis, TN) What was the weight loss?

GRACE: The weight loss for this type of transverse gastroplasty was 25% of body weight at the end of six months and 33% or one-third of body weight at the end of the first postoperative year. I did 155 of these operations before stopping.

COWAN: How do they relate to the MMPI?

GRACE: There was no correlation.

QUESTION: Do you recommend routine preoperative psychiatric evaluation?

BUCKWALTER: (Joseph A. Buckwalter, Chapel Hill, NC) I would like to answer that question. When we began to do this surgery ten years ago we did multiphasic personality testing on all the patients and had them interviewed by a psychiatrist. It very quickly became evident that when they did see the patients their contribution was generally negative, so we discontinued this service. The only patients that I think should be referred to psychiatrists are ones that present with specific problems, for example, unreal expectations of the operation.

GRACE: We would agree with that. In fact, I've had much more help from Dr. Valley and the psychologists than I have from the psychiatrists. But, for most patients, even the psychological assessment is not necessary. There's still no doubt, however, that these patients, whether they get it from the psychologist or the surgeon or the dietitian, need postoperative support and benefit from it. That is still a very essential part of this type of surgery, not just for a few months but on a long-term basis.
Since the outset of the era of gastric reduction surgery for morbid obesity bariatric surgeons have been searching for an operation which would result in satisfactory long-term weight loss for the great majority of patients. During the course of this search, the basic prototype operations, gastroplasty and gastric bypass, have undergone numerous technical modifications. Gastric reduction operations have been designed to modify eating behavior by preventing consumption of large quantities of solid food at one time. It has become apparent that some morbidly obese patients will not achieve adequate weight loss with technically intact operations. Behavioral and psychosocial variations among morbidly obese patients are probably also relevant determinants of long-term weight loss. Since the beginning of our program for the surgical treatment of morbid obesity we have utilized a multidisciplinary team approach including the expertise of a clinical dietitian, psychologist and psychiatrist. Our studies have been oriented towards observing the effects of gastric reduction operations upon eating behavior, postoperative psychosocial adjustment and long-term weight loss.

CLINICAL MATERIAL

In March, 1981 we began performing a suture reinforced horizontal gastroplasty. This operation partitioned the stomach with the TA-55 stapler leaving a 20 ± 5 cc upper gastric pouch with a central 9 mm stoma leading to the remainder of the digestive tract. The stoma was reinforced with interrupted through-and-through silk sutures on either side to minimize stomal dilatation. We have performed this operation on 56 morbidly obese patients. Prior to operation, all patients underwent separate screening interviews with the operating surgeon, clinical dietitian and psychiatrist or psychologist. The dietitian obtained a detailed diet history that focused on individual food preferences and eating patterns. The psychological evaluation consisted of a detailed personal interview oriented towards determining the patient's psychological stability, basic understanding of the operation and commitment to long-term follow-up. Psychological tests included the
Symptom Check List 90 (SCL-90), Zung self-rating depression scale and a standard intelligence test. Forty-two patients (75%) have been followed at regular intervals for 12-18 months. All patients were seen at three month intervals during the first postoperative year, then at four to six month intervals thereafter. Patients remained on a modified full liquid diet for six weeks prior to the introduction of soft solid foods.

The present study was designed to learn what factors in the patient profile correlated with weight loss outcome at 12 months postoperatively. Six predictor variables were selected for statistical analysis. These variables included: (1) initial percentage over ideal body weight; (2) age; (3) level of psychopathology as measured by the SCL-90 T-score; (4) level of life stress measured in life change units; (5) number of preoperative food count contacts per day; (6) socioeconomic status.

Weight loss outcome was rated on a 3 point scale as shown in Table 1. Patients in Group 1 were considered as successful results by all criteria. Patients in Group 2 were considered successful in that they had notable improvement of obesity-related medical problems with a lesser degree of weight loss. Patients in Group 3 were considered failures as they were either still morbidly obese by weight criteria or had not shown improvement of obesity-related medical problems.

RESULTS

The distribution of patients according to weight loss outcome group was: Group 1 - 18 patients; Group 2 - 5 patients; Group 3 - 19 patients. Pearson product-moment correlations were computed between each of the predictor variables and the outcome measure. The initial percentage above ideal weight was strongly correlated with outcome ($p \leq 0.0007$) in that a lower preoperative weight was associated with the most successful weight loss. Age was also significantly correlated with outcome ($p \leq 0.05$). There was a linear relationship between preoperative weight and outcome classification. The lightest morbidly obese patients were the most successful and the heaviest patients comprised nearly all of the failures found in Group 3. Although weight was related in a linear fashion to outcome, age was not, in that Group 1 and Group 3 patients were both younger than the intermediate Group 2. The number of preoperative food contacts and the level of life stress correlated with
outcome at roughly equal levels that approached statistical significance ($p \leq 0.06$). The SCL-90 T-score and socioeconomic status did not correlate with outcome. A discriminant function analysis correctly classified 75% of patients into outcome groups with 100% accuracy for the Group 1 patients. Weight and age were the two most powerful variables in the multivariate equation.

Further differentiation of Group 1 and Group 3 patients was attempted by examining the other variables studied. Surprisingly Group 1 patients had the highest levels of life stress. They reported more symptoms on the SCL-90, most commonly on the interpersonal sensitivity and depression scales. Group 1 patients also had fewer preoperative food contacts per day. Group 3 patients were heavier and had more food contacts per day. Although they had lower levels of life stress, their SCL-90 scores were nearly as elevated as the Group 1 patients. The interpersonal sensitivity scale was the only scale that was consistently elevated in the Group 3 patients.

**DISCUSSION**

Throughout the history of gastric reduction surgery for morbid obesity weight loss problems have been primarily attributed to technical flaws in the operations themselves. Recently it has become apparent that some patients can defeat technically sound operations by dietary "maladaptation." This maladaptation takes the form of eating the types of food that do not produce much satiety including liquids and soft solids such as ice cream, pastry, candy, and salty junk food. When we began our study of stapled gastroplasty in 1981, the long term results of that operation were unknown. Our goal was to study the effectiveness of gastroplasty on postoperative eating behavior and psychosocial adjustment. The core group of investigators included a surgeon (Robert E. Brolin), a dietitian (Karen A. Kasnetz), a psychiatrist (Daniel P. Greenfield), and a psychologist (Lynn P. Clemow). By utilizing a multidisciplinary team approach we hoped to discern what behavioral and psychological factors might be important in influencing the long term outcome of these operations.

After analyzing our data from the first 56 gastroplasty patients, we selected six intake variables for statistical analysis. These particular
variables were selected in an attempt to include anthropomorphic, psychological and behavioral factors. The anthropomorphic variables, preoperative weight and age, were the only ones that statistically correlated with outcome, though the number of preoperative daily food contacts and level of life stress correlated with outcome at levels that approached statistical significance \( p \leq 0.06 \). The three point outcome classification was designed to stratify patients according to both the weight loss result and improvement of obesity-related medical problems. Patients in Group 1 whose final weight was within 50% of their ideal weight were considered successful results by all criteria. Weight loss of this degree could be expected to have a positive impact on obesity-related life table statistics. Group 2 patients lost as much weight as the Group 1 patients but were not within 50% of their ideal weight at the time of stabilization. However, each of these patients was less than 100 pounds overweight and had substantial amelioration of obesity-related medical problems. Group 3 patients were considered failures in that they either weighed more than 100 pounds above ideal weight at the time of stabilization or did not show improvement of obesity-related medical problems. Obesity-related medical problems transiently improved in all patients during the first six months following operation. However, when weight lost ceased at more than 100 pounds above ideal weight, signs and symptoms of these medical problems began to appear.

A composite profile of a typical successful result after stapled gastroplasty is as follows: these patients are younger, less obese, have fewer food contacts per day and a higher level of life stress. In contrast, the "failures" are substantially heavier, have a higher number of daily food contacts and an apparently lower level of life stress. In summary, preoperative weight was the most powerful variable in predicting outcome after stapled gastroplasty. Younger patients also tend to be more successful although the advantage of youth is nullified in the heaviest morbidly obese patients. The most successful patients apparently have life situations that make high demands on them for adjustment causing them to experience a number of symptoms of psychological distress. This distress is not simply an awareness that they appear different from others, but in addition, they have an internal
distress often described as depression. These environmental demands appear to be more powerful than obesity-related physical symptoms (as expressed on the SCL-90) in motivating patients to successful weight loss after stapled gastroplasty.

As a result of these studies, we now discuss stapled gastroplasty only with patients who weigh less than 150 pounds over ideal weight and have fewer than four preoperative food contacts per day. We recommend Roux-en-Y gastric bypass for all patients who do not meet these criteria. It is possible that a more radical operation such as pancreaticobiliary bypass will be necessary to produce satisfactory weight loss in the heaviest morbidly obese patients.
TABLE 1

WEIGHT LOSS OUTCOME CLASSIFICATION

<table>
<thead>
<tr>
<th>OUTCOME GROUP/NO. PATIENTS</th>
<th>MEAN PREOP WT/% OVER IBW</th>
<th>MEAN POSTOP WEIGHT</th>
<th>OUTCOME CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>269# (86%)</td>
<td>198#</td>
<td>&lt; 50% above ideal weight</td>
</tr>
<tr>
<td>2</td>
<td>302# (117%)</td>
<td>230#</td>
<td>&lt; 100# above ideal weight, Improvement of medical problems</td>
</tr>
<tr>
<td>3</td>
<td>323# (127%)</td>
<td>262#</td>
<td>&gt; 100# above ideal weight, no Improvement of medical problems</td>
</tr>
</tbody>
</table>
HALVERSON: Dr. Brolin will comment on the paper. Can you please use the microphone at the center of the room for your questions? It's very difficult to hear at the periphery if you don't.

SUGERMAN: (Harvey Sugerman, Richmond, VA) We conducted a randomized prospective trial comparing the Roux-en-Y gastric bypass with the vertical banded gastroplasty, and at two years the weight loss difference continues to be statistically significant (p < 0.001 with 67% loss of excess weight in the gastric bypass group and 41% in the vertical banded group). We categorized our patients into sweet eaters and non-sweet eaters. We found that the patients who were addicted to sweets did reasonably well when they had the gastric bypass. A difference is beginning to develop between the sweet eaters and the non-sweet eaters even with the gastric bypass but it's not statistically significant, although it may become so with time or with larger numbers. With the vertical banded gastroplasty, there is a major difference between sweet eaters and non-sweet eaters that is statistically significant when compared to the gastric bypass group. The patients who are addicted to sweets will beat a gastroplasty-type procedure. We are now choosing the type of operation according to the patient's sweet eating habits. Patients not addicted to sweets will still do well with a gastric bypass, and perhaps even better than with a gastroplasty. However, we are noticing that gastric bypass patients who are snackers or nibblers may beat their operation, that is, they'll snack through the gastric bypass. We have begun to do some of the Scopinaro-type procedures in that group of patients. Do you have any comments from your experience in regards to this?

BROLIN: I certainly do. I think you and I share the feeling that one operation is not suited for all morbidly obese patients, and your data supports this strongly. Our data also lends support to this. As a matter of fact, we've used our own data to attempt to stratify patients into gastroplasty versus Roux-en-Y gastric bypass groups and, in fact, during the last 18 months, using our criteria, we've only found one candidate that we considered might respond well to gastroplasty.

DEITEL: (Mervyn Deitel, Toronto) I feel it is difficult to talk about these operations without being specific as to technique. There are
tremendous differences in the way each person is doing these operations. When somebody says they're comparing prospectively Roux-en-Y gastric bypass and vertical banded gastroplasty, they should state their procedure for vertical banded gastroplasty, i.e., what is the material, how big is the collar, etc, and the same for the Roux-en-Y gastric bypass.
THE PREDICTION OF WEIGHT LOSS FOLLOWING BARIATRIC SURGERY
Joseph Barrash, M.A., Evelyn M. Rodriguez, David H. Scott, Jacob O.
Sines, Ph.D., and Edward E. Mason, M.D., Ph.D.

This study examined the relationship between preoperative variables
and weight loss -- the percent of initial excess weight lost -- 12 months
after operation. Patients were 83 women weighing an average of 282 lbs
who received a vertical banded gastroplasty at the University of Iowa
Hospitals and Clinics between April, 1982 and October, 1983. We felt
that widely varying weight loss to a highly standardized procedure (from
15% to 86% of initial excess weight) could be predicted, to some
significant extent, by psychological characteristics of the patients.

In the past decade several studies have investigated the relationship
between psychological characteristics and outcome. These studies generally
report psychological characteristics found to be differentially
associated with good and poor outcomes. Such studies have added to our
understanding of patients with either outcome, but because of the great
variance in the outcomes of patients with any particular preoperative
characteristic, they have been of limited help in predicting the outcome
of any individual patient.

In our effort to improve prediction of outcome for the individual
surgical candidate, we were guided by the premise that patients who are
highly psychologically homogeneous will tend to have similar responses to
surgery, which will be reflected in their postoperative weight loss. If
that is correct, then observing the average weight loss in patients with
a particular psychological "profile" should allow us to predict the
outcomes of future patients with that psychological profile.

The 83 women followed up in this study all completed a Minnesota
Multiphasic Personality Inventory, or MMPI, during their preoperative
evaluation. A statistical cluster analysis of MMPIs was then performed to
identify subsets of women who had highly similar MMPI profiles according
to a stringent statistical definition (of similarity). Eight groups of
patients, termed MMPI types, were identified and used in later analyses.
The size of these groups ranged from 3 to 6 patients.

At twelve months after operation, the mean weight loss was 73 lbs,
47% of patients' initial excess weight. Factors that were significantly
related to weight loss were: initial percent of ideal weight (patients with greater overweight lost less of their excess weight); initial weight (heavier patients lost more); age (younger women had more successful weight loss); activity level on the job (more active jobs led to greater weight loss); employment status (employed women, whatever their activity level, lost less, on the average, than unemployed women); and MMPI type (women with particular MMPI profile patterns had outcomes similar to others with that MMPI profile). No individual MMPI scale, by itself, was significantly related to weight loss.

Next, hierarchical regression analysis was performed. Preoperative characteristics entering into the predictive model in the first stage of the analysis were preoperative percent of ideal weight, activity level of one's occupation, preoperative weight, and two MMPI scales, Pa and Mf. These five conventional predictors, in combination, accounted for 33% of the variance in weight loss. When MMPI type was added to that predictive model, the variance accounted for increased to 45%, a significant increase of 12%. If allowed to enter the regression model first, MMPI type accounted for a significant 22% of variance in weight loss.

Using this model, we could predict the percentage of a patient's excess weight lost at one year, plus or minus 9%, with 90% confidence.

Twenty percent of the women failed to lose one-third of their initial excess. For the sake of analyses, they were said to have "poor outcomes." The regression model predicted that 12 patients would have a poor outcome, and 8 of them did. Only 2 of the 12 lost as much as 36.5% of their excess weight, and the mean loss among the 12 predicted to have poor outcomes was less than 29% of their excess.

One conclusion that we drew from our results is that a patient's preoperative percent of ideal weight is a most powerful variable which must be controlled for when considering postoperative weight loss, or the relationship of any potential predictor with weight loss. It has been noted in the past that the heavier patients are preoperatively, the less of their excess weight they can be expected to lose. This relationship, however, exists by virtue of the fact that heavier patients generally have a greater percentage of excess weight also. When preoperative excess was statistically controlled for, it was seen that heavier
patients, at a given level of overweight, lost significantly greater percentages of their excess weight. Thus, a more accurate warning is that the greater the patient's percentage of weight over ideal, the less of that excess the patient can be expected to lose.

We also observed that women with more active jobs preoperatively lost more weight than those with less active jobs, but unemployed women lost still more weight. It may be that the unemployed women tended to be even more physically active, on the average, than working women (whatever the demands of their jobs). Unfortunately, we had no measure of a patient's overall activity level. Such a measure would appear to be a very useful piece of information to collect at preoperative evaluation.

The hierarchical regression analysis revealed that psychological factors are important factors in the wide variance in postoperative weight loss. Even after variance explained by weight characteristics and activity level was partialled out, MMPI type still accounted for a sizable portion of the variance in weight loss. Despite the fact the 8 MMPI types only included 40% of the 83 women, just knowing that information about those 33 women enabled us to account for over half of the predictable variance in the weight loss of all patients. The MMPI type with the poorest average weight loss had the MMPI profile most indicative of serious psychological disturbance; those women lost only one quarter of their excess weight. While we cannot conclude that serious psychopathology in general suggests a poor outcome, it appears that certain particular forms of psychological disturbance definitely do signal a poor risk candidate.

The approach I have described this morning, identifying subsets of patients who generate highly similar MMPI profiles and then noting their characteristic outcomes, promises to yield real clinical benefits. A 1977 study by Lundgren, Scott and Grabski demonstrated that postoperative counseling of patients considered by a psychiatric consultant to be a poor risk resulted in superior outcomes and a significant reduction in postoperative complications, compared to poor risk patients who did not receive counseling. Discovering the MMPI profiles that, in conjunction with other predictors, indicate patients at risk for poor surgical outcomes holds promise as a cost-efficient means of identifying those patients most in need of pre- or postoperative counseling.
The number of followed-up patients with any one of the MMPI profiles derived from our cluster analysis was small, and it is clear that our results require cross-validation before more exact expected outcomes can be offered for these profiles. There is, however, some support for the generalizability of these MMPI types from other studies in which massively obese surgical candidates are clustered.

In conclusion, preoperative psychological characteristics are useful predictors of operative success -- when the psychological profile of a patient is considered. Clear support was found for the underlying premise of this study, that patients who are highly similar psychologically will tend to have similar postoperative weight loss. We believe that this approach to prediction can eventually lead to well-directed interventions that will improve operative outcome for high-risk surgical candidates.

REFERENCES:

HALVERSON: Boyd, can you take the microphone?
COMMENT: Would you clarify your statement that in your study those patients who had the greater initial weight lost a greater fraction of their weight, yet were not as successful as the lighter patients?
BARRASH: When you statistically partial out the effect of a patient's preoperative excess weight you find that it's not their actual level of weight, i.e., how many pounds they weigh, that leads to better or poorer outcome. Rather, the more powerful factor is their percent excess weight. If you just look at number of pounds, heavier patients do have poorer outcomes, however, that is due to the fact that the patients who are heavier also have greater percentages of excess weight. When you control for that greater percentage of excess weight, you find that patients who have greater weight but aren't more overweight have better outcomes. Preoperative weight, absolute weight and percent excess weight
are highly correlated. If you have two patients with the same weight but different levels of excess, the weight loss is going to be greater in the patient who has less excess weight. It's not the weight that someone has that carries the main bulk of predictive value but rather their percentage of excess.

HALVERSON: One last question.

ANDERSEN: (Teis Andersen, Copenhagen) Did you measure the pouch volume and stomal diameter, and did you introduce these variables into your statistical calculations?

BARRASH: Yes, we did.
PREOPERATIVE BASAL AND EXERCISE BMR AS PREDICTORS OF WEIGHT LOSS IN GASTRIC BARIATRIC SURGERY

Kenneth J. Printen, M.D.

INTRODUCTION

Since the inception of gastric operations for the control of obesity in 1967, clinical investigators have cataloged a massive amount of information concerning the efficacy of these operations in producing weight loss. However, there remains a constant population of patients with technically sound post-surgical anatomy who either do not lose weight or lose it at a rate far below the average patient. While rigid physical criteria have been established for performance of gastric bariatric surgery, there is as yet no reliable objective standard of either a psychiatric or physiologic nature which satisfactorily predicts the success of technically correct gastric bariatric operations in producing weight loss. We are able to exclude patients from consideration for surgery for a variety of reasons to include lack of motivation and/or adequate dentition, but have yet to be able to determine preoperatively which patient will not lose weight.

Garrow, et al, have reported that a high basal metabolic rate (BMR) correlates well with weight loss in obese patients and may be used as a predictor of those patients who would do well after bariatric surgery. Since the majority of patients in Garrow's study were not morbidly obese, this study was undertaken to assess the validity of the BMR/VO₂ in predicting weight loss following gastric bariatric surgery.

MATERIALS AND METHODS

Thirteen morbidly obese patients, nine women and four males, underwent oxygen consumption studies at basal and steady state exercise conditions preoperatively and once postoperatively at a range of 141-305 days (mean 208 days or 6.9 months). They continued to be followed for weight loss after this period but no further metabolic studies were done. The mean weight of these patients was 157±11.2 kg and mean age 33±2.3 years. Details of the physiologic measurements have been reported elsewhere. This study correlates the continued weight loss with the preoperative exercise and resting BMRs.
All patients underwent a standard Roux-en-Y gastric bypass with a measured pouch of less than 30 cc and an anastomosis measured at 1.2 cm in diameter. As a group the patients lost weight satisfactorily with a mean loss of 56 percent excess body weight (EBW) at one year and 63 percent loss EBW at two years. For purposes of prediction, percent excess body weight loss was compared to preoperative basal and steady state exercise BMRs at six months, one year and two years postoperatively. These comparisons (Table 1) failed to demonstrate any predictive correlation. Body weight does correlate well, even at two years, with the preoperative exercise BMR (Table 2). None of the patients tested had basal VO₂ measurements below 300 ml/minute.

DISCUSSION

Garrow, et al, 4 offered BMR as a valuable tool to predict successful outcomes with bariatric surgery. In our earlier work there did appear to be a significant trend toward correlation between weight loss and exercise BMR. However, these observations were made at six months post surgery and fall prey to the same criticism leveled at earlier studies which used diet rather than surgery as the means to produce the weight loss, namely patient followup was not long enough to adequately assess the real predictive value of the BMR/VO₂.

It is predictable that almost all patients will lose some weight following a gastric restrictive procedure of any kind no matter how poorly it is designed. This was manifestly apparent in the first gastroplasty procedure of 1971 which was discarded after one year because of poor weight loss that became evident in the six month to one year postoperative followup period. 5 Further, in our previously reported data 3 above average daily weight loss of 0.29 kg/day was observed only in the patients with a preoperative weight over 175 kg. All others lost in the range of 0.17-0.22 kg/day regardless of their preoperative weight or BMR test results. From these data it appears that the absolute predictive value of the BMR/VO₂ rests in the exclusion of those individuals with a VO₂ below 300 ml/minute, who are most likely to be failures at surgical therapy. 2 Unfortunately this is likely to occur in only about 3 percent of the morbidly obese population.
Of more interest is the speculation as to why a metabolic test which correlates so well with body weight fails to be a useful predictor of weight loss following bariatric surgery. If one uses the ill fated 1971 gastroplasty as a model, it is apparent that even with this poorly designed procedure weight loss proceeded, albeit slowly, for six months postoperatively. Since it has been observed that the first six months following bariatric surgery is the period of most rapid weight loss, it may be that this time frame represents the point during which the operative procedure itself exerts most influence.

After six months it seems reasonable to examine other factors which might play a part in offsetting or enhancing the effects of the surgery. Exercise is championed as an adjunct to weight loss in gastric restrictive surgery and certainly its use is a part of the post surgical regime. There is, however, nothing but anecdotal reference to the influence of exercise on the postoperative weight-loss status of these patients. Even at that we do know that the same amount of exercise, even in patients matched for weight and age, does not produce the same caloric expenditure in each patient, a factor which could contribute to altering any linear relationship between the BMR/VO₂ and weight loss.

Perhaps of even more importance is the whole area of patient compliance with dietary restrictions, especially as to types of food ingested and the frequency of eating. Both anecdotal reports and Halverson's data show that this compliance diminishes the further the patient progresses in the postoperative period. It stands to reason that close followup of these patients will provide the reminders necessary for good nutrition but in the end only the patient can put this advice into practice.

In conclusion, because of the complexity of interactions which come into play at least six months after gastric bariatric surgery, the preoperative exercise and basal BMR/VO₂, while useful to obtain exercise and respiratory physiologic data, are not effective in predicting long term weight loss in the postoperative period. They are reliable enough indicators to exclude that small number of patients whose VO₂ is below 300 ml/minute and thus would be unlikely to lose weight following any gastric bariatric procedure.
SUMMARY

Since the inception of gastric bariatric surgery, there have been many attempts to identify objective preoperative indicators which correctly predict postoperative success in terms of weight loss. Several reports of the effectiveness of basal metabolic rate (BMR) in predicting successful dietary control of obesity led us to investigate the predictive value of BMR both in the resting and steady exercise state (walking at 2 miles/hour on the exercise treadmill) in 13 patients undergoing gastric bypass. All patients underwent Roux-loop gastric bypass by the same surgeon and were followed for two years. All patients lost weight satisfactorily with a mean weight loss of 56 percent excess body weight (EBW) at one year and 63 percent loss of EBW at two years. Body weight correlates significantly with preoperative exercise BMR through the two-year followup. However, there was no correlation of percent excess body weight loss with either resting or exercise BMR. We conclude that although BMR in a resting and steady state exercise conditions provides valuable physiological data, it is not a reliable predictor of weight loss and cannot be recommended to screen candidates for gastric bariatric surgery.

REFERENCES


Table 1: Correlation of % EBW loss with preoperative exercise and resting BMR

<table>
<thead>
<tr>
<th>Time</th>
<th>R Value % EBW Loss/ Exercise BMR</th>
<th>R Value % EBW Loss/ Resting BMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 mos</td>
<td>-0.29</td>
<td>-0.42</td>
</tr>
<tr>
<td>1 yr</td>
<td>-0.02</td>
<td>-0.06</td>
</tr>
<tr>
<td>2 yrs</td>
<td>-0.28</td>
<td>-0.15</td>
</tr>
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</table>

Table 2: Correlation of body weight with preoperative exercise and resting BMR

<table>
<thead>
<tr>
<th>Time</th>
<th>R Value Body Wgt/ Exercise BMR</th>
<th>R Value Body Wgt/ Resting BMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preop</td>
<td>.90</td>
<td>.70</td>
</tr>
<tr>
<td>6 mos</td>
<td>.83</td>
<td>.68</td>
</tr>
<tr>
<td>1 yr</td>
<td>.75</td>
<td>.59</td>
</tr>
<tr>
<td>2 yrs</td>
<td>.82</td>
<td>.60</td>
</tr>
</tbody>
</table>
COWAN: Dr. Printen, I wonder if you agree with us that for the morbidly obese patient walking is a skilled exercise. It is very difficult for them to ambulate with their thighs distracted one from the other due to the large amounts of fat. We abandoned the use of the treadmill in our exercise tests and replaced it with a stationary bicycle with an enormous tractor seat. We have found that this works much better. Is it possible that some of the difficulties in showing a difference were attributable to your method? Secondly, did you look at, in your exercise studies, a relationship to Wasserman's work? He related the oxygen consumption with the heart rate as a fitness index. This appears to be, in our study, the only entity which shows a difference relative to the weight loss.

PRINTEN: To answer your second question first, yes, we did. As patients lose weight, with exercise their heart rate decreases from preoperative levels. In regard to your first question, most of our patients are able to walk 2 miles/hr. That minimal amount of exercise will convert a significant number of these patients to anaerobic metabolism preoperatively. This, of course, does improve as they lose weight.

HOWELL: (Michael Howell, Fargo, ND) I've been using basal VO\textsubscript{2} studies for years. Our Respiratory Laboratory uses a resting oxygen consumption over one minute. The normal, according to my expert, is 200-300 cc per minute and is directly correlated to muscle mass. In general men will have 40% more resting oxygen consumption than women because they have 40% more muscle. My observation has been women under 200 cc per minute do poorly, especially the older woman who has very little muscle.
STATISTICAL ANALYSIS OF WEIGHT LOSS AFTER GASTRIC BYPASS, PREDICTORS OF RESULTS

John D. Halverson, M.D.

INTRODUCTION

Gastric restriction procedures have been the accepted surgical means of treating morbid obesity for a number of years. Many reports have described massive weight loss in the first few years after operation (up to two-thirds of excess weight), but comparatively few reports have attempted to correlate preoperative parameters with excellence of weight loss. In addition, little is known about the tendency to gain weight after these surgical procedures. Data herein are derived from the loop gastric bypass series at the Washington University School of Medicine.

METHODS

Eighty-two patients had a loop gastric bypass between 1977 and 1982 after a thorough evaluation on the Clinical Research Center of the Washington University School of Medicine. At operation, the patients averaged 125±31% (m±SD) above ideal weight (Table I). The patients were followed long term on a regular basis or, if medically indicated, as needed. Early weight loss results and metabolic disturbances have been reported elsewhere (1,2). The data in this report are based upon the fifty-eight patients (of the above group) that have been followed for at least three years postoperatively. Data were stored in an IBM PC-XT computer using storage and retrieval software written in the MUMPS language. Statistical evaluation included paired and unpaired t-tests and linear regression analysis by the method of least squares.

RESULTS

Table II demonstrates the mean per cent of excess weight lost at yearly intervals to and including the fifth year postoperative for the entire group of eighty-two patients. These results include four patients who developed deep venous thrombosis postoperatively and had persisting unilateral leg edema of sufficient magnitude to interfere with interpretation of their weights. In subsequent analyses, these four patients have been deleted from the weight loss analysis. Figure 1 demonstrates the per cent of patients at each range of excess weight
lost at 24 months (81% follow-up) and 48 months (69% follow-up) postoperatively. A shift to the left can be seen, representing those patients who regained weight between the second and fourth year postoperatively.

Computer analysis was carried out to analyze correlations between twenty preoperative parameters and the per cent of excess weight lost at the various intervals postoperatively. These parameters included the usual demographic data, preoperative weight and per cent excess, dietary habits, psychiatric status, previous surgery (including previous jejunoileal bypass), and family history of obesity. Statistically significant positive correlations (p<0.005) existed between excellence of weight loss and: race (Caucasian) and married status (married) (Fig 2). Patients who had had a previous jejunoileal bypass operation showed a negative correlation (p<0.005). There was also a negative correlation between per cent of excess weight at operation and per cent of excess weight lost. That is, the patients most overweight lost a lesser per cent of their excess. This relationship held true for the first three years postoperatively (p<0.025).

In an attempt to analyze regain of weight, a computer search was carried out for the lowest weight obtained postoperatively in all patients (the nadir). The mean per cent of excess weight lost at the nadir was 67±2% at a mean of 27±2 months postoperatively. Regain of some of the lost weight occurred in 71% of patients (mean regained 24% of lost weight). Figure 3 shows the distribution of the regain of weight, together with the percentage of patients regaining that amount of weight. Nearly two-thirds of the patients who regained weight regained less than 20% of the weight they had previously lost. A statistically significant negative relationship was found (by linear regression analysis) between per cent regained and the per cent excess lost at nadir. That is, the better the patients lost weight postoperatively to the point of their nadir, the less likely they were to regain (p<0.0005).

DISCUSSION

It has been reported frequently that excellence of weight loss after stomach stapling can be correlated positively with young age and
minimal morbid obesity.\textsuperscript{1,3,4} That is, the older and the heavier the patient, the lesser per cent of excess weight loss achieved. Further, closeness of follow-up postoperatively correlated positively with weight loss, and smaller pouches at one year postoperatively were correlated with the best weight loss.\textsuperscript{1} Based upon our previous experience, it has been our impression that, once a patient is given an adequate operation, excellence of weight loss becomes a function of compliance to postoperative dietary requirements (behavior). Further, since patients with genetic or endocrine causes of obesity are excluded from most surgical series, it is no surprise that positive correlations could be shown between social or behavioral factors and weight loss. Several investigators have shown that correlations exist between either stress, negative life factors, or scores on the Minnesota Multiphasic Personality Inventory and postoperative course of the patients.\textsuperscript{4,5,6} In our series, statistically significant positive correlations exist between weight loss and both marital status and race. While a negative correlation exists between a previous history of intestinal bypass surgery and weight loss, the significance of these correlations is not clear. Certainly one could postulate that a patient who has had a JI bypass and who postoperatively continued with little or no change in eating habits might have, upon having a gastric stapling, more difficulty in complying to a postoperative diet. In fact, given an adequate operation, it has been our impression that behavioral failure has been the commonest cause for inadequacy of weight loss.\textsuperscript{7}

Further, the strong positive correlation between the married status of the patients and excellence of weight loss is consistent with the findings of Barrash and Valley, both of whom have reported that psychosocial parameters influence operative outcome.\textsuperscript{5,6}

On the other hand, while the achievement of a statistically significant better weight loss in our Caucasian patients might seem to imply a cultural bias, the sample size is inadequate to make such a statement with certainty, and no predictive inferences can be drawn from such results.
CONCLUSION

The exposure of a morbidly obese patient to the potential morbidity and mortality of a gastric stapling procedure carries with it, on the part of the patients' physicians, an obligation to carefully select, by whatever criteria can be demonstrated to be valid, the optimal group for such an operation. Little is known of absolute predictive factors which can be used in selecting patients for gastric stapling. Consequently, we must rely upon our cumulative experience and perhaps upon those parameters which seem to correlate with a weight loss result, whether excellent or inadequate.

BIBLIOGRAPHY

### TABLE I

**LOOP GASTRIC BYPASS**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>M +/- SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AGE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALL</td>
<td>82</td>
<td>33.4 +/- 8.6</td>
</tr>
<tr>
<td>MALE</td>
<td>14</td>
<td>35.4 +/- 7.1</td>
</tr>
<tr>
<td>FEMALE</td>
<td>68</td>
<td>33.2 +/- 8.8</td>
</tr>
<tr>
<td><strong>PREOP WGT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALL</td>
<td>82</td>
<td>289 +/- 43</td>
</tr>
<tr>
<td>MALE</td>
<td>14</td>
<td>325 +/- 50</td>
</tr>
<tr>
<td>FEMALE</td>
<td>68</td>
<td>281 +/- 37</td>
</tr>
<tr>
<td><strong>% &gt;I.W. @ OP</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALL</td>
<td>82</td>
<td>125 +/- 31</td>
</tr>
<tr>
<td>MALE</td>
<td>14</td>
<td>110 +/- 39</td>
</tr>
<tr>
<td>FEMALE</td>
<td>68</td>
<td>127 +/- 29</td>
</tr>
</tbody>
</table>
### TABLE II

WEIGHT LOSS - LOOP GASTRIC BYPASS  
(N=82)

<table>
<thead>
<tr>
<th>Months P.O.</th>
<th>12</th>
<th>24</th>
<th>36</th>
<th>48</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>% XS WGT LOSS (M)</td>
<td>57+/-18</td>
<td>58+/-23</td>
<td>54+/-28</td>
<td>46+/-33</td>
<td>47+/-25</td>
</tr>
</tbody>
</table>
GASTRIC BYPASS
(n=66) 24 mos.
(n=45) 48 mos.

% OF PATIENTS

% EXCESS WEIGHT LOST
Figure 2. Percentage of excess weight lost (±SEM) over months postoperative for different groups.

- **Married**
- **Unmarried**
- **White**
- **Non-White**
- **No Previous JIB**
- **Previous JIB**

Significance levels indicated as follows:
- **p < .01**
- **.005**
- **.005**
- **.001**
- **.005**
- **.005**
Figure 3
HALVERSON: I'll take questions from the floor regarding this talk for just a few minutes, and then we have a little bit of time left for some of you who didn't have a chance to ask questions earlier of the other panelists. We'll open the questions. Yes?

COMMENT: I found in my patients, those who lost most rapidly tended to keep the weight off longer.

HALVERSON: That's an interesting observation. It's the opposite of what we found. In fact, we found that rapidity of weight loss in the first six months was inversely correlated with the ultimate result. The faster they lost at the beginning the worse they ended up doing. Did you do unpaired t-tests to compare their mean percent excess weight loss or look at that as a function of their rapidity of weight loss?

ANSWER: No. My observation was that if a patient lost 90% or more of their overweight, over a period of three to five years they tended to keep the weight off.

QUESTION: What is your reoperation rate?

HALVERSON: The incidence of reoperation in my series has been very low, not because I'm any better but because I'm more stubborn. In the majority of cases where patients fail to lose, in my experience, it was not because of technical or anatomically correctable problems. It's most often a behavioral problem. My incidence of reoperation for weight regain is approximately 2-3%.

QUESTION: Regarding patients in your series with JI bypass who were reversed, were the reversals undertaken because of poor weight loss or for other problems?

HALVERSON: The majority were reversed for medical rather than simple weight loss reasons.

QUESTION: Were the gastric procedures done at the same time as the JI bypass reversals?

HALVERSON: Yes, in about half the cases they were.

BUCKWALTER: We've reversed about 60 JI bypasses, and in all but two instances we did a simultaneous gastric operation. Some of the patients were very sick, but on the other hand, if you do a staged type of procedure, they're likely to regain all the weight they've lost. I think these procedures should be done simultaneously if at all possible.
INTRODUCTION

Gastroplasty could result in weight reduction by causing earlier satiation. A smaller volume of food would be consumed at each meal. However, another mechanism that might contribute to weight loss could be delayed pouch emptying resulting in a prolonged feeling of fullness and therefore reduced frequency of eating. Delayed pouch emptying postoperatively could be a prognostic indicator of successful surgery. Rapid pouch emptying postoperatively could be a poor prognostic indicator of weight reduction.

This study was initiated to determine, first, the effect of gastroplasty on gastric emptying and, second, whether gastric emptying studies have any prognostic potential in the pre- and postoperative periods.

Gastric emptying could vary with age in obesity because of gastroparesis due to occult or overt diabetes mellitus. This should be unmasked in the older age group. Thus we set out to compare gastric emptying with patient age.

METHODS AND MATERIALS

Twenty-three morbid obese patients underwent gastric emptying studies (Tc-99m egg-salad sandwich with 100 ml water) preoperatively and at 3 months and 12 months postoperatively. One surgeon performed a transverse gastroplasty. A 50 ml proximal pouch was created by a double row of staples across the proximal fundus which emptied via a 1.2 cm diameter Marlex reinforced greater curvature stoma.

An additional 216 morbid obese patients underwent a single preoperative gastric emptying study.

RESULTS

At 3 months pouch emptying was variable with 9 of 23 patients having prolonged t½ (p<.0001) and 14 shortened t½ (p<.0001) despite both groups having identical weight loss (p>.05).
At 12 months pouch t\$ returned to baseline in every patient (p>.05).
Preoperatively, gastric t\$ did not correlate with age or weight.

CONCLUSION
This data suggests that gastroplasty causes weight loss solely by reducing the gastric volume resulting in reduced meal volume. Weight loss is not related to delayed pouch emptying which might result in a prolonged feeling of fullness.
Gastric emptying studies have no weight loss predictive value.
Gastric emptying is not impaired in older morbid obese patients.
POUCH EMPTYING OF SOLID FOODS AFTER GASTROPLASTY FOR MORBID OBESITY
Teis Andersen, M.D., B. Hojlund Pedersen, J. H. Henriksen, and A. Uhrenholdt

INTRODUCTION
To reveal information on possible determinants of weight loss after horizontal gastroplasty, pouch emptying was prospectively investigated.

METHODS AND MATERIALS
A scintigraphic method was chosen for the examinations, at which a standardized test meal labelled with 200 μCi chelated technitium-99m diethylenetriamine penta-acetic acid was given. Examinations were carried out every 6 months until 2 years after gastroplasty. Pouch emptying was described by means of mean transit time and emptying rate. The study comprised 27 consecutive morbidly obese patients.

RESULTS
These measures all showed a significant acceleration of pouch emptying to take place before 6 months after surgery.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Postoperatively</th>
<th>At 6 months</th>
<th>At 24 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean transit time (min)</td>
<td>46 (17-57)</td>
<td>*</td>
<td>26 (13-55)</td>
</tr>
<tr>
<td>Pouch emptying rate (g/h)</td>
<td>16 (0-46)</td>
<td>*</td>
<td>45 (7-97)</td>
</tr>
</tbody>
</table>

Thereafter pouch emptying was unaltered. No significant association could be detected between measures of pouch emptying and weight loss.
Table 2. Absence of correlation ($p > 0.05$) between measures of pouch emptying and weight loss ($r$-values with their 95% confidence limits).

<table>
<thead>
<tr>
<th>Weight Loss</th>
<th>From 0-6 months</th>
<th>Maximum</th>
<th>From 6-24 months</th>
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<tbody>
<tr>
<td>Mean transit - postop time - at 6 mos</td>
<td>0.25(-0.19-0.58)</td>
<td>0.25(-0.18-0.59)</td>
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<tr>
<td>Pouch emptying rate - postop - at 6 mos</td>
<td>-0.18(-0.52-0.22)</td>
<td>-0.18(-0.52-0.22)</td>
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</tbody>
</table>

From calculation of 95% confidence intervals for coefficients of correlation it proved very unlikely that pouch emptying is a major determinant of weight loss; coefficients of determination can be stated as $< 0.35$ with only a 2.5% risk of stating a too small value.

**CONCLUSION**

Pouch emptying speeds up within the first 6 months after horizontal gastroplasty. Neither the results of the postoperative examination nor those obtained at 6 months can predict weight change.
KRAL: (John Kral, New York) How do emptying rates in morbidly obese patients compare with controls?

GRACE: The difference is not in the way they empty but when they start. Dr. Desna finds a lag time in the initiation of gastric emptying between 7 and 8 minutes in normal patients whereas the lag time in the initiation of gastric emptying in the morbidly obese patients is about 17 minutes.

TERRY: (Boyd E. Terry, Columbia, MO) Dr. Grace, it wasn't clear to me if you were describing half-time of pouch emptying or half-time of gastric emptying.

GRACE: The initial study was on gastric emptying, but postoperatively we looked at pouch emptying.

TERRY: In my experience there is a difference in the gastric emptying as opposed to the pouch. The pouch may empty fairly quickly while the stomach emptying is delayed as compared with normals.

QUESTION: Is there clinical correlation between emptying time and weight loss?

GRACE: I think that Dr. Doherty's study last year showed much better correlation of gastric emptying with weight loss than we obtained with the transverse gastroplasty, and that is the difference between the operations. The fundal pouch doesn't empty as reliably or as well as the vertical banded gastroplasty. The smaller stoma must lead to slower emptying and a more prolonged feeling of fullness in such patients, although it's a very complex issue. I don't know how far one can go with making the stoma smaller.

ANDERSEN: We have tried to correlate the stomal sizes after horizontal gastroplasty with the weight loss outcome and found no correlation between these measures. It has been published in the Scandinavian Journal of Gastroenterology. Moreover, we have tried to see if there was any correlation between pouch emptying and the stomal size and found no correlation.
PRESIDENTIAL ADDRESS
Edward E. Mason, M.D.

I have many things I would like to tell you about the state of the art of surgical treatment of obesity and the place your Society has in this activity. First, however, it gives me great pleasure to introduce to you some distinguished guests from Japan. Chikashi Ito worked with me in the laboratory for three years during the development of gastric bypass; his work proved that gastric bypass could be used safely in patients without concern for a high incidence of stomal ulcer. The history of our work is reviewed in the first chapter of my book. Dr. Ito practices general surgery in Sapporo on the northern island of Hokkaido, and is a guest of the Society on this occasion. When we worked in the laboratory, he always did more than I asked him to do. Chikashi, I am delighted to see that you have not changed. He has brought his wife, Nobuko, and his four lovely daughters, Yukari (who is a medical student), Miki (who, like my wife, Dordana, is a dietitian) and the twins, Fumiko and Yoshiko (whom we first met in the fall of 1977 in Sapporo when my wife and daughter and I visited the Itos).

Ethical Practice

The American Society for Bariatric Surgery was organized in part in order to assure ethical surgical care of the morbidly obese. We knew when we organized the Society that obesity represents a huge problem and that pressure from patients to find solutions creates a real potential for abuse. Recently, some information has come to my attention which may be illustrative. An organization has been established to solicit surgeons and patients, and match them up geographically. The question that immediately arises is, is it ethical for surgeons to pay a national organization for referral of patients? What if that organization says 90% of the money will be spent on national advertising? Fees for this service include, by the way, a start-up payment plus $1,000 per month.

The basis for referral on the part of the organization appears to be monetary, although they claim that only qualified and experienced surgeons will be on their list. The way that they judge qualification of surgeons is not stated. To the extent that they guarantee quality of care they are, of course, likely to become involved in any legal action
stemming from dissatisfied referred patients. The first surgeon to subscribe in a geographical area becomes the only one in that area who will be provided patients. This has the appearance of the selling of patients to those surgeons who are willing to buy. In my opinion, this is unethical. The Society cannot make recommendations regarding the business aspects of your practice without being in jeopardy of interfering in free trade. But you can discuss this sort of activity among yourselves and in your various medical societies and decide what you consider ethical and in the best interests of your patients. However, it would seem that patients have enough expense as it is, without incurring broker's fees.

**Patient Support Groups**

Formally organized patient support groups may provide an alternative as long as each group clearly supports patients rather than a particular surgeon. We, as surgeons, should make ourselves available for talks and, when asked, we can furnish expert medical advice to patient support groups. This is one of the ways in which we can help make reliable information freely available to those who need to know about surgery for obesity. This will permit patients to choose their surgeons in a fair and informed manner and only the best care will survive.

Along this same line, I know of at least one hospital now that actively advertises for patients and, at the same time, promotes a form of gastric reduction that I thought had been abandoned because of its high failure rate. Advertising may not appeal to many of you, but, if properly carried out by individual surgeons, it is the way to counteract solicitation of patients by third parties.

**Friends of the Courts**

The legal profession takes great interest in everything we write, say and do. Attorneys are not only reading our papers but asking us to review records. In my opinion, if you can find the time to look at some of these records and to provide some really expert advice, you may do much to promote proper understanding of what is really involved in patient care. The alternative is to let "hired guns," who may be less than expert, provide opinions which may perhaps do a great deal of harm.
The testimony should be in the interest of the court in helping to find the truth and could help the defense as much as the plaintiff, if, in fact, there is a high standard of care. At any rate, this is another, often difficult, ethical matter that each of us must deal with and one that warrants open and calm discussion. We all must think carefully of our responsibility to patients when there is a question about the standard of care.

**Risk of Obesity**

There are still well-respected members of our profession who believe that obesity is normal and does not deserve the attention that we, as surgeons, have provided. There are still health insurers who claim that surgical treatment of morbid obesity is not indicated at all, or that it is indicated only when certain complications have already developed. The risk of obesity has been well established by the 30-year study of the population of Framingham, Massachusetts. Garrison and Castelli concluded their abstract for a presentation at the National Institutes of Health Consensus Development Conference, February 11-13, 1985, as follows: "The adverse impact of overweight on the longevity of Framingham men is enormous. Analysis demonstrates that overweight, even slight overweight, is associated with dramatically higher mortality rates, especially in nonsmokers. There is no indication in Framingham data that there is a 'safe' level of overweight, that weight gain after middle age is 'healthy,' or that 'desirable' weights increase with age."

At this same conference Edward A. Lew reviewed the American Cancer Society Studies of one million men and women. Approximately 750,000 were determined to be in good health. The study covered a period from 1959 through 1972. For both men and women judged to be healthy but with a weight 140% of average or greater, there was a mortality rate of 187% of the average for normal weight people. When examined in relationship to age, the mortality rate was over 200% of average for ages 40 to 59 and 185% for ages 60 to 69.

The mortality for males who never smoked and were 140% or more of ideal weight, the mortality increased at a steady rate with increasing the age. But, the mortality ratio decreases with increasing age because the mortality rate of normal weight patients increases with age. In
other words, at older ages, the risk of death from all causes rises to a level that makes obesity appear to be relatively less of a risk when using mortality ratios. However, it continues to be a risk at all ages.

Body configuration should be used in calculating the risk of obesity. Bjorntorp stated in his abstract for the recent Consensus Conference that when the ratio of abdominal circumference to waist circumference "exceeds 1.0 in man and 0.8 in women, the risk for cardiovascular disease seems to increase sharply." Hiramatsu et al found that the central obesity index (COI) calculated as truncal circumference divided by the sum of the bilateral peripheral circumferences was an excellent way of screening Japanese women for Cushing's syndrome. In the same article they provided some data which showed that this ratio is higher in diabetic women than in women who are simply obese and do not have diabetes or other endocrine disease. A large amount of evidence has now been gathered which indicates that central, or android, body configuration in the obese is predictive of increased risk.

Leibel and Hirsch have found differences in the receptors on fat cells obtained from the abdominal and gluteal areas which in turn explain observed differences in susceptibility to weight reduction. Beta-1 receptors stimulate and alpha-2 receptors inhibit lipolysis. Beta-1 receptors predominate in abdominal adiposity while alpha-2 receptors are more likely to be found in gluteal fat cells according to a report at the recent Consensus Conference.

Gail Harrison in an abstract for the Consensus Conference concluded that, "the preponderance of evidence points to the conclusion that for young and middle-aged adults, very high relative weight and/or obesity is related to a significantly enhanced risk of premature death or disability. This is not a simple relationship. It is mediated by other risk factors; therefore, two individuals with the same relative weights may experience quite different kinds of risk." As surgeons considering patients for operation and evaluating results, we need to develop cost/benefit formulae that take into consideration the risk factors for individual patients. Shapiro's article illustrates cost/benefit analysis of antimicrobial prophylaxis in abdominal and vaginal
hysterectomy and exemplifies the type of approach that you might consider in deciding the indications for surgical treatment of morbid obesity.

Most of the papers on risk of obesity do not address the risk of being 200% of ideal weight or greater. Drenick's paper is an exception. He observed a 12-fold increase in the mortality rate for males 25-34 years old and a sixfold increase at ages 35-44. We really need evidence that patients who have undergone surgical treatment of obesity do live longer and lead happier, more productive lives. It will take time and dedicated effort by the members of our Society to collect this evidence. The process could be helped by pooling data collected by protocol and kept up-to-date by each participant. Much useful information about patient response to operation can be obtained at relatively low cost by use of questionnaires.

**Benefits of VBG**

One of the most interesting findings in the use of gastric reduction operations is the observation that patients who have been morbidly obese are happy and comfortable in spite of a marked restriction in their intake. After vertical banded gastroplasty (VBG), 79% of patients felt their satisfaction with life to be greatly improved. The quality of life is remarkably satisfying even with regard to eating and drinking for most patients. This should be considered in the cost/benefit equation.

Intestinal bypass was supposed to be ideal for morbid obesity because it allowed patients to eat as they always had. Some advocates of intestinal bypass predicted that gastric restriction operations would not be tolerated. In fact, eating behavior and appetite seem to be normalized by the provision of a small meal-sizing upper gastric segment. Before operation, 64% of patients remembered being hungry all the time. After the operation only 4% were hungry all the time. The figures for thirst dropped from 42% to 20%. Reducing the capacity to eat and drink reduces the desire for food and drink.

Operations with smaller stomas are more restricting and patients may try to compensate by eating more often. Vomiting occurs if there is too much restriction or if the patient exceeds capacity. It is an
infrequent and minor problem that warns the patient not to overeat and is often welcomed as a sign that the operation is working. Of course, if the operation is too restrictive and does not permit essential nourishment, urgent correction is needed before such complications as Wernicke-Korsakoff's syndrome develop. This complication has not been observed to date in patients with VBG which is an operation that makes the stoma a correct and stable size from the beginning. We must be cautious, however, about reducing the collar size.

Meat is an important index for monitoring the effectiveness of gastric reduction operations. It is fibrous and must be well chewed before it is swallowed. If patients suddenly find they can eat meat without chewing it thoroughly, weight gain will soon follow and usually a disruption of the partition will be found.

Because of the restriction in food intake, patients with VBG are more likely to have hard and infrequent bowel movements and may need a stool softener. By contrast, patients with gastric bypass have lost control of the emptying of stomach contents into the small bowel and as a result the hyperosmotic jejunal contents stimulate peristalsis and consequently the stools are softer. Answers to our questionnaire confirm this phenomenon.

Gastric bypass has also produced intolerance to milk in some patients who were able to drink milk preoperatively. Again, we theorize this results from a too rapid flow of gastric contents into the small bowel, which may have an inadequate level of the enzyme lactase. Intestinal mucosal lactase assays have not been made. Nonetheless, the increase in the number of patients who are unable to drink milk after gastric bypass is marked, and it is especially unfortunate because milk is the only adequate source of calcium in our diet. We all need a quart of milk a day, even as adults, to assure strong bones. Bypass of the duodenum, therefore, contributes to a negative calcium balance and bone disease, not only by causing malabsorption, but by making more patients intolerant of milk.

Reoperation Rates

As you know, we sent a questionnaire to the members of the Society earlier this year. Eighty-seven surgeons responded and the data
collected are most enlightening. I will refer to this study from time to time and compare it with data collected on our patients at The University of Iowa.

I have argued over the years that the rate of reoperation, calculated on an actuarial basis, is an important part of the evaluation of results. When the reoperation rate is high, it is time to modify the operation and to eliminate the causes. The rate of reoperation after VBG is 1.7%/year which is as low as for any gastric reduction operation with which we have had experience. About half of the reoperations have been to restore a disrupted partition. Still, the rate of staple line disruption is not great enough to warrant division of the stomach since this would increase the risk of leak and peritonitis or abscess. However, even a low level of disruption of the staple line does warrant an effort to find a more secure partition, if this can be accomplished without increasing risk. Everything we do enters the risk/benefit equation and must be so evaluated.

Partitions

It seems reasonable to assume that staple disruption is due to distention of the pouch or the greater stomach, but this is difficult to prove. Looking at the recently collected data from the 87 Society surgeons regarding variations in the way these operations are being performed, we noticed that the smaller the collar, the higher the incidence of staple failure. More evidence is needed. However, the numbers are suggestive. The risk of staple line breakdown was 0.54% for patients with 5.5-cm circumference collars, 0.8% for 5-cm collars and 0.9% for 4.5-cm collars. It seems logical that if the stoma is made smaller, distention of the pouch will increase thus leading to more disruptions of the partition.

We examined the influence of distance between the double staple application of staple lines. The incidence of staple disruption when the two sets of staples were placed with no space between was 0.9%. When the distance was 5 mm or more, the rate was 0.4%.

I am surprised that there are not more disruptions when the sets of staples are placed 5 mm or more apart. I have seen disruptions in that part of a partition where the staples were more widely separated. I
suspect that if there is too much space, a cyst forms and the resultant pressure generated in that space contributes to the disruption. The ideal is to have the area between staple lines so tight that there is not only destruction of the mucosa but ingrowth of scar tissue. The partition is maintained not by the staples but the scar tissue in the middle and regeneration of mucosa on both sides. You must not leave a closed space of a centimeter or more as can occur when revising a pouch by parallel stapling to reduce its size. During revision the end of the Ewald tube can be used as a J-maneuvered probe to check the old staple line and to make sure it is open so that the intervening space can empty.

I use three cartridges, if the patient is having an intestinal bypass restored in conjunction with a VBG. I do this because Alden reported an increased rate of partition failure after combined restoration of intestinal bypass and establishment of gastric bypass. According to Shizal, patients with intestinal bypass often have some degree of protein depletion. It was, therefore, reasoned that weakness of the muscularis mucosa could account for the higher incidence of staple line breakdown in these patients. Recently, we have used three sets of staples in all of our VBGs. I don't know if this will decrease the rate of partition failure which so far remains less than 0.5% per year but there seems to be no harm from six rows of staples placed closely together and perhaps the partition will be stronger.

Staple line disruption can be difficult to diagnose. I know of a patient who had a combined jejunoileal bypass takedown and gastric reduction operation and later, while in another country, was hospitalized for what was probably a gastroenteritis. In spite of her telling the physicians about her small gastric pouch, she was encouraged to drink large amounts of fluid and liquid nourishment. When she left the hospital she could eat and drink without limit. Disruption of the staple line was suspected but might have been missed if the radiologist had not positioned the patient so as to show the partition without its being covered by barium in the adjacent stomach and without over-distention of the pouch and stomach with barium.
In our survey, 14 of the 87 surgeons using vertical pouches are oversewing the two sets of staples. As I mentioned before, instead of improving the security of the staple line, this actually increases the breakdown rate (147 of 2,428 patients). Most of the surgeons who oversew use prolene. It may be that the running prolene causes chronic low grade. Whatever the reason, at this time oversewing cannot be recommended.

National Registry

I believe we can learn a great deal from this type of questioning of our surgeons, but the findings would be more useful if we collected raw data collected for each patient so that actuarially derived rates of staple line failure could be calculated. As it is now the results are more descriptive than statistically based. This raises a question. Should our Society support a National Registry to carry on this sort of analysis of results? Only by examining trends in large numbers of patients can we determine whether we can make further, perhaps small, but nevertheless worthwhile, improvements in our procedures.

Super Obesity

Throughout the history of surgical treatment of obesity, it has been apparent that the final weight correlates with the initial weight. Comparing the final or most recent weight with initial weight, for patients who had VBG with a 5.0-cm collar (VBG-5.0), there appears to be a convenient dividing line in the scatter of the data at about 225% of initial estimated ideal weight. Below this level, the final weights cluster around 130% of ideal, which is considered a healthy weight. Patients who begin above 225% of ideal, never reach 130% of ideal. We decided on the basis of these data to use a smaller (4.5-cm circumference) collar for the heavier patients. As yet we cannot say whether this will be sufficient to bring these heavier and more aggressive eaters to a more normal weight but it appears that the heavier patients tolerate the smaller collar.

With long-term followup data now available for those who had gastric bypass in the period 1966-70, it is possible to look at separate weight curves for patients who required revision operations and for patients whose weight was maintained with their initial operation and
never need further surgical intervention. The average initial weight for patients requiring revisions is higher, which again indicates that these super-obese patients are more aggressive in their eating behavior and require more restriction than their less heavy cohorts.

In a recent review of patients treated with VBG, we calculated the revision rate on an actuarial basis so that all available data could be used. For patients whose initial weight was <225% of ideal, the revision rate was 1.3% per year regardless of collar size. However, when initial weight was >225% of ideal, the revision rate was 3.9% per year for patients with a 5.0-cm collar and 4.6% per year for patients with a 5.5-cm collar. These data support the thesis that bigger patients are more aggressive eaters. They will need more revisions, even to attain a weight further above ideal than that obtained by the less heavy group of patients.

Heavier patients lose more absolute weight than less heavy patients even though their percent excess weight loss is less, and they level off at a higher percent of ideal weight. It seems reasonable to consider these heavier patients as a separate group, both in analysis of results and in designing the operation to fit their special needs. They seem less disturbed by an even greater restriction in their eating. They are more tolerant of a smaller stoma than their less heavy cohorts. So now we have four degrees of obesity: overweight, obese, morbidly obese and super obese.

Stoma Construction

Turning to the construction of the stoma, we found that 85% of the 87 surgeons who answered the questionnaire use Marlex® mesh. Silastic tubing is used by 7%. Teflon and Gore-tex® were used by one surgeon each. The rate of erosion with Marlex mesh must be in the range of 0.1%. We have not seen erosion from the Marlex mesh in over 680 patients in the combined series at the University of Iowa Hospitals and at St. Francis Memorial Hospital in San Francisco. Only a few have been reported to me by other surgeons, and I usually hear about complications that develop.

This low incidence of erosion of Marlex mesh in VBG is in contrast to my experience with its use on the greater curvature for primary
operations. I used Marlex mesh in revisions also but only for a short time. The rate of erosion was so high that I gave it up in these circumstances. Kroyer and Grace have had extensive experience using Marlex mesh on the greater curvature but I believe they have had enough trouble with it that they are either no longer using it or are seeking ways to make it better tolerated. A surgeon who visited me told me that he had used Marlex mesh to reinforce the gastroenterostomy in three patients with Roux-en-Y gastric bypass and had had erosion with obstructive symptoms in all three. This confirms my own experience that Marlex mesh is not well tolerated in the region of an anastomosis.

What is the difference? Erosion probably occurs secondary to infection which results from a combination of factors such as sutures between the mesh and the lumen, decreased blood supply, hematoma, tissue trauma, so on. The VBG does not leave any sutures between the Marlex mesh and the lumen. Vessels are not interrupted except for those removed with the EEA window and there is minimal trauma. There is not a lot of scar tissue, unless infection occurs, or unless the Marlex mesh comes in contact with the liver or some adjacent tissue to which it may densely adhere.

Questions remain about the amount of stretching that occurs with Marlex mesh, both early and over the years. It may be better to place the Marlex mesh in a direction in which there is the least stretch in the material. On the other hand scar tissue may immobilize the mesh and thereby limit the stretching. I have removed a few 5.5- and even 5.0-cm collars in order to place a 4.5-cm collar in patients whose original weight was in excess of 225% of ideal because we now know that these patients need greater restriction. Based on these few cases, I have found that the mesh does increase some in length. The important point is that if the material is used in the same way each time and the results are not satisfactory, then the length can be changed. In the experience at The University of Iowa, we have cut the Marlex mesh from a 3-cm wide piece originally prepared for inguinal hernia repair. Such a piece stretches mostly in length rather than width. Headley uses a larger piece of Marlex mesh that allows one to cut appropriate lengths from across the strip. This provides less stretch in the long,
circumferential direction. Perhaps this will both improve the mean weight loss, for a given circumference collar, and reduce the variability of results. Headley's long-term results will be very important in determining how much of the variability in our results is caused by differing degrees of stretching of the Marlex mesh over time.

Gore-tex may be a material that could safely provide a more uniform stomal diameter. We are comparing the Marlex mesh and Gore-tex soft tissue patch in growing pigs, subjected to VBG. The main lesson learned so far is that these animals are so aggressive in their eating that they tend to rip out the partition. Some surgeons who have measured Marlex mesh under tension have had obstructions at the stoma. If we are to use Gore-tex in patients, one of the first questions relates to whether it should be measured under tension or whether it should be measured with no pull in the long direction as we have done with Marlex mesh. It is not elastic but the shape can be changed. If it is pulled in one direction, it narrows in the other, and thus the total area remains the same. Another question relates to the most desirable thickness of the Gore-tex soft tissue patch. The polytetrafluoroethylene material is very strong even when only 2-mm thick.

Many seemingly simple questions of this nature come up as we work with the operation and as we exchange information about the way in which we are performing it. It has been of great help to me and probably to many of you to be able to discuss our problems as they arise in the care of individual patients.

At the Central Surgical Society meeting this year, Freeman, from Ottawa, presented his experience, with a VBG which he claimed was similar to what we described. He reported a 70% failure rate at two years. However, there were marked differences in his technique. For example, he pushed the EEA as close as possible to the indwelling 28F bougie, even to the point of causing "blanching of the adjacent stomach wall." After the first ten operations, with no complications, he experienced three leaks during a four-month period, all of which he attributed to malfunction of the EEA stapler. All three patients required reoperation. Nine patients of his first 22 developed stenosis, requiring long-term parenteral feeding and dilatations. In six patients he attributed the stenosis to
ischemia and reaction to the Marlex. He said that when he switched to a 32F bougie, as we described in 1982, there were no more leaks or stenoses. I was confronted with this some decision about the amount of tissue to use in the stoma early in the use of VBG. Fortunately I decided that the calibration was provided by the circumference of the collar and I elected to leave enough tissue so that when the collar is applied it is comfortably filled by stomach. I wanted an adequate cushion between the lumen and the collar so that there would not be erosion.

Freeman has voiced great concern about the large number of these operations being performed in North America, while published long-term follow-up reports are lacking. We have just finished a detailed manuscript describing our results and I hope this will appear soon in one of our national medical journals. You have a copy of this paper in your packet, and as you will see, it puts Freeman's concerns to rest, provided the operation is performed to specifications. We have waited this long in order to be able to present three-year results. In the meantime we have had these spring meetings where we have been able to exchange ideas and we have had many other contacts with those of you who have had problems or comments to make about the operation. You have kept us on the right track in the expanded use of VBG and I want to thank those of you who have contributed to this effort by keeping in touch.

On the other hand, there remains much work ahead. We do not have the kind of data that would be desirable for many of the choices that we must make regarding the materials that we use for collars, the stapling equipment, and even the staples themselves. Probably most of the items in use are satisfactory, however, surgeons should not conclude that these choices do not make a difference. I heard of a surgeon who used silicon drainage tubing as a collar. Such substitution of untested implant material may cause problems and such choices are going to be increasingly difficult to defend if they do not work out as expected. We do now have a great deal of experience with Marlex mesh, including six years with its use as stomal reinforcement in gastric reduction (considering the experience of Kroyer and Grace with greater curvature collars), not to mention the much longer experience with its use in
repairing defects in the abdominal wall. Before new materials are used they should undergo testing of some sort to determine their reactivity and to allow us to know as much as we can about their advantages or disadvantages over materials and equipment with which we have had extensive experience. Our continual dialogue about problem areas might benefit from an electronic bulletin board. Perhaps this could be run in conjunction with the Registry.

**Gastric Banding**

There is an operation in which reinforcement of the stoma comprises the whole procedure, namely gastric banding. Not long ago I heard about a surgeon who had been performing this operation using only one hand. He has recently begun to use two hands, not out of need, but because he was advised that he must have a second opinion. Or was it a gynecologist?

In a study of gastric banding in cats, Skarstein and Lekven of Bergen, Norway, have measured mucosal blood flow at 24 hours after banding. They used radioactive microspheres injected just before sacrifice and then counted the radioactivity in samples of mucosa. They took samples from the anterior wall, greater curvature, posterior wall, in the region of the band, above the band and below the band for a total of nine samples. They discovered a reduction of blood flow beneath the band. This study was stimulated by the death of a patient from perforation after gastric banding. This patient also had a splenectomy with interruption of the vasa brevia and so, in the experiment with cats, comparisons were made at two days between banding with and banding without splenectomy. They found that splenectomy also decreased blood flow in the region of the band and on the greater curvature of the stomach. In fact, there was a fatal course in cats allowed to go as long as five to 12 days and, therefore, long-term study of the blood flow was not attempted. This experiment did not control the pressure at which the band was applied, but a nasogastric tube was used to maintain the lumen while the band was tightened.

Surgeons have been under the impression that the blood supply in the stomach is so diffuse and profuse that collateral blood flow will take care of tissue along the greater curvature if vasa brevia are
interrupted. Apparently this is not always the case. Perhaps the reduction in incidence of perforation with lesser curvature stomata as compared with greater curvature stomata can be explained on a similar basis. Certainly vasa brevia are divided when a greater curvature pouch is used, whether the spleen is removed or not. Studies of circulation following other techniques of gastric banding are in order but the warning remains that if splenectomy or interruption of the vasa brevia are required, the stomach will be at increased risk, especially if the operation includes some other division of tissue or element of pressure that could decrease blood flow.

Coelho et al studied gastric banding in miniature pigs using a Gore-tex or Dacron® arterial graft and found a tendency for erosion and penetration into the lumen. They explained that the pig and human are both omnivores and have similar gastrointestinal physiology. However, the pig is more unreasonable in eating than the morbidly obese human and may overstress any reduction operation. Couca et al did recommend caution in the use of this simple operation of gastric banding in humans.

What, then, are we to conclude about the safety of gastric banding? Kuzmak's use of pressure control during the tightening of the band may be a way of providing the necessary quality control to make for maximum and uniform safety in the hands of all surgeons who elect to use banding. Some surgeons may be able to judge the tension accurately enough that they do not need to measure or control pressure, but, as with pouch and stomal size in all gastric reduction operations, if we do not make the measurements and keep a record of these parameters we will not know how important the variable is in overall safety and effectiveness.

**Risks and Benefits of Bypass**

Bypass is not a necessary part of gastric reduction. If it were we would not have had to revise our early gastric bypass operations at a rate of 5% per year for the first ten years regardless of whatever else may have been wrong with them. Our experience with VBG has demonstrated that if a small pouch and a small stable stoma are provided, then weight loss is as great as with any form of gastric bypass.
We thought, in the late 1960s, that gastric bypass was a Pavlovian training operation and that if it created dumping, then this would contribute to weight control. The trouble is that only half of the patients have the potential to dump and dumping goes away with time. If the stoma is small enough to control eating and drinking of hyperosmotic fluids, then dumping is much less likely to occur, even if the patient is so disposed. Also, it is probably not possible, on the basis of a preoperative history of eating habits, to know what the patients' habits will be after being provided with a small meal-sizing pouch. Sugerman had conducted a randomized study of this, but his number of patients was small. The study needs to be repeated before we conclude that all morbidly obese patients who like sweets should have a gastric bypass with its potential for malabsorption, in preference to an operation that maintains a normal sequence of digestion and absorption.

Some surgeons have taken the position that gastric bypass, in their hands, produces better weight loss. If this is true, is it because an 80-cm long jejunal limb is used? In the case of bilio-pancreatico-jejuno-ileal bypass most of the digestive tract is taken out of the food stream. This must increase the malabsorption of some essential nutrients, and it seems likely to produce earlier and more severe bone disease. Malabsorption is not necessary and no form of bypass should be accepted as long as a non-bypass procedure will provide adequate weight control. Most of us agree that intestinal bypass should not be used but there seems to be some reluctance to judge gastric bypass by the same standards. Perhaps future longitudinal bone density and bone biopsy studies comparing various bypass operations will remove some of this resistance.

**Evaluation of Results**

Let me turn now to the problem of evaluation of results. Andres prepared a table that compares weight-for-height based on actuarial data collected by the Metropolitan Life Insurance Company that is not corrected for age and age-specific Gerontology Research Center recommendations regarding normal weight. This table takes into consideration the normal rising weight of individuals as they increase in age. When comparisons are made between postoperative weight and
preoperative weight, it might seem reasonable to correct for the age of the patient at each time of calculation. This is especially true if the patient was a growing child when the operation was performed.

Using Andres' table of weights, our 1966-70 gastric bypass patient data were used to calculate percent of ideal weight for the age at operation and again at time of followup study. The consequent constant percent ideal weight was compared with the change in percent ideal weight based on the Metropolitan Life Insurance Tables. At ten years calculations of percent of ideal using Andres' table showed a 19% greater weight change than calculations based on the Metropolitan Life Insurance table. I am not ready to recommend categorically that we use Andres' tables in reporting results, but such a recommendation should at least be considered. One argument for not using Andres' tables would be that even though there is an increased weight with increasing age, this may not be a healthy change. Perhaps people would live longer if over the years their weights remained at the average level of younger people. Maybe this is one aspect of aging that can and should be controlled.

Those who are enamoured with percent excess weight, or any other single parameter for evaluating results, should study further the effects of initial weight on their results. No single parameter allows comparisons of different operations, surgeons or groups of patients if those patients have varying average initial weights. Higher initial weights produce greater absolute weight loss but lower percent weight losses whether percent initial or percent excess is used. Regression analysis of the final percent ideal versus initial percent ideal does allow comparison of different groups of patients provided the age distribution is the same.

**Selection of Patients**

Finally, when we have solved all technical and analytical problems, what can we do about patient selection to improve results? Joseph Barrash, in his Master's thesis at The University of Iowa, found 27 clusters of MMPI variables that identified at least five morbidly obese patients in each cluster. Further analysis of these cluster groups indicated that eight prototypes can be identified that have predictive value relative to weight loss from vertical banded gastroplasty. Only
40% of patients studied were included in these eight groups but this decreased the variability of results for the remaining 60%. Two prototypes (6 and 7) that were predictive of a poor outcome are indicative also of serious psychological disturbance. Women with type 6 MMPI prototype, according to Barrash, "have histrionic tendencies with much interpersonal conflict and hostility. Substance abuse and eating disorders are common in women with such profiles, as are circumscribed cognitive distortions. Some difficulties complying with postoperative regimens may be expected." These type 6 women had the poorest outcome in the sample of 83 patients, averaging a loss of barely 25% of their initial excess weight. This study is being replicated to further define its validity and then additional investigation will be undertaken with incorporation of other variables in an effort to reach a clinically useful method of identifying both those patients who will do exceptionally well and those who will do poorly, both in weight loss and in emotional response to gastric reduction.

I have tried to summarize the state of the art of bariatric surgery as I see it today. We, as a Society, must now look toward the challenges of the future. Our actions will be closely scrutinized by, and have direct effect upon not only patients, but insurance companies, attorneys and other similar medical organizations. We can do a lot to shape the thinking of our peers and society in general in regard to morbid obesity. And we must not forget, misuse or abuse this potential.

Morbidly obese people need physicians who will listen to their often unique problems and learn or develop effective treatment techniques. The physician must be committed to follow up the patient for life and be prepared to manage changes or complications that result either from the primary disease or as a consequence of the treatment.

As surgeons we have developed techniques that help the patient to reduce the intake of calories. We are learning how to care for these patients and how to evaluate their response to treatment. We are also learning to manage or eliminate completely problems that arise. And, as with all new endeavors, we seek to learn also from the experience of our colleagues.
The American Society for Bariatric Surgery formalizes and promotes this exchange of information. Selection of patients, variations in operative procedures, patient care, collection of data and the evaluation of results are all areas of keen interest and concern to the Society. The value of our organization rests upon the shoulders of each member and depends upon the effectiveness with which we communicate, both with our patients and colleagues and among ourselves. My charge to each of you is to remain kind, humble, open and receptive. We must also strive to be alert, honest, critical and wise as we care for our morbidly obese patients.

BIBLIOGRAPHY

SECTION MODERATOR: Stanley J. Dudrick, M.D.

CHANGES IN MENSTRUAL CYCLE PATTERN AND SEX HORMONE BINDING AFTER GASTROPLASTY
D. Michael Grace, M.D., Ph.D., J. A. Nisker, M.D., and G. L. Hammond

INTRODUCTION
Obese women are known to have low sex hormone binding globulin (SHBG) capacity resulting in a high percentage of unbound estradiol and an increased risk of endometrial carcinoma. We wished to determine the changes in sex hormone binding and menstrual cycle pattern when women of reproductive age lost weight after gastroplasty.

METHODS AND MATERIALS
Fifty-three women, ages 21 to 54 (mean 36), were assessed preoperatively and one year after transverse gastroplasty using Marlex to support a greater curve channel. Menstrual cycle pattern was assessed by a standard questionnaire. SHBG was measured by liquid phase immuno-radiometric assay, corticosteroid binding globulin (CBG) by solid phase radioimmune assay, and albumin by Bromocresol green dye binding assay. Blood samples were stored at -20°C and analyzed in series at the end of the study.

RESULTS
Mean preoperative weight (±SD) was 269.9 (±42.4) pounds and this decreased to 195.3 (±46.1) pounds after one year (p<0.0001). 35.0% of women in the study had regular periods in the year prior to gastroplasty. One year later 66.7% had regular periods (p<0.01). This is of extra interest since our clinical questionnaire showed that 68.3% of patients had regular periods until they became obese. The mean SHBG capacity (±SD) increased from 26.2 (±12.2) nmol/l preoperatively to 42.5 (±18.8) nmol/l after weight loss (p<0.0001). The mean pre- and postoperative CBG levels (±SD) were 19.7 (±3.4) nmol/l and 19.9 (±8.5) nmol/l (p = 0.89). Albumin (±SD) increased from a mean of 40.8 (±5.9) g/l preoperatively to 46.2 (±3.7) g/l after weight loss (p<0.0001). The serum testosterone decreased from a mean (±SD) of 105.9 (±48.7) ng/dl preoperatively to 65.5 (±31.4) ng/dl after weight loss (p = 0.0007).
CONCLUSIONS

Profound weight loss in morbidly obese women results in a return of the very low SHBG capacity toward normal. Regulation of menstrual pattern is likely secondary to these changes. Increased SHBG capacity after gastroplasty and weight loss results in a marked decrease in unbound estradiol and implies a decreased risk of endometrial carcinoma. The return to regular menstrual cycles suggests a return of normal ovulation which may explain the pregnancies observed following gastroplasty in previously infertile obese women. The increase in serum albumin after weight loss is subject to further study.

QUESTION: Does the atypical endometrial hyperplasia regress after weight loss?
GRACE: We think it does, but we do not have the proof yet.
O'LEARY: (J. Patrick O'Leary, Dallas, TX) Do you have any idea why somebody who is heavy would have a decreased sex hormone binding globulin in this particular protein?
GRACE: I don't. The question is whether testosterone has an effect on the liver that in turn is affecting the synthesis of this globulin. There are other theories, of course. The large amount of peripheral fat may have some sort of binding effect with the globulin, making it unavailable. The answer is not clear.

COMMENT: Can you explain how women who have difficulty becoming pregnant before operation seem to be able to get pregnant after the operation, sometimes within as little as two to three months?
GRACE: It's a complex issue, but obviously as periods regulate then ovulation returns to normal, and then, of course, there's an increased chance of becoming pregnant. I think it's very important that those younger women take appropriate birth control measures for the first year after gastroplasty, especially while they're losing weight rapidly.
OBSTRUCTIVE SLEEP APNEA IN THE MORBIDLY OBESE PATIENT: CONSIDERATIONS AND THERAPY

Michael D. Poole, M.D. and Duncan S. Postma, M.D.

INTRODUCTION

Obstructive sleep apnea (OSA) is a common clinical problem with potentially fatal consequences. The true incidence is unknown but it probably affects about one percent of unselected adults, and is considerably more common in older men and in the overweight population. Indeed, the prevalence of OSA among the morbidly obese is probably close to 30%. The conditions associated with OSA range from simple bothersome snoring to hypertension, cor pulmonale, and sudden death due to arrhythmias. Secondary hypersomnolence may result in marked personality changes with alteration of mental status or an inability to work, drive, or even carry on a conversation.

In most patients, the severity of the OSA is directly related to weight. Weight loss, whether voluntary, or secondary to bariatric surgery may dramatically resolve symptoms, even though weight change is over a narrow range. Consequently, medical management has focused on weight loss, with tracheotomy as the only reliable treatment for severe persistent OSA. In 1981, Fujita et al. reported their results of treatment of OSA with a new procedure, the uvulopalatopharyngoplasty (UPPP). The operation improves or relieves OSA in most patients, and has been rapidly accepted as an alternative to tracheotomy. The surgical goal is to remove redundant and thickened mucosa in the area of the soft palate, tonsillar fossae, and lateral hypopharyngeal walls, thereby enlarging the oropharyngeal airway. The reported effectiveness of the procedure has varied among institutions, but nearly always improves symptoms though improvement of sleep study parameters have been present in only about 50% of patients.

The obese patient is not only more likely to have OSA, but he is prone to be more severely affected. The upper airway obstruction appears at least in part to be due to the excess weight and redundant tissue in the neck and parapharyngeal tissues. For reasons that are not entirely clear, data on the usefulness of UPPP in the obese patient has been conflicting. Simmons et al suggested that obese patients were less
likely to benefit from the procedure. Conversely, Fujita et al.\(^6\) concluded that being 25% overweight improves the likelihood of responding to surgery, although additional excessive weight did not further improve prognosis.

**MATERIALS AND METHODS**

Since December 1983, 55 patients have undergone surgical procedures for OSA at North Carolina Memorial Hospital (NCMH). Fifteen patients were morbidly obese, either 100% or 50 kg over weight. A history of chronic severe snoring was present in all, and hypersomnolence in 12 of 15. All patients underwent preoperative daytime polysomnography after one night of sleep deprivation. Monitoring included continuous recording of electrocardiogram, hemoglobin saturation by transcutaneous oximetry, airflow, and intrathoracic pressure measurements by esophageal manometry. Apnea is defined as cessation of flow for greater than 10 seconds, and sleep apnea syndrome exists if there are greater than 30 apneic spells during seven hours of sleep. The apnea index is the number of apneic spells per hour. The classification system used is that described by Simmons et al.\(^7\): A = Mainly simple snorers with a low apnea index and minimal arterial hemoglobin desaturation. B = Mild OSA, desaturation no less than 75%, with no daytime symptoms. C = Moderate OSA, with desaturation between 60% and 75%, with daytime symptoms. D = Severe OSA, with daytime symptoms, oxygen desaturation below 60%, or with any serious cardiac arrhythmias.

**RESULTS**

Data from the 15 morbidly obese sleep apnea patients are presented in Table 1. Eleven patients have had severe (class D) OSA or symptoms warranting tracheotomy. Four of these patients when initially evaluated were in marked congestive failure (patients 3, 4, 8, 10), which has resolved completely with treatment. The two patients only undergoing tracheotomy were spared UPPP because their cardiopulmonary status was so tenuous at the time of tracheotomy that operative time was minimized. Nine of the fifteen patients have shown significant improvement in their OSA following airway surgery. In this responder group, six achieved significant weight loss although two of these underwent bariatric surgery. Three patients are documented to have unimproved sleep apnea.
and another three are suspected of little improvement. None of these non-responders have lost a significant amount of weight.

The following cases are described in more detail as illustrative cases. Patient 3 is a young woman who developed progressive heart failure in the two years preceding her tracheostomy. She had become hypersomnolent and was diagnosed as a psychotic schizophrenic on the basis of mental status changes. Progressive hypoxemia and hypercapnia was accompanied by bronchospastic lung disease. She became bedridden and required continuous supplemental oxygen. Weight gain was progressive as she awakened essentially only for meals. She was in and out of intensive care units with acute respiratory arrests and right heart failure with fluid overload. A hepatic insufficiency - related coagulopathy resolved on medical management before she underwent a tracheotomy under local anesthesia. Within two months her mental status and activity level was normal with only mild resting hypoxemia. With a resumption of exercise and her tracheostomy aiding motivation, she has lost 34 kg. A recent sleep study showed no complete apneic spells, although she showed moderate nocturnal desaturation, felt to be related to her intrinsic lung disease.

Patient 7 was initially referred to NCMH for bariatric surgery. Preoperative evaluation showed marked hypercapnia (70-90 mmHg) with mild hypoxemia. With a history suggestive of OSA, a sleep study was performed, showing severe OSA, with hemoglobin saturation dropping regularly below 20%. He was felt to be in moderate congestive failure and deemed to be too high of an operative risk for bariatric surgery. At that time he underwent a tracheotomy under local anesthesia. In the following two months his cardiopulmonary problems completely resolved, as did a venous stasis ulcer of 18 months' duration. He lost 20 kg and underwent an uneventful vertical banded gastroplasty. The tracheostomy was removed and he has subsequently lost an additional 50 kg. He has no symptoms of OSA.

Patient 8 was a 62-year-old male when referred to NCMH after his fourth episode of acute respiratory arrest secondary to congestive failure and cor pulmonale. His family gave a classic history for OSA, and his snoring and hypersomnolence were legendary in their community.
His alertness had declined so that he could not engage in conversation without falling asleep. He frequently took three hours to eat a meal. With inactivity and fluid retention, his weight steadily increased. After a sleep study demonstrated severe OSA, he underwent a standard tracheostomy without skin flaps, a UPPP, and adjuvant nasal surgery. Postoperatively, as his mental status improved, he became less tolerant of his tracheostomy. Standard tracheotomy tubes were inadequate in traversing the abundant soft tissue of his neck, and exposed adipose tissue was painfully slow to heal. He removed the tracheotomy tube three weeks postoperatively against medical advice. Postoperative studies have shown resolution of his apneic spells, although he has partial airway obstruction associated with mild hypoxemia. For the first time in five years he can read a book and work in his yard. He sleeps soundly for five hours per night and takes no naps.

CONCLUSIONS

These data suggest that upper airway surgery alone may be effective in improving OSA in some morbidly obese patients. It also appears that weight loss alone can resolve symptoms, as has been documented in patients undergoing bariatric surgery without airway surgery.\(^3\) Although that study demonstrated weight loss dependent reduction in apneic episodes, arterial desaturation was not measured. No patient was noted to be in congestive failure or acutely ill. Unlike previous reports\(^6,7\), which showed no significant weight loss associated with sleep apnea surgery, several of our patients lost a significant amount of weight, with gross improvement in their OSA. The reasons for weight loss are difficult to identify with certainty, but improved cardiopulmonary capacity, and normalization of mental status and energy level would seem to be critical. Postoperative oropharyngeal pain and the goal of tracheostomy decannulation are additional factors.

With reference to obstructive sleep apnea in morbidly obese patients, we would make the following recommendations:

1. The morbidly obese should be carefully interviewed for a history suggestive of OSA (snoring, apnea, and hypersomnolence). It is a common finding, and, apart from its own intrinsic morbidity, may significantly interfere with weight loss. Polysomnography with oximetry should be arranged when a positive history is obtained.
2. Patients with severe OSA should undergo tracheostomy prior to bariatric surgery. We generally recommend adjunctive UPPP and nasal surgery when appropriate. A sufficient interval should be allowed to optimize cardiopulmonary function. It is possible that continued weight loss will obviate bariatric procedures.

3. A skin flap tracheostomy speeds healing, and yields a more secure and comfortable stoma. Tracheostomy can be performed under general anesthesia, but only after careful examination by the anesthesiologist and otolaryngologist confirms there are no anatomic problems with intubation.

4. In young patients with a history of severe OSA, decannulation of the tracheostomy should be done only after repeat sleep study confirms resolution of OSA and there is a reasonable probability that the anatomic factors and weight problems that contributed to the apnea have been permanently resolved.

5. Obese patients with persistent OSA should be seriously considered for bariatric surgery.
<table>
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<th>class</th>
<th>weight</th>
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<th>class</th>
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Table 1. Patient Data

OPNs = operations received, T = tracheostomy, N = nasal airway procedures, U = uvulopalatopharyngoplasty, * = gastroplasty performed concurrent with airway surgery, ** = gastroplasty 4 years ago with regaining of weight, *** = gastroplasty 4 mos following tracheostomy, F/U = follow-up period, response = significant improvement in sleep apnea, (+) = improved, (-) = unimproved, ? = class unknown with postop study not yet obtained, decann. = tracheostomy decannulated, Y = yes, N = no.
BIBLIOGRAPHY


BUCKWALTER: (Joseph A. Buckwalter, Chapel Hill, NC) Some people feel that these operations should be staged. I don't think so. Unless there is a condition such as cor pulmonale or some other really strong indication, it should be done as one operation. Otherwise there is the risk that the patient will not return.

POOLE: For patients with obstructive sleep apnea there are three options. The first option is to do bariatric surgery alone. That option was exercised by a group in Israel and reported in Annals of Surgery last year. Those patients apparently had mild cases of obstructive sleep
apnea. None were in failure. All of them had dramatic improvement of their condition after weight loss. Most of our patients have severe apnea including nightly episodes of life-threatening arrhythmias and hypoxemia. It seems clear such patients must have improved cardio-pulmonary status immediately. A third group of patients fall somewhere in between these extremes. They probably can safely undergo concurrent procedures. The decision should be based on a good sleep study.

SUGERMAN: (Harvey J. Sugerman, Richmond, VA) We've had experience with 38 patients with respiratory insufficiency and obesity, of whom 19 had severe sleep apnea, and of that group a third were in heart failure and had markedly elevated pulmonary, capillary, wedge and PA pressures. I would agree that the safest thing to do in these patients is a tracheostomy. But it doesn't make sense to me to do a UPP on top of a tracheostomy if you're going to do gastric surgery for obesity. It's a redundant procedure since in every one of our patients with weight loss the tracheostomy tube can eventually be removed. A second point is that patients with life-threatening arrhythmias must be monitored until you can operate. We had a patient who died prior to surgery who had been toying with this for two years. There's a relatively new technique for treating these patients called continuous nasal SEPAP. It may obviate the need for a tracheostomy in most patients.
EFFECT OF GASTROPLASTY AND WEIGHT LOSS ON IMMUNE RESPONSE
D. M. Grace, M.D., I. A. Harle, M.D., K. M. Rycroft, B.Sc., and N. R. S. Sinclair, M.D., Ph.D.

SUMMARY

Immune responsiveness was assessed in 22 morbidly obese patients before and 6 months after gastric bypass. In vivo skin testing was carried out with 5 recall antigens. In vitro responsiveness assessed the ability of isolated lymphocytes to take up $^3$H-thymidine after culture with the same antigens. Mean preoperative weight (±SD) of 122 ± 14 kg declined by 33.5 ± 8 kg after 6 months. Number of positive skin tests increased from 1.8 ± 0.17 (SEM) to 2.1 ± 0.17 ($p = 0.2$). One patient, anergic prior to gastroplasty, responded normally 6 months later after substantial weight loss. In vitro response, expressed as a stimulation index (± SEM), increased from 4.71 ± 0.65 to 7.95 ± 1.56 ($p = 0.06$) for the average of all antigens and from 12.85 ± 2.05 to 15.79 ± 2.84 ($p = 0.2$) for the largest response. We conclude that the in vitro and in vivo response to test antigens is not altered significantly 6 months after gastric bypass and profound weight loss. Patients with severe vomiting, rapid weight loss or sepsis may behave differently and require individual assessment.

INTRODUCTION

Gastroplasty and gastric bypass have become common operations for the management of morbid obesity. Some studies have suggested that a significant proportion of patients become malnourished postoperatively. Malnourishment in developing countries is known to be associated with an impaired host immune response. The pioneering work of Meakins has shown the usefulness of skin testing in predicting postoperative complications. Since gastroplasty patients may require further operations on an urgent basis for problems such as stomal obstruction or electively for management of hernias, gallstones, or dependent skin it seemed appropriate to assess the skin test responsiveness of a group of obese patients after gastroplasty. We chose six months as the appropriate postoperative time for follow-up study since most weight loss occurs in this period of time. We chose to monitor skin test responsiveness by the techniques developed by Meakins and to use an
in vitro test of cellular immunity which has been useful in monitoring transplant patients. 6

MATERIALS AND METHODS

The study population was a group of morbidly obese patients admitted to University Hospital for gastric bypass. Selection criteria were standard for this type of operation. Patients were between the ages of 20 and 60 and weighed more than twice ideal weight. The operation was a Roux-en-Y gastric bypass. At least 2 days prior to operation skin testing was carried out with 5 recall antigens. Intradermal injection of 0.1 ml of antigen was carried out as described by others. 4 Antigens employed were candida, mumps, PPD, trichophyton and varidase. The area of induration was measured at 24 and 48 hours and a test considered positive if induration was greater than 5 mm. The test was repeated six months after operation.

For in vitro testing the procedure was carried out as described previously for cell-mediated lymphocytotoxicity. 6 Forty ml of blood were drawn from each patient prior to skin testing. Lymphocyte separation was carried out by a Ficoll-Hypaque technique. Cells were made up to a concentration of 2 x 10^6 ml and suspended in tissue culture medium (RPMI) with 20% heat inactivated autologous serum or A serum. Tests were carried out in triplicate in microtitre plates using 0.1 ml of cells and 0.1 ml of medium containing antigen giving a final cell number of 1 x 10^5 and serum concentration of 10%. Controls included 1 x 10^5 cells in 0.1 ml of 20% A serum in RPMI, 1 x 10^5 cells in 0.1 ml of 20% autologous serum in RPMI and 1 x 10^5 cells in 0.1 ml of RPMI medium only. Antigen dilutions were candida (Bencard Allergy Service) 1/100 and 1/200, mumps (Lilly) 1/200 and 1/400, PPD (Connaught) 0.2 mg and 0.02 mg, trichophyton 1/100 and 1/200 and varidase (Bencard Allergy) 0.1 ml (5 u. streptokinase & 1.2 u. streptodornase or 0.5 u. streptokinase and 0.12 u. strepto- dornase). Cells were incubated for 4 days at 37° with 5% CO₂ and then pulsed with 1 mCi of ³H-thymidine for 16 hours. After harvesting each plate was counted for 5 minutes in a B counter. Blastogenic response was recorded as a Stimulation Index (SI) which was calculated as

\[
\text{mean c.p.m. stimulated cells} \quad \frac{\text{mean c.p.m. for control.}}{}
\]

The test was repeated six months later.
Patients were seen preoperatively and postoperatively in hospital by a dietician and were given diet sheets to take home. They were followed by their family doctor and seen monthly in our Obesity Clinic. High protein intake was encouraged but exact caloric intake was not assessed. Multiple vitamins containing iron were taken by all patients.

RESULTS

A total of 22 patients (2 men and 20 women) were included in the study. Average age was 41 ± 9 (S.D.) with a range of 20 to 60. Average postoperative weight was 122 ± 14 (S.D.) kg. Six months after gastric bypass weight had decreased to 86 ± 11 kg. Results of skin testing and in vitro responsiveness are summarized in Table 1. There was a tendency for responsiveness to increase rather than decrease postoperatively but the change was not significant. Skin testing was considered normal or reactive if a positive response (induration greater than 5 mm) occurred to two or more antigens. Response to only one antigen indicated relative anergy and no response indicated anergy. Table 2 indicates the proportion of patients in each category pre- and postoperatively. Table 3 shows the change in immune responsiveness in relation to weight loss.

Review of clinical data showed no unusual features except in the patient who was anergic preoperatively. He had a transverse gastroplasty with Marlex around a greater curve channel on July 14, 1982. An umbilical hernia was also repaired. His weight at that time was 180 kg and his height 188 cm. Initial recovery was uneventful and he was discharged eight days postoperatively. Over the next two months excessive vomiting was a major problem and upper gastrointestinal series with barium confirmed that the stoma was narrow and gastric emptying delayed. Within 2 months of operation he had lost 40 kg or 22% of body weight. Because of continued vomiting revision to a gastric bypass was performed on October 20, 1982. Skin testing prior to reoperation showed him to be anergic. Postoperative recovery and subsequent course was uneventful. One year later his weight was 104.6 kg.

DISCUSSION

Our patients, who recovered uneventfully from gastric bypass and lost 27% of body weight in 6 months, showed no significant change in
immune response as shown by skin testing and an in vitro test of cellular response to standard antigens. In fact, there was a tendency for the tests to improve although the changes were not statistically significant. Preoperatively many obese patients eat a poorly balanced diet high in fat and carbohydrate. Postoperatively the diet is low in calories but should be high in protein and vitamins as a result of dietary advice and careful follow-up. The improved diet could explain the tendency for immunologic tests to improve.

The fact that four of our patients were relatively anergic prior to gastroplasty is surprising and unexplained. In a group of 727 preoperative patients with a variety of health problems including cancer and sepsis, 18% were relatively anergic and 12% anergic. In the same study 25 morbidly obese patients all had normal preoperative skin tests. It is not clear whether our results are due to faulty technique, since skin testing is difficult to interpret, or whether our patients were abnormal prior to gastroplasty.

More precise measurement of skin test response using 7 rather than 5 antigens may give a more useful assessment of cell-mediated immunity. The one anergic patient should have been excluded from the study by a prior gastroplasty but he demonstrates that anergy can occur. We were fortunate that he did well following a revision gastroplasty. In retrospect he should have been placed on parenteral nutrition on the basis of excessive preoperative weight loss. The lack of skin test response was an even stronger indication for delaying operation. Placement of a feeding tube was not possible because of a stenotic stoma but a smaller operation such as jejunostomy would have allowed nutritional correction prior to the more major revision procedure. Such procedures have proven useful after gastroplasty.

There is controversy as to whether patients are malnourished after gastric stapling operations. One study using sophisticated methods to determine sodium/potassium ratio showed a significant degree of malnutrition after gastroplasty. Another study which determined body cell mass by whole body counting after gastric bypass showed that lean mass was preserved although temporarily reduced early after operation. Protein malnutrition does not always affect the immune response.
Anergy may be more important than nutritional status in predicting susceptibility to infection. However, other clinical studies suggest that nutritional data can predict postoperative complications.

In our study immunosuppression was not detected six months after gastric bypass. Testing early postoperatively might have demonstrated a change in skin test responsiveness. Although most of the weight loss occurs in the first six months, the most rapid weight loss occurs during the first three months. Immunological tests at this time might have shown a different result. For patients requiring emergency reoperation after gastroplasty or gastric bypass, there is no time for nutritional or immunologic assessment. Where there is the luxury of time prior to elective operations such as cholecystectomy, hernia repair or abdominal lipectomy, nutritional assessment is important. For most patients common sense may be as useful as immunologic tests in predicting postoperative complications. For the exceptional case with severe vomiting or excessive weight loss skin testing may help to determine the need for parenteral nutrition and delayed operation. One must always remember that in some patients sepsis must be treated and abscesses drained before anergy can be corrected.

In conclusion, most patients will have no detectable change in skin test responsiveness or in vitro tests of cellular immunity six months after gastric bypass and substantial weight loss. Careful dietary advice and regular follow-up are essential to maintain nutritional status and allow early detection of complications.

BIBLIOGRAPHY


Table 1 - Immune Response After Gastroplasty in Twenty-Two Patients

<table>
<thead>
<tr>
<th></th>
<th>Preoperative</th>
<th>Postoperative</th>
<th>P Value</th>
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<tbody>
<tr>
<td>No. +ve skin tests</td>
<td>1.8 ± 0.17</td>
<td>2.1 ± 0.17</td>
<td>0.2</td>
</tr>
<tr>
<td>Average SI</td>
<td>4.71 ± 0.65</td>
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</tr>
<tr>
<td>Largest SI</td>
<td>12.85 ± 2.05</td>
<td>15.79 ± 2.84</td>
<td>0.2</td>
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</table>

Average ± Standard Error of the Mean

Table 2 - Skin Test Responsiveness After Gastroplasty

<table>
<thead>
<tr>
<th></th>
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<th>Postoperative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>17</td>
<td>17</td>
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<tr>
<td>Relative anergy</td>
<td>4</td>
<td>5</td>
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<tr>
<td>Anergy</td>
<td>1</td>
<td>0</td>
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Table 3 - Change in Immune Responsiveness Related to Weight Loss

<table>
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<tr>
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<th>Number</th>
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<tr>
<td>Improved Response</td>
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<td>Normal</td>
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<tr>
<td></td>
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<td>26</td>
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<tr>
<td></td>
<td>Normal</td>
<td>Normal</td>
<td>14</td>
<td>29</td>
</tr>
<tr>
<td>Worse Response</td>
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<td>Relative anergy</td>
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<td>24</td>
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</table>

22
PINK URINE IN MORBIDLY OBESE PATIENTS FOLLOWING GASTRIC PARTITIONING
Mervyn Deitel, Douglas A. Thompson, Colin F. Saldanha, and Max C. Patterson.

We observed that following gastric partitioning performed for morbid obesity, the plastic urinary tubing frequently became strawberry pink and the urine deep amber. This caused considerable concern and led to a prospective study.

MATERIALS AND METHODS

A study was done on 187 consecutive patients who were at least twice ideal weight and who underwent gastric partitioning, performed by two applications of the TA-90 stapler (Gomez horizontal gastroplasty or Mason vertical banded gastroplasty). Pre- and postoperatively, 24-hour urine collections were done, and the urinary uric acid level, pH, volume and osmolality were determined; urine cultures were performed before removal of the catheter, and the urine was subjected to x-ray crystallography. The urinary tubing was changed at intervals to determine how long "pinkness" of the urine persisted. The patients' dietary histories were recorded, and all the patients received a standard hospital diet from the time of admission. A record was kept of all drugs given before, during and after surgery. Plastic urinary tubing from five manufacturers was used, and samples of the tubing were analyzed by the manufacturers. For comparison, 14 non-obese patients undergoing abdominal surgery underwent the same studies.

The pre- and postoperative data on the individual patients were analyzed by the paired t-test, and the data for the various groups were compared by the t-test for independent samples.

RESULTS

No pink color was seen postoperatively in the plastic tubing from the urinary catheters of the 14 non-obese controls, nor was the urinary tubing from any other patient in the hospital reported to be pink. In 59 morbidly obese patients (32%), pink urine commenced 4 to 24 hours postoperatively and lasted up to 48 hours. The color was not caused by diet, drugs, hemoglobinuria, hematuria, myoglobinuria, bacteria or any material in the various plastic collection tubings.
On light and electron microscopy after centrifugation of the urine, preoperatively uric acid dihydrate crystals were seen infrequently but postoperatively they were seen in high concentration in the sediment in all morbidly obese patients. This was confirmed by x-ray diffraction crystallography, which identified the d-spacing characteristic only of uric acid dihydrate.\(^1,2\) The supernatent was clear. Preoperatively (I), obese patients had serum uric acid in the high normal range (see Table). Early in the postoperative period (II) in all groups, serum uric acid decreased (p<0.05) and 24-hour urine uric acid increased (p<0.01). However, the increase in the urinary uric acid was above the upper limit of normal (i.e. >4.5 mmol/day) only in those with high body mass index.

The serum creatinine level, the 24-hour creatinine clearance and the arterial pH were within normal limits in all the patients both pre- and postoperatively.

DISCUSSION

X-ray diffraction analysis showed that the pink precipitate that appeared postoperatively in the urine of the morbidly obese patients was made up of uric acid dihydrate crystals.\(^3\) Pure uric acid crystals are colorless, but in the urine they are almost always colored by adsorbed urinary pigments,\(^4,5\) which color the urine deep amber and form pink to reddish-brown deposits along plastic urinary tubing and a pink sediment when the urine is centrifuged.

The patients in our study who had "pink urine" were the most obese, as determined by body mass index,\(^6,7\) compared to those without "pink urine." Obese patients have a greater rate of purine biosynthesis and an exaggerated rate of uric acid production.\(^8,9\) It is likely that the urine uric acid and uric acid clearance measurements in the patients who showed "pink urine" were falsely low, because the uric acid dihydrate crystals that had precipitated along the urinary tubing were not taken into account.

A postoperative increase in the urine level of uric acid may be related to a non-osmotic release of antidiuretic hormone (ADH) due to the stress of surgery. An increase in the circulating level of ADH would cause expansion of the extracellular fluid volume, which in turn would increase the urinary clearance of uric acid by decreasing the rate of
reabsorption in the proximal tubule. The increased secretion of ADH would also explain the reduced urine volume and increased urine osmolality of the patients with "pink urine." Another reaction to the stress of surgery is activation of the adrenal cortex; the release of corticosteroids would increase the clearance of uric acid through their uricosuric effect. The urine levels of uric acid could also be increased by the crushing of gastric tissue by the stapler, which would release nucleotides; when purines are metabolized, uric acid remains as the end-product.

In our study, the "pink urine" had a significantly lower pH than the postoperative urine of normal color from obese patients (p<0.05) and the postoperative urine of the non-obese patients. Uric acid has a pKa of 5.75 and its undissociated form is highly insoluble; therefore, it is more likely to precipitate in acidic urine. Alkalization with sodium hydroxide caused dissolution of the pink precipitate, which is characteristic of uric acid crystals due to the dissociation of uric acid into urates, which are much more soluble. The cause of the lower postoperative urine pH in the patients with "pink urine" has not been determined.

The patients with postoperative "pink urine" had the lowest urine volume and a significant increase in urine osmolality. This would also favor increased precipitation of uric acid crystals in the urine.

CONCLUSION

The pink color on the plastic urinary tubing of morbidly obese patients after gastric partitioning was due to precipitation of uric acid dihydrate crystals. This correlated significantly with increased urine osmolality and decreased urine pH and volume. Crushed gastric tissue with release of nucleotides may have been a contributing factor.

BIBLIOGRAPHY


Table - Results preoperatively (I) and postoperatively (II)

<table>
<thead>
<tr>
<th></th>
<th>Serum uric acid</th>
<th>Urine uric acid</th>
<th>Uric acid clearance</th>
<th>Urine Osmolality</th>
<th>Urine pH</th>
<th>Urine volume</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>μmol/L</td>
<td>mmol/d</td>
<td>mL/min</td>
<td>mmol/kg</td>
<td></td>
<td>mL/d</td>
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<td>Females with pink urine</td>
<td>I</td>
<td>342 ± 104</td>
<td>3.5 ± 0.9</td>
<td>4.7 ± 1.3</td>
<td>552 ± 308</td>
<td>5.72 ± 0.80</td>
</tr>
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<td></td>
<td>II</td>
<td>311 ± 102 †</td>
<td>5.2 ± 2.3 †</td>
<td>8.8 ± 5.3 †</td>
<td>694 ± 212*</td>
<td>5.30 ± 0.51†</td>
</tr>
<tr>
<td>Females without pink urine</td>
<td>I</td>
<td>341 ± 90</td>
<td>3.2 ± 1.5</td>
<td>5.6 ± 4.1</td>
<td>641 ± 213</td>
<td>5.60 ± 0.82</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>315 ± 96 †</td>
<td>5.2 ± 2.4 †</td>
<td>8.9 ± 5.3 †</td>
<td>664 ± 149</td>
<td>5.75 ± 0.93</td>
</tr>
<tr>
<td>Males with pink urine</td>
<td>I</td>
<td>480 ± 70</td>
<td>4.4 ± 1.5</td>
<td>4.7 ± 2.1</td>
<td>802 ± 230</td>
<td>5.47 ± 0.21</td>
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<td></td>
<td>II</td>
<td>460 ± 43*</td>
<td>4.8 ± 1.2*</td>
<td>7.2 ± 0.8*</td>
<td>850 ± 174</td>
<td>5.40 ± 0.48</td>
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<tr>
<td>Males without pink urine</td>
<td>I</td>
<td>422 ± 65</td>
<td>4.5 ± 2.6</td>
<td>4.9 ± 2.4</td>
<td>782 ± 59</td>
<td>5.55 ± 0.61</td>
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<td></td>
<td>II</td>
<td>412 ± 110</td>
<td>5.8 ± 2.3†</td>
<td>8.8 ± 4.5*</td>
<td>730 ± 97</td>
<td>5.94 ± 0.88*</td>
</tr>
<tr>
<td>Non-obese females</td>
<td>I</td>
<td>261 ± 101</td>
<td>2.0 ± 0.9</td>
<td>4.3 ± 2.5</td>
<td></td>
<td>5.81 ± 0.38</td>
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<tr>
<td></td>
<td>II</td>
<td>212 ± 154*</td>
<td>3.1 ± 1.5*</td>
<td>5.0 ± 8.2</td>
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<td>6.10 ± 0.40</td>
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<tr>
<td>Non-obese males</td>
<td>I</td>
<td>305 ± 66</td>
<td>2.1 ± 0.3</td>
<td>5.3 ± 3.0</td>
<td></td>
<td>5.82 ± 0.23</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>282 ± 45*</td>
<td>4.0 ± 0.7†</td>
<td>6.1 ± 0.7</td>
<td></td>
<td>5.91 ± 0.47</td>
</tr>
</tbody>
</table>

Body mass index = BMI = wt(kg)/ht(m)². Values are mean ± SD. Values of II compared with I: *p<0.05, †p<0.01, ‡p<0.001. For values of I compared with I and II compared with II, see text.
DUDRICK: Any comments on the pink urine? Pat?
O'LEARY: I believe that uric acid crystals are clear. Why do they turn pink in your urine?
DEITEL: Uric acid crystals are clear. It depends on the degree. If the amount of uric acid in the urine increases to a large extent they adsorb a pigment called uroerythrin. This will make a pink color if it adheres to plastic surfaces, and this will form a cayenne pepper brown color if it is within the urine itself and not adherent to the walls.
QUESTION: Was there a significant rise in ketones associated with the pink urine?
DEITEL: No, there wasn't.
QUESTION: Could the pink urine have been caused by drugs?
DEITEL: We ruled out all drugs, including all the anesthetic agents.
QUESTION: How about the presence of amorphous phosphate?
DEITEL: No, we did not find amorphous phosphates. We could find no significance to the state of hydration of the patients either before or after operation. We cannot say why these patients had slightly lower pH and slightly higher specific gravities.
COWAN: (George Cowan, Memphis, TN) What's your postoperative incidence of ureteral and renal calculi?
DEITEL: At the present it is zero -- but, if this phenomena continues over a longer period of time, we are sure that we will see uric acid stones.
DUDRICK: Have you considered doing an in vitro study with these crystals while manipulating pH and concentration?
DEITEL: Yes, we've done it.
QUESTION: Have you seen pink urine in patients other than those who have undergone obesity operations?
DEITEL: We did eventually find it in a few other patients that had far-advanced leukemia where there was a tremendous amount of uric acid turnover. Those are the only other patients in whom we found it.
THE FATE OF STOMAL SILASTIC RING SUPPORT IN ROUX-EN-Y GASTRIC BYPASS

John H. Linner, M.D. and Raymond L. Drew, M.D.

Silastic rings have been used to prevent dilation of the outlet in vertical gastroplasties with apparent success, and except for rings that were covered (buried), minimal erosion or extrusion has been reported.\textsuperscript{1,2}

To prevent dilation of the anastomosis in the Roux-en-Y gastric bypass (GBP) we have placed a silastic ring 8-12F (most of them 12F) in 177 patients over a period of approximately three years. Except for the first 33 rings, all were made from tubing with a radiopaque strip that permitted us to determine their presence at any time in the postoperative period by a single left upper quadrant radiograph. The tubing used for the ring was usually cut 6.3 cm in length, and applied around the gastric side of the anastomosis securing it by ligating an indwelling Prolene suture.\textsuperscript{3} (Fig 1) The ring was never tight, and was not buried or covered except to place adjacent fat over it to prevent adherence to the liver and possible obstruction due to acute angulation.\textsuperscript{4}

This report is a study of the fate of silastic rings placed in this group of patients over a period of from one to three years postoperatively. As shown in Table I, of the 177 total operations there were 88 suitable for inclusion in this report. Reasons for exclusion shown in Table II are the following: less than 1 year follow-up - 17; lost to follow-up or refused x-ray in time for this report - 39; rings not radiopaque so could not be evaluated - 33. The results are shown in Tables III, IV, and V and summarized in Table VI.

We were aware from the symptomatic cases that there were a few erosions and extrusions, but were greatly surprised at the number of asymptomatic extrusions. In these cases, except for radiographic proof of their absence, we would have assumed the rings were still present.

Although follow-up has been too short to draw any conclusions with respect to late failure, we have had only two patients with ring erosion accompanied by dilation of the anastomosis and weight gain. This low incidence may be because, in addition to the short time interval involved, scarring around the anastomosis due to the ring may have prevented its dilation. In addition, failure may be averted because the pouches are very small. Other factors associated with the gastric bypass...
such as the dumping deterrent, Roux limb hypoperistalsis,\textsuperscript{5} and upper GI tract bypass effect may also play a role.

Weight loss results in the primary group of 127 silastic ring patients can be seen in Fig. 2, and a comparison excess over ideal weight study in Fig. 3.

X-ray evaluation will be continued for a period of at least five more years in patients with a persistent ring, and routine annual examinations on a lifetime basis for all patients.\textsuperscript{6}

Because it was our impression that the small anterior pouch with a small rigid outlet might increase the incidence of staple line disruption, we compared disruptions in all categories of patients over an eight year period. As seen in Tables VII and VIII, the comparative studies suggest an increased incidence of disruptions in the small pouch with silastic and Prolene supported outlets, especially those with single staple lines.

Tables IX, X, and XI show the early and late complications in this group of patients.

As a result of these findings we are currently employing the technique outlined in Table XII as follows. We are still using the small 10-15cc anterior pouch, and an anastomosis of 10-12mm internal diameter as before, but now supported with a fascial strip from the anterior abdominal wall, 1 cm wide, marked with a row of staples down its center. To prevent staple line disruption we transect between pouch and stomach, eliminating this cause for revision. There have been no leaks in primary patients and the blood supply to the pouch has invariably been excellent. We use a tube gastrostomy from the distal stomach in all patients and no NG tube. This has the advantage of providing an alternate route for feeding if needed in early outlet stenosis, and in addition, fusing the anterior gastric to the anterior abdominal wall greatly facilitates percutaneous x-ray visualization of distal stomach via skinny needle technique, should that ever be desired.

Because of the gratifying results we have experienced with the Roux-en-Y gastric bypass, we continue to use it in the great majority of our patients. It is a technically more demanding operation than gastroplasties or gastric bandings and requires supplementation with
multivitamins, B-12, and in many instances calcium, and iron at least during the first two years, and possibly for a lifetime.

We describe alternative operations to our patients, and to demonstrate our ecumenical spirit we have performed one biliopancreatic bypass, and one vertical banded gastroplasty.
FATE OF SILASTIC RINGS IN ROUX-Y GBP
1-3 YR FOLLOW-UP

<table>
<thead>
<tr>
<th>Type of Operation</th>
<th>Total Cases</th>
<th>Eligible Cases</th>
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<tbody>
<tr>
<td>Primary GBP</td>
<td>127</td>
<td>62</td>
</tr>
<tr>
<td>JIB Reconst/GBP</td>
<td>23</td>
<td>15</td>
</tr>
<tr>
<td>Revis./Conv</td>
<td>27</td>
<td>11</td>
</tr>
<tr>
<td>Totals</td>
<td>177</td>
<td>88</td>
</tr>
</tbody>
</table>

[89 unsuitable for study]

Table I

REASONS FOR EXCLUSION FROM STUDY

1. Less than 1 year follow-up 17
2. Lost to follow-up (refused x-ray) 39
3. Ring non-radio opaque (early cases) 33

Total 89

Table II
RESULTS

I. Primary Roux-y GBP
   No. Eligible 62
   A. Spontaneous Extrusion (Asymptomatic) 16
      Time interval mos. 12 18 24 30 36
      No. cases 2 3 4 3 4
   B. Symptomatic (removed surgically at 19 mo. post op.) 1
      Total 17 (27%)

Table III

RESULTS

Secondary Operations:

II. JIB Takedown Plus GBP
   No. Eligible 15
   A. Spontaneous Extrusion (Asymptomatic) 8
   B. Symptomatic Extrusion 0
      Total 8 (53%)

Table IV
RESULTS

Secondary Operations:

III. GBP Revisions/Conversions  No. Eligible  12
   A. Spontaneous Extrusion (Asymptomatic)  2
   B. Symptomatic Extrusion  2
       Total  4  (33%)

Table V

SUMMARY - FATE OF SILASTIC RINGS 1-3 YEARS

<table>
<thead>
<tr>
<th>Operation</th>
<th>Eligible Patients</th>
<th>Rings Extruded</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Roux-y GBP</td>
<td>62</td>
<td>17</td>
<td>27</td>
</tr>
<tr>
<td>JIB Takedown/GBP</td>
<td>15</td>
<td>8</td>
<td>53</td>
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<tr>
<td>GBP Rev/Conv.</td>
<td>11</td>
<td>4</td>
<td>33</td>
</tr>
<tr>
<td>Totals</td>
<td>88</td>
<td>29</td>
<td>37%</td>
</tr>
</tbody>
</table>

Table VI
Figure 2. 36 Month Results with Silastic Ring Small Anterior Pouch Technique
127 Primary GBP Patients

Figure 3. Final Percent Overweight for Three Procedures Distributed in Quartiles and Graded from Excellent to Poor
## STAPLE LINE DISRUPTIONS

### Anterior Pouch Prolene Suture Support [10-15 cc]
- Single staple line (suture support) 3/31 (10%)

### Anterior Pouch - Silastic Ring [10-15 cc]
- Single staple line (suture support) 6/67 (9%)
- Double staple line (suture support) 1/53 (2%)

Table VII

---

### Greater Curve Pouches [30-50 cc]
- Single staple line (50% suture support) 9/184 (4.1%)

### Lesser Curve Roux-y [15-20 cc]
- Double staple line (suture support) 1/24 (4%)

### Over All Disruptions
- 44/800 (5%)

Table VIII
### EARLY COMPLICATIONS — SILASTIC RING

<table>
<thead>
<tr>
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<th>Primary 127 Pts.</th>
<th>Revision 50 Pts.</th>
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<td>Post op. bleeding</td>
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<tr>
<td>S.B. obst.</td>
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<td>(1)</td>
</tr>
<tr>
<td>Wd. Inf.</td>
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<td>2</td>
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( ) Surgical Rx

Table IX

### LATE COMPLICATIONS — SURGICAL Rx

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<th>Revision 50 Pts.</th>
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<td>Staple Disrupt.</td>
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<td>(2) 3</td>
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<tr>
<td>Stomal ulceration</td>
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<td>Stomal Dilation</td>
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<tr>
<td>Gastric ulcer</td>
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<tr>
<td>Ventral Hernia</td>
<td>(4)</td>
<td>(6)</td>
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<tr>
<td>S.B. obst.</td>
<td>(1) 1</td>
<td>(1) 1</td>
</tr>
<tr>
<td>Cholelithiasis</td>
<td>(3)</td>
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</table>

( ) Surgical Rx

Table X
LATE COMPLICATIONS — MEDICAL Rx

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<thead>
<tr>
<th>Condition</th>
<th>Count</th>
<th>Rate</th>
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</thead>
<tbody>
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<td>Anemia - iron</td>
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<td>1</td>
</tr>
<tr>
<td>Anemia - B-12</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Neuropathy</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Hypocalcemia</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Table XI

CURRENT TECHNIQUE

1. Roux-y anterior small pouch [10-15 cc]
2. Anastomosis 10-11 mm internal diameter supported by 1 cm wide fascia strip
3. Transection between pouch and stomach
4. Routine tube gastrostomy to distal stomach
5. No NG tube

Table XII
BIBLIOGRAPHY
1. Eckhout, G.V.: Long term results of vertical gastroplasty with chronic or silastic ring supported gastric stoma vs gastric bypass for treatment of morbid obesity. Presented at University of Iowa, June 4-5, 1984, Bariatric Symposium.

QUESTION: What antibiotic do you use before operation and during the procedure?
LINNER: We are using Ancef at the present time.
COMMENT: I use Cleocin on all of my patients and I'm using the silastic band.
BROLIN: (Robert Brolin, New Brunswick, NJ) In light of your results with the silastic ring and the fact that there was no significant difference in weight loss between those patients who had erosions and those who did not, do you feel there would be significant benefit in using these rings with Roux-en-Y gastric bypass?
LINNER: When you have this small a pouch with a Roux-en-Y gastric bypass, it is questionable whether a ring is necessary at all. We felt that controlling the enlargement of the outlet would be important in preventing late failures. We all get good results the first three years, but it's after the first three years where things begin to fall apart.
VERTICAL BANDED GASTROPLASTY AS AN ANTIREFLUX PROCEDURE

Mervyn Deitel, John Hagen, Rokesh K. Khanna and Riivo Ilves

Among the problems in the morbidly obese is heartburn and regurgitation. In a previous study on 55 such patients, we found an incidence of reflux symptoms in 72.7% of patients and a subnormal lower esophageal sphincter (LES) pressure in 47.3% of patients.¹

The VBG is a relatively simple and safe operation which has been performed on 353 patients at St. Joseph's Health Centre without mortality and with acceptable loss of excess weight thus far.² Because patients noted cessation of the preoperative heartburn in the months following VBG, we studied the effect of this operation on the mechanisms which prevent reflux.

A 28 mm EEA-window was cut against a 32F Ewald tube along lesser curvature, enabling two adjacent applications of the TA-90 stapler to form a secure partition from the lesser curvature margin of the window to the angle of His, tightly against the Ewald tube, producing a straight channel. The premarked Marlex collar was threaded under the vagi and wrapped about the tube, with its stretch-ability vertically but not transversely, and was sutured to itself so that its circumference was not greater than 5.0 cm. Greater omentum was sutured over the Marlex. If one wanted to prevent reflux, a Nissen fundoplication could be done in these deep adipose patients, but we studied the effect of this channel alone.

The similarity of this procedure to the Colles gastroplasty for acquired short esophagus is evident; Colles cut a vertical gastric tube or neo-esophagus which enabled stomach to be reduced below diaphragm, and changed the abnormal obtuse angle to an acute angle, which he considered important.³ Others improved this technique by addition of a partial⁴ or total⁵ fundoplication. These procedures required a thoracic or thoracoabdominal approach.

The lesser curvature tube is lined mainly by mucous-secreting cells. Berger in 1934 found that stomach adjacent to cardia had few parietal cells,⁶ and this was further confirmed by lack of acid in the aspirate from proximal gastric pouches by Mason and Ito⁷ and Simonowitz and co-workers.⁸ Billencamp in 1929 showed that the Magenstrasse is devoid of pepsin secretion.⁹
MATERIALS AND METHODS

Over a 4-month period, 29 females and 2 males (age 35.2±9.5 SD yr) with preoperative weight >45 kg above ideal (excess weight 61.1±12.0 kg or 114.1±21.8% and body mass index 45.1±4.9) were studied. In studying the effect of VBG on reflux, it was important to perform the postoperative studies before loss of excess weight, in order to avoid the effect of weight loss itself on reflux mechanisms. Pre- and postoperative studies consisted of standardized interview (by J.H. and R.I.), initial esophagogastroduodenoscopy at inception of the operation (by M.D.), and manometry with Bernstein acid perfusion test. Repeat studies were performed postoperatively at 7-24 wk (mean 13.0±5.5 wk), after the edema from the operation and esophageal handling had resolved, but before excess weight loss; weight loss at this time was 20.9±7.6 kg or 18.2±6.3% of preoperative weight with body mass index 36.9±4.7.

RESULTS

Symptoms were graded from 0-none to 3-severe. Of the 31 patients (Table I), heartburn was experienced in 24 (77.4%), the grade averaging the entire 31 patients being 1.6, regurgitation 17 patients (54.8%) with grade 1.1, occasional dysphagia in 1 patient, nocturnal aspiration in 2 and sensation of "lump in throat" in 2. Postoperatively at 13.0±5.5 wk, 7 patients had heartburn (although decreased in all), mean grade for the entire 31 patients being 0.4. At subsequent follow-up, heartburn had disappeared in all by 36 weeks. The comparison postoperatively differs from preoperatively in that the operation produced very early satiety and patients now followed a fluid, blended and mushy diet without dysphagia or aspiration.

Preoperatively barium studies showed hiatal hernia in 7 patients and gastroesophageal reflux in 7 (5 who showed a hiatal hernia). On postoperative studies, barium slowly traversed the gastric channel, travelled to antrum as well as retrograde to fundus, and progressed through pylorus. However, after barium had passed distal to the channel, Trendelenburg position plus pressure could not demonstrate reflux or hiatal hernia in any patient. The cardia occasionally appeared widened. Because of the partition, the angle of His could be construed to be at the bottom of the staple-lines or actually at the window.
Preoperatively, endoscopy identified a hiatal hernia in 11 patients and mild esophagitis in 3 (2 of whom were symptomatic and showed reflux on preoperative barium study). Postoperative endoscopy identified no hiatal hernia or esophagitis.

Esophageal manometry on the fasted patient utilized the triple-lumen polyethylene catheter, with three sideholes 5 cm apart and oriented at 120° to each other, passed transnasally and withdrawn at 1 cm increments. The three ends of the catheter were connected to an Arndorfer pneumohydraulic low-compliance capillary infusion system, with pressure (i.e. resistance to outflow from the catheter) recorded on a 4-channel Beckman Dynograph, calibrated by a mercury column sphygmamometer through a pressure range of 0-80 mmHg. The mean of the six readings from two station pullthroughs was calculated. At the end of the study, the Bernstein test was performed at a point 5 cm above the LES, using 0.1 N HCl, with normal saline for confirmation.

Preoperative tracings using intragastric pressure as 0 baseline showed relatively low mean LES pressures before the esophageal respiratory inversion point. Postoperatively, tracings characterized the channel proximal to the intragastric baseline by a caudad peak indicating the Marlex collar, and elevated gastric channel pressure, and an improved elevated lengthening of the LES pressure prior to the respiratory reversal point. Diagrammatically (Figure 1) is shown gastric baseline, mean collar pressure, gastroplasty channel and LES pressure, and the negative esophageal pressure. The length of the neo-esophagus from collar to respiratory inversion point was 6.8±1.4 cm, and the calculated theoretical fasting channel pressure (πr² x length) was 6.2 mL.

Statistical comparisons used t-test for paired samples (Table II). Mean basal LES pressure was 14.5 mmHg preoperatively and 20.1 mmHg postoperatively. Marlex collar pressure was 19.2 which when compared to preoperative LES pressure had p<0.01, but was not significant when compared to postoperative LES pressure. Pressure under the rigid Marlex collar was higher than the 9.5 mmHg channel pressure. Preoperative Bernstein test was positive in 7 patients (all had heartburn), and remained positive in 3 at 13.0±5.5 wk postoperatively.
DISCUSSION

How does VBG satisfy current concepts for prevention of reflux? Gastroesophageal competence has been shown to depend on: 1) the amplitude of the LES high pressure zone and 2) the length of esophagus exposed to abdominal positive pressure. If one of these decreases, the other must increase to inhibit reflux. The gastroplasty tube fulfills these two requirements. The staple-lines also maintain an acute angle of His (although animal studies have shown that this is not a requisite for competence) and also, by their rigidity, tend to inhibit passage of stomach up through esophageal hiatus. Also, a long high pressure channel has been shown to impair transmission of gastric wall tension as a distracting force to the LES. Furthermore, in VBG, lesser curvature clasp (open C-shaped) muscle fibers and circular fibers are secured by perpendicularly applied staple-lines, producing a muscular tube with intrinsic pressure. Finally, by LaPlace's law (P = ), the decreased radius will be associated with elevated pressure in the channel.

CONCLUSION

VBG creates a high pressure channel from just above crow's foot to angle of His, inhibiting reflux of gastric juice with no other procedure added. We may speculate that in the future VBG warrants study as a transabdominal antireflux procedure for non-morbidly obese patients, using a larger bougie, long channel from just above crow's foot, and no collar, to permit normal diet.

BIBLIOGRAPHY

TABLE I — SYMPTOMS ON STANDARDIZED INTERVIEW*

<table>
<thead>
<tr>
<th>SYMPTOMS</th>
<th>PREOPERATIVELY</th>
<th>POSTOPERATIVELY 13.0±5.5 WK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO. OF PATIENTS (N=31)</td>
<td>GRADE</td>
</tr>
<tr>
<td>HEARTBURN</td>
<td>24 (77.4%)</td>
<td>1.6±1.1</td>
</tr>
<tr>
<td>REGURGITATION</td>
<td>17 (54.8%)</td>
<td>1.1±1.2</td>
</tr>
<tr>
<td>DYSPHAGIA</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>NOCTURNAL ASPIRATION</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>&quot;LUMP IN THROAT&quot;</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

*Grading was based on the mean of all 31 patients.
Postoperative diets were not equivalent; patients now on tiny minced meals, chewed well and taken slowly. A transient postop dysphagia in one patient was relieved when swallowed bubble-gum was removed endoscopically.
Regurgitation refers to reflux of bitter acidy gastric juice from beyond the neo-esophagus (ie. channel).
<table>
<thead>
<tr>
<th>Les Pressure (mmHg)</th>
<th>Marlex Collar Pressure (mmHg)</th>
<th>Gastric Tube (Channel) Pressure (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Préop 14.5±7.2</td>
<td>Postop 20.1±7.7 P&lt;0.005</td>
<td>19.2±7.8 P&lt;0.01 compared to préop les pressure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.5±6.0</td>
</tr>
</tbody>
</table>
FIGURE 1: Manometric characterization of VBG. Calculated fasting volume of the non-distended channel from collar to LES is 6.2 ml; this result is consistent with Agha et al,16 who found on radiologic study that the VBG pouch could best be visualized when 3 to 6 ml of barium is swallowed.
DAYTON: (Merril Dayton, The University of Iowa) Would you predict this operation might have application as an antireflux operation?

DEITEL: I think it could have application, especially for the patient who has reflux esophagitis, hiatal hernia, and in whom the stomach can be reduced into the abdomen. It's unlikely after this procedure that the fundus will go back up because we have produced an angle of His just like a board, and that whole area between it is a fibrotic area.

SUGERMAN: I've found that both vertical banded gastroplasty and the Roux-Y gastric bypass patients have a marked decrease in reflux symptoms and heartburn. Your data about the lower esophageal sphincter pressure is very interesting, but I wonder if the decrease in heartburn is due to the fact that there is very little acid left in the small pouches created by either of those procedures.

DEITEL: I think what you bring up is very true. There is the possibility that the decrease in symptoms owes to the lack of acid in this area, but I will say that a Collis gastroplasty alone did not stand the test of time, and something more had to be added. Therefore, I think that for a reflux procedure, some change has to be made, and one way is to lengthen the channel. The length of the channel is very important because as it increases, the lower esophageal sphincter pressure may decrease, but with competence still being maintained.

QUESTION: In a patient who is preoperatively morbidly obese with symptomatic reflux esophagitis demonstrated on endoscopy, and absence of lower esophageal sphincter on manometry studies, would you do a Nissen fundoplication?

DEITEL: No, I would just do the straightforward vertical banded gastroplasty.
O'LEARY: Statistics are defined as a body of concepts or methods of learning or for learning from experience. The very notion of learning from experience carries with it the concept that we take knowledge from previous sets of incidences and then project that knowledge into the future to the next set of incidences that may or may not occur. Consequently, it is important that we have assurance that our first interpretation is correct before we project it to the next. Another critical point is that the next set of incidences must be similar to the first set of incidences or the projection will be meaningless.

Mark Twain claimed that there are three types of liars: regular liars, damn liars, and statisticians. To illustrate this point, I could add up all the scores in the recent NBA playoffs and then calculate the mean, the median and the standard deviation. Based on these calculations it can be proven statistically that there's no difference between the winners and losers. Now, of course, this is statistical trick. The reason there's no difference is because the range, or the standard deviation from the mean, is so great that you cannot reach statistical significance. In the perfect gaussian curve, the mean, the median and the mode form the single line that runs through the middle. The mean is the average of all the observations, the mode is the largest number of observations that will occur on that line, and the median is the halfway point between all observations. Later Dr. George Cowan will explain the meaning of standard deviation. For our purposes, you must keep in mind that two standard deviations from the mean will account for 95% of all observations.

When we speak of a p value of 0.05, which is the p value that most of us accept as being a significant observation, it simply tells you or the reader of a scientific text, that the null hypothesis can be rejected
at a 95% level of confidence. In other words, a p of 0.05 is telling us that there's a 5% chance that the results could be by chance alone, but a 95% chance that there is in fact a relationship to whatever is being studied. The standard error is a way to quantitate how far from mean or median a given observation lies.

We must always keep in mind what kind of statistics are needed to demonstrate our points. Often a regression analysis will be helpful in giving meaning to data that includes several variables. Reading the surgical or medical literature without at least a basic understanding of statistics can be confusing. It is recommended that you study statistics and learn how to use them properly.

People often speak of studies that are prospective and randomized. There are weaknesses as well as strengths in prospective and randomized studies. Prospective studies are difficult to do. They require great amounts of time and are costly. Ethical problems must also be considered. Volunteers are often needed, but they may be improper cohorts by virtue of the fact that they are volunteers. A large number of subjects are always necessary, and attrition is a major problem. The benefits of such studies include a control group that is less accessible to bias. Recall is not necessary, and the incidence of diseases can be determined as well as the relative risks. The majority of the studies presented at this meeting have been retrospective. The problems with retrospective studies include control group bias in selection and bias in recall. In other words, the patients who are lost to follow-up substantially detract from our interpretation of retrospective studies. You cannot determine incidence with them and relative risk is only approximated. Another topic is clinical significance versus statistical significance. It is often true that something will be clinically significant without absolutely reaching statistical significance. It is also true that statistical significance can be reached when clinically it doesn't make a difference. When you choose to do a research study, one of the first things you must do is decide how you're going to determine what your results are. In addition, you need to know where you're going and how you're going to get there.
THE STANDARD DEVIATION CHALLENGE

George S. M. Cowan, Jr., M.D.

The Standard Deviation (S.D.) is a true "parameter," a type of measure, or 'meter,' of how data points are distributed around, or 'para' to, their average. It provides a way to describe how certain groups of numeric values are each distributed around their arithmetic average, or mean, whose usual symbol is $\bar{x}$. It usually follows the mean and a $\pm$ sign, signifying its use as a parameter which describes the distribution of data above and below the mean. The wider the range of the numbers, the wider the distribution and, hence, the greater the standard deviation.

The S.D. can be used as a unit of measurement where, for example, a number can be described as being so many standard deviations from the mean. The Figure illustrates the division of a bell-shaped frequency curve into S.D. Since it simulates a large, well-distributed population, it forms a smooth, ideal, bell-shaped frequency curve.\(^1\) The total population 1 S.D. on both sides of this, or any mean, is 34% + 34%, or 68%. Ninety-five percent of this population is 2 S.D. on either side of the mean. This 95%, or 2 S.D. value, is generally accepted as the "normal" range for a given population, separate from the outlier, or "abnormal," two and one-half percent which falls at either end of the curve.\(^1\) The S.D. "ruler" measures 2 S.D. (actually 1.96 S.D. rounded off) above and below the mean. It could be applied to a large population of patients whose weights we wish to study. The weights plus or minus 2 S.D. on either side of the mean include 95% of all the patients whether it is a series from Minnesota, Iowa, Italy or elsewhere. The actual patient weights and numbers of each weight from such representative centers will probably be different but the means and S.D.s of each population can be calculated and then statistically compared with each other to determine if they represent statistically similar weight groups. By doubling any S.D., then adding and subtracting it from its mean, one can determine the "normal" 95% range of any of these figures. Three S.D. from the mean include $>99\%$ of the population as shown in the Figure.

Part of the problem many seem to experience with understanding S.D. is accepting the need to do the complex calculations to derive this number. It is natural to feel that there must be a more straightforward
way to characterize the "spread" of a group of raw data points than by adding, squaring, subtracting, dividing them and then taking the square root of the result. The "S.D. Challenge" is a response to such reservations, to see if there is a better way to analyze and describe parametric data than by using a S.D. To do so, we will take some fabricated, tongue-in-cheek data, attempt to analyze it more simply than an S.D. to try to produce at least equally useful numbers.

Dr. Mason stated, in a recent paper concerning abdominoplasties, that the umbilicus is, on average, 16 cm below the sternum. His overly-dedicated associate, Dr. Pat U. Navel, measured students on the Iowa Union elevator and confirmed this with the data points listed below. Dr. Scopinaro's summer associate, Dr. Belli Buttoni, performed similar measurements on the Genoa Lido but found the mean umbilico-sternal distance (UMB. DIST.) was only 14.0 cm in this population.

The International Abdominoplastists' Convention will shortly convene in Antarctica. Since environmental conditions will preclude measurements at the meeting, they need to have existing data analyzed to determine whether there is, or is not, a significant difference between these two populations:

<table>
<thead>
<tr>
<th>IOWA DATA</th>
<th>GENOA DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>UMB. DIST. (cm)</td>
<td>frequency</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>17</td>
<td>2</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
</tr>
</tbody>
</table>

N = 9         N = 9
X = 16.0 cm   X = 14.0 cm

There are some possible ways to try to analyze this data without using the S.D. Although 2 S.D. equal 95% of the population, we can calculate 95% of the range or of the entire population more easily than the S.D. These are the ranges for 95% of each groups' data:
IOWA Range is 18 cm - 14 cm = 4 cm

95% of 4 cm is 3.8 cm or 1.9 cm on either side of the mean

IOWA

14 15 16 17 18

95% of Range

< 14.1

17.9

95%

GENOA Range is 16 cm - 12 cm = 4 cm

95% of 4 is the same as Iowa, 3.8, or 1.4 on either side of the mean

GENOA

12 13 14 15 16

95% of Range

< 12.1

15.9

95%

The ratio of these 95% ranges is 1.0. It tells us nothing more. It has no further applicability. Also, the ranges do not take the frequency of each UMB. DIST. into account. We cannot meaningfully take these 95% ranges any further to statistically analyze them to determine whether they are statistically similar populations.

Since 2 S.D. can determine 95% of each population, and statistically compare them, it is superior to calculating percentages of each population or range as above.

Another way to analyze the data would be to subtract each number from its group's average or mean, and then add all these 'distances from the mean' together.

For the Iowa data, this comes to:

-2, -1, -1, 0, 0, 0, 1, 1, 2

Adding these together gives zero, which, when we think of it, we could have expected since Iowa's symmetrical data is equally distributed above (plus) and below (minus) the mean. The Genoa data gives the same result.

In order to prevent the differences from the means from cancelling themselves out, we could try using absolute numbers and sum all the
values. However, absolute numbers are extremely difficult to manipulate mathematically and are essentially useless for our purposes.

Historically, students of the subject tried these and other ways to achieve a measure of variation about a mean which would be universally applicable and usable to compare data like ours.

If we take the distance of each number from its mean and square it, all of the numbers are positive thereby solving the problem encountered earlier of the minuses cancelling out the pluses. For the Iowa data, this comes to:

<table>
<thead>
<tr>
<th>X minus DIST. (Δ)</th>
<th>Differences Squared (Δ²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>4</td>
</tr>
<tr>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
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<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
</tr>
</tbody>
</table>

Twelve is the sum total of differences of each data point from the mean squared and added together. To phrase it more concisely, 12 is the sum of the squared deviations from the mean. Since we treated nine values this way, we need to divide by nine to obtain their variance about the mean, a number used in more advanced calculations. Actually, it is better to divide by the Number of subjects, N, minus 1, since it has been found to produce numbers which can more closely approximate the true parameters we're seeking, especially for smaller populations. Division of 12, the sum of the squared deviations from the mean, by N-1, or 9-8=8, produces 12/8 or 1.5, the variance, for the Iowa data. Since we squared each deviation from the mean earlier, we must unsquare this number. The square root of 1.5 = 1.22 which is our S.D.!!

The way we arrived at the S.D. is simple but would be very tedious for a large group of numbers. We would have to store each number until all the numbers were entered in order to obtain the mean and subtract it from each number. There is an algebraic transform of the formula which is used in many calculators and computers.
There are only three unknown values in this formula: \( N, \Sigma X \) and \( \Sigma X^2 \). As each number is entered, the programs calculate each of these values by counting (\( N \)) of the numbers (\( X \)) entered, summing all these entries by simple addition (\( \Sigma X \)), squaring each number as it is entered (\( X^2 \)) and summing all of these squared numbers by simple addition (\( \Sigma X^2 \)). These operations take up very little memory space and, when all the entries are completed, the \( N \) and the two sums are entered into this equation and solved. The only effort required was to "tell" the computer to perform a S.D. of data to be entered and enter the data.

We have taken the "S.D." Challenge and S.D. won. There doesn't seem to be a better way for our purposes but one needn't be too concerned about doing the mathematics for literature review since journal articles usually have the S.D.s of their data calculated. Inexpensive calculators are readily available when needed to determine mean and S.D. From these, we can calculate the 95% ranges of data as described earlier. Although the calculator frees us from the tedium of the arithmetic, the ease of calculation has inherent dangers. We can take data that is inappropriate and effortlessly compute out meaningless S.D.s and other statistics. To perform an S.D., there are certain requirements that the data ought to fulfill:

1. It is best to have well-distributed data which plots similarly to the bell-shaped, or Gaussian, curve;

2. It must consist of ratio (continuous) numbers. These are numbers which have the same distances between each progressive whole number and equal fractions thereof.

The UMB.DIST. numbers are ratio numbers since the distance between each of these progressive numbers from 12 to 18 is 1 cm. However, if we had measured the visual intensity of a skin color and graded it as "0," "+," "++", "+++," or "+++++," the distance between each of these values is unlikely to be exact and, therefore, they are non-ratio values. They should not be analyzed by parametric methods like S.D. Non-parametric
statistical tests, such as Chi-square, are available to analyze such data. When the data is poorly distributed, other statistical tests, usually non-parametric ones, should normally be used even with ratio numbers. Another option is to collect additional data points to allow the distribution curve to become more bell-shaped. If it does, then using a S.D. may become appropriate.

As the well-distributed N or a population increases in size, the S.D. algebraically becomes nearer to 95% of the population. In our very small Iowa and Genoa series, you may have noticed this was not the case. The populations and their S.D.s are each statistically valid, however, as they are evenly distributed, continuous ratio number data.

The S.D. is more powerful than the other mathematical methods we tried to use. We can compare the two groups by using the t-test which uses the S.D., N and mean of each group to test for a significant difference between them. This is beyond the scope of this presentation. However, for your information, the data was found not to be comparable since the Iowa measurements were made with the subjects standing in an elevator and the Genoa subjects were very supine. The International UMB.DIST. Standard is being delayed until more data is obtained.

SUMMARY

Many are unable to interpret, or to accept, the value of performing the multiple arithmetic steps to derive a Standard Deviation (S.D.). The S.D. challenge is presented to the reader to devise a simpler, equally effective way to do the S.D. tasks. Use of percentages of ranges, addition of deviations from a mean and absolute numbers were found to be less satisfactory than S.D. and S.D. "won" the challenge. The appropriate use of S.D. and its application to calculators and computers was discussed.

BIBLIOGRAPHY

BLACKBURN: We want to be able to use the field of statistics to confirm the outstanding work that this body and organization is doing. This is important because we are the only advocate for the morbidly obese and superobese population. Clearly our group is providing effective therapy, but we have not characterized it and documented it. Since this is the way score is kept in the scientific field, it behooves us to do this.

There are several questions we must ask ourselves and areas that should be examined. To begin with, our theoretical data regarding morbidity and mortality among obese people comes largely from two studies, the Lew and Garfinkel data and the Framingham data. Yet all that data is derived from people who are not more than 140% of ideal weight. There's practically no population who weighs more than 140% for which there are morbidity and mortality rates. The Drenick data allows us some solid, quantifiable insight into the heavier patient population. Consequently, when we make extrapolations we must be careful. Our hypothesis is that a hypercaloric diet and excess fat mass with associated high salt, saturated fat and non-nutrient calorie intake does lead to documented metabolic effects which have been scientifically related to changes in glucose, uric acid, free fatty acid, cholesterol and triglyceride levels and increased blood pressure on exertion, creating a whole variety of disease states. The reverse of this is that if you take away this diet and fat mass, which is what this Society is doing, you change all these metabolic effects and all these diseases go away. We must ask ourselves, how do we use the statistics to document this very substantial accomplishment?

In most of our series loss of excess weight rarely reaches 100%. How does this dictate our approach to setting hypotheses and designing the experiments? These are just a few of the things we should keep in mind when we design our studies and attempt to provide the best possible care for our patients.

O'LEARY: The justification of doing surgery in the morbidly obese must come from our results. What we have to do is prove to ourselves and to others that we're doing good for the patients. We must prove that we decrease the incidence of uterine carcinoma, that we decrease the incidence of congestive heart failure, and that we significantly decrease
the incidence of hypertension and cardiovascular death. Our main problem in doing this is trying to find a cohort of patients that represents our group of operated patients. This is very difficult. Flemming Quaade, in Denmark, has made a substantial attempt in a prospective manner to try to answer that question, but to date long-term follow-up study is not available.

COWAN: We have been challenged to answer whether we need to develop different statistics for our problems for our patient populations and how we can relate our statistical studies to different problems such as relationship of weight loss to the reduction of various disease states. How do we do this? How do we know when we read about somebody else doing it that he's doing it correctly? To begin with, we must look at the type of statistic that we're using. Statistics are incorporated in two basic bodies. One is called parametric, the other non-parametric. I defined parameter as a means of finding a descriptive measure for the width of variability around a particular variable. Parametric statistics provide us with a parameter, a standard deviation to show how far out we can go and still be within what we call normal. Many statistical evaluations are based on ratio numbers that have set intervals that cannot deviate. For example, the distance between one inch and another is always the same, regardless of whether we are measuring between inches 3 and 4 or inches 14 and 15. However, if we look at something such as the color of skin, there is no mathematical way to determine degrees of difference. For that type of evaluation we use non-parametric statistics because we cannot develop a standard deviation with those types of numbers. We also use non-parametric statistics when we're dealing with population numbers. The classic test for such cases is chi square. There are other ones, such as the Wilcox, that are used as well. Our main task is to recognize into which type of statistical group our data fall, parametric or non-parametric. Then the appropriate statistical tests must be applied correctly.

HALVERSON: There are several points that we must keep in mind. Even though we can describe our data and show some statistical significance in a descriptive way, we're in a bind in terms of knowing what our data mean. We don't know whether we should compare our postoperative slim
patients with a normal population or with cohorts who did not lose weight or with a control group who were not operated. Compared to the rest of medicine, we are still a very young field. We are at a stage of purely descriptive rather than predictive statistics. We are just beginning to figure out what kind of an impact we and our patients are making upon the incidence of disease in morbidly obese people. As difficult as the data can be to massage, the quality of life issue is very important. We need to continue that kind of work. Clinical impression is totally different from statistical significance, and we've got to be careful, especially in meetings like this, about getting up and saying things definitively that are not definitive. We should make statements about our data only when the population is well defined.
INTRODUCTION

The jejunoileal bypass (JIB) is no longer indicated in the treatment of morbid obesity due to its high complication rate. Although the majority of patients with the JIB learn to tolerate its side effects, our experience, as well as other reports, indicate that approximately 25% of patients with the JIB will eventually require takedown. Operative strategy should include reversal of the bypass, but conversion to a gastric restrictive procedure has been thought by some to entail too high a risk in these patients who are malnourished, electrolyte-depleted, and sometimes cirrhotic. The choice of which gastric restrictive procedure to perform is also in question; as in primary obesity surgery, the gastric bypass is emerging as superior to horizontal gastroplasty.

PATIENTS AND METHODS

We have reversed 90 patients at the University of Florida between 1976 and 1984 for severe complications of the JIB. Thirty-one patients had reversal only (TD/JIB). Forty-one patients were also converted to a gastric partition (TD/GP), and 18 patients have been converted to Roux-en-Y gastric bypass (TD/GB). Primary indications are listed below:

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>TD/JIB</th>
<th>TD/GP</th>
<th>TD/GB</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver dysfunction</td>
<td>9</td>
<td>7</td>
<td>6</td>
<td>22(24%)</td>
</tr>
<tr>
<td>Metabolic (diarrhea, electrolyte abnormalities)</td>
<td>12</td>
<td>16</td>
<td>6</td>
<td>34(38%)</td>
</tr>
<tr>
<td>Nephrolithiasis</td>
<td>9</td>
<td>12</td>
<td>4</td>
<td>25(28%)</td>
</tr>
<tr>
<td>Bypass enteropathy (includes migratory arthralgias)</td>
<td>1</td>
<td>6</td>
<td>2</td>
<td>9(10%)</td>
</tr>
</tbody>
</table>
RESULTS

Clinical information and ideal body weight (IBW) before and after surgery:

<table>
<thead>
<tr>
<th></th>
<th>TD/JIB</th>
<th>TD/GP</th>
<th>TD/GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>31</td>
<td>41</td>
<td>18</td>
</tr>
<tr>
<td>Men/women</td>
<td>10/21</td>
<td>8/33</td>
<td>3/15</td>
</tr>
<tr>
<td>Age (mean, range)</td>
<td>41(24-60)</td>
<td>42(20-60)</td>
<td>42(27-62)</td>
</tr>
<tr>
<td>Yrs. from JIB to conversion (mean)</td>
<td>5.1</td>
<td>4.7</td>
<td>6.2</td>
</tr>
<tr>
<td>Pre-JIB weight (mean %IBW)</td>
<td>193±42</td>
<td>186±38</td>
<td>206±42</td>
</tr>
<tr>
<td>Wt at conversion (mean %IBW)</td>
<td>119±20</td>
<td>119±27</td>
<td>122±33</td>
</tr>
<tr>
<td>Follow-up wt (mean %IBW)</td>
<td>164±38</td>
<td>152±42</td>
<td>107±14</td>
</tr>
<tr>
<td>Follow-up (mean, years)</td>
<td>4.1</td>
<td>3.1</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Complications are listed below:

<table>
<thead>
<tr>
<th></th>
<th>TD/JIB</th>
<th>TD/GP</th>
<th>TD/GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wound infection</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Atelectasis</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Anastomotic leak</td>
<td>-</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>UGI bleeding</td>
<td>-</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Partial SBO</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Hepatitis</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Gastric outlet obstruction</td>
<td>-</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Death</td>
<td>1</td>
<td>2</td>
<td>-</td>
</tr>
</tbody>
</table>

| Morbidity (total, %)     | 6(19%) | 21(51%) | 6(33%) |
| Mortality (total, %)     | 1( 3%) | 2( 5%)  | 0( 0%) |

CONCLUSION

Takedown of the JIB may be common at bariatric centers due to the fact that about 25% of JIBs may eventually require takedown. Simple reversal of the JIB is associated with the lowest complication rate, but leads to rapid weight regain. In our experience, gastric partition was associated with a substantial morbidity (51%) and a weight regain similar to simple conversion alone. Gastric bypass seems to be the procedure of choice; the morbidity is acceptable (33%) for these poor risk patients, and the weight loss experienced after the JIB is maintained.
DEITEL: (Mervyn Deitel, Canada) I know of one surgeon in Vancouver who, in JI bypass, hooks the bypassed loop into the upper end of the stomach. At the time of his report he had done that on 50 new patients. In addition, he had converted about 150 of his prior JI bypass patients who had bypass enteritis and the other complications. His technique was to hook it into the upper end or fundal area of the stomach. With this technique he claimed that diarrhea was less, and there was no migratory arthritis, bypass enteritis or any of the problems of the long blind loop. This is another possible procedure on the horizon which should be kept in mind. If his results are true and stand the test of time, it may become another means of converting a JI bypass to an acceptable procedure.

KRAL: (John Kral, New York) Dr. Eric of Sweden described in 1976 an operation whereby one hooks up the long blind loop to the gallbladder, provided of course that the gallbladder is intact and functioning.

O'LEARY: (J. Patrick O'Leary, Dallas, TX) I understand Dr. Eric is still reporting 27% progressive liver disease after JI bypass. The University of Florida is perhaps the only group that has solid evidence about post JIB liver disease because they biopsy the liver routinely. So a word of caution, these patients with JI bypass are definitely at increased risk for progressive liver disease. Even though they may be totally asymptomatic, they should be watched closely.

GRIFFEN: I just have one comment. I think the JI bypass operation is a terrible procedure. Not only do the patients develop occult liver disease but they can also develop parenchymal renal disease which can still occur no matter what kind of modifications are made.
LEAKS FOLLOWING GASTRIC BARIATRIC OPERATIONS
Joseph A. Buckwalter, M.D. and Charles A. Herbst, M.D.

This is a report of our experience with 19 patients who had leaks, 2.5% of 754 gastric bariatric operations performed since 1975 at the University of North Carolina. In 710 patients the 16 leaks (2.3%) occurred after the first gastric bariatric operation. In the other 44 patients 3 (6.8%) leaks occurred after revision of the initial gastric bariatric operation. Three leaks occurred in 70 patients (4.3%) who had a gastric bypass with loop gastrojejunostomy (GBL); 8 of 216 in patients (3.7%) treated by gastric bypass with Roux-en-Y gastric gastrojejunostomy (GBRY); 1 of 47 patients (2.1%) treated by greater curvature gastropasty (GCG); 4 of 260 patients (1.5%) treated by gastrogastrostomy (GG); and 3 of 161 patients (1.9%) treated by vertical banded gastropasty (VBGP). The 19 patients who had leaks can be divided into two groups; 10 in which the leak was life-threatening (LT) and 9 in which the leak was not life-threatening (NLT). The leaks were LT in 3 GBL, 3 GBRY, 1 GCG, 1 GG and 2 VGBP patients. The leaks were NLT in 5 GBRY, 3 GG and 1 VBGP patients. The diagnosis of a leak was established from 1 to 92 days after operation. The diagnosis was established by a gastrograffin swallow (GGS) in 10 patients. The GGS was negative in 3 patients. In 4 patients the diagnosis was made on the basis of clinical findings, in 3 by a dye study using methylene blue or carmine red and 2 by either a sinogram or an upper GI barium study. A second operation performed to treat the leak in 17 of the 19 patients, was performed in from 1 to 92 days (mean 12.6 days) after the first gastric bariatric operation. The mean was 4.5 days for LT and 21.6 days for NLT patients. The leak closed in all patients in from 0 to 180 days after the second operation, excluding 3 patients discharged and later readmitted to treat the leak. The 16 patients were discharged in 18 to 127 days (mean 39.5) after the first operation. The 10 LT patients had a mean postoperative stay of 44.8 days compared with 30.7 days for the NLT patients. There were no deaths. Six of the 17 patients who were operated on because of the leak, had one or more additional operations. All 17 patients were drained with a penrose and/or sump drains at the time of the second operation. Our experience suggests that penrose drains are more effective than sump
drains. In 7 patients a subphrenic abscess was drained. A feeding jejunostomy was performed in 6 and a feeding and suction jejunostomy in 3 patients. It was possible to close the leak at the time of the second operation in 6 patients. A gastrogastrostomy was performed in 2 and a partial gastrectomy in 1 patient. Poor weight loss, less than 60% of the excess weight one year or longer after the leak, occurred in 7 patients. There were 3 incisional hernias. One patient had reflux esophagitis. Another patient developed a stomal ulcer which was treated by transthoracic vagotomy.

Our conclusions are:

1. Gastric bypass with loop gastrojejunostomy should not be performed because of the possibility of postoperative afferent limb obstruction.

2. Always consider the possibility of a leak in a patient having a gastric bariatric operation with unexplained tachycardia, tachypnea, a left pleural effusion or other evidence of postoperative sepsis.

3. The differential diagnosis always includes atelectasis and pulmonary embolism.

4. A gastrograffin swallow should be performed whenever leak is suspected.

5. Immediate operation is indicated when the gastrograffin swallow is positive, a clinical diagnosis of a leak.

6. Immediate operation is indicated even if the gastrograffin swallow is negative if the clinical findings suggest a leak.

7. When a vertical banded gastroplasty is performed after completing the vertical staple line, methylene blue should be placed in the proximal gastric pouch to test the integrity of the staple line and measure the pouch size. This test should also be used with other gastric bariatric operations.
GRIFFEN: Ursula?

SEINIGE: (Ursula Seinige, Philadelphia) When you reoperate on a vertical banded gastroplasty patient for a leak that is proximal to the Marlex, do you take out the Marlex or will you leave the possibility of a partial obstruction distal to a fistula?

BUCKWALTER: I haven't had that experience. The one patient who leaked from a vertical banded gastroplasty was reexplored at three months. The Marlex had become so infiltrated and so part of the scar tissue that it was not possible to remove it. I don't know what the time factor is, I haven't had an occasion to reexplore a patient within a week. Perhaps it is still possible to take it out then, but I don't think you can take it out a month later or two months later. I think you've got to do something else.

COMMENT: That's not true. In fact, it's very easy to take it out. If you have a leak it probably won't be very easy, but we've taken it out at six months or a year after operation without any problems in patients who had requested takedowns.

HOWELL: (L. Michael Howell, Fargo, ND) My feeling is that if the patient is an obviously poor candidate for operation, we should delay operating for two, three or four months. I think we should insist that these people lose some weight before operation. This operation is one hundred percent elective and if you have someone that's a high risk, they should improve their PO2, quit smoking, and generally get into better condition before operation.

GRAVES: (Herschel Graves, Jr., Nashville, TN) I recommend the use of a gastrograffin swallow whenever a leak is suspected. However, a word of caution. A normal gastrograffin swallow doesn't always mean there's not a leak. If you really suspect a leak and it doesn't show on x-ray, reoperate anyway. We must be aggressive and not let patients die because they leak.
ABSTRACT

We did a retrospective analysis for the etiology of vomiting in 151 patients with gastroplasty for morbid obesity. Stenosis or obstruction of the gastric stoma; mesh intrusion; abnormal esophageal motility; foreign body obstructing the gastric stoma; and esophagitis, gastritis and gastric ulcer were the common causes. Endoscopic examination proves to provide both diagnosis and therapy.

Obesity is a very common medical problem in the United States. The epidemiological studies demonstrated that a 20 percent excess over ideal weight imparted a health risk. By using that criterion, 20 to 30 percent of men and 30 to 40 percent of women in this country are obese. So far there is no ideal way to treat these patients. Medical treatment is often frustrating to patients and physicians. Many patients have sought gastrointestinal operation as a means of treatment. Within the past two decades, a variety of surgical techniques have been advocated for the purpose. Gastric partitioning has become popular in these days due to the technical advantages of using a simple application of the stapling instrument. In order to improve the operative result, the surgeons in our area have changed their technique from Pace transverse gastroplasty to transverse stapling gastroplasty with mesh reinforcement of the stoma then to vertical banded gastroplasty.

Vomiting is the most common postoperative complication in patients with gastroplasty. We have found that patients with different gastroplasties had different causes for vomiting.

MATERIALS AND METHODS

Data for this study was obtained by retrospective chart review of all patients who were referred to our gastroenterology clinic with chief complaints of vomiting and inability to eat after gastroplasty for obesity. From April 1981 to November 1984 a total of 151 patients were seen with this problem. All of the patients had endoscopic examination. Most of the patients also had upper GI x-ray. Eight patients had esophageal manometric study. The causes of vomiting and types of surgical procedures were obtained from medical records. The data was
then analyzed. The result of the treatment was obtained mostly from the medical records from the office of the operating surgeons.

RESULTS

From April 1981 to November 1984, we have seen 151 patients in our gastroenterological clinic with postgastroplasty vomiting. Among them, 55 patients had transverse stapling operation, 45 patients had vertical banded gastroplasty and 51 patients had vertical banded gastroplasty with previous transverse stapling operation.

In the group with transverse stapling operation; 31 had stenosis or obstruction of the gastric stoma, 10 had mesh penetration into the channel of the gastric stoma, 7 had severe esophagitis, gastritis and ulcer, 4 had foreign body (food or medicine) obstructing the gastric stoma, 2 had gastric atonia, 1 had duodenal ulcer.

In the group with vertical banded gastroplasty; 22 had hypertensive esophageal motility or spasm of the gastric stoma, 12 had stenosis of the gastric stoma, 4 had gastritis and gastric ulcer, 4 had foreign body obstructing the gastric stoma, 2 had mesh penetration into the channel of the gastric stoma, and 1 had small bowel obstruction due to adhesion.

In the group with vertical banded gastroplasty with previous transverse stapling operation; 16 had stenosis of the gastric stoma of banded gastroplasty, 13 had hypertensive esophageal motility of esophagus and spasm of the gastric stoma, 10 had mesh penetration into the channel of the gastric stoma, 10 had stenosis at middle upper gastric pouch on the old transverse stapling line, and 2 had gastric ulcer and gastritis.

Stenosis and Obstruction of the Gastric Stoma

Stenosis and obstruction of the gastric stoma is the most common etiology of postgastroplasty vomiting. It can be dilated with balloon dilators. We have used 15 millimeter Gruntzig dilator from Med-Tech or Rigiflex balloon dilator from Micro Vasive. The result of balloon dilatation of 69 patients with stomal stenosis or obstruction is summarized in Table I.
TABLE I

RESULTS OF GASTRIC DILATATION

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>TOTAL</th>
<th>SUCCESS</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tranverse stapling gastroplasty</td>
<td>31</td>
<td>26</td>
<td>84%</td>
</tr>
<tr>
<td>Vertical banded gastroplasty</td>
<td>12</td>
<td>10</td>
<td>83%</td>
</tr>
<tr>
<td>Vertical banded gastroplasty with previous transverse stapling gastroplasty</td>
<td>16</td>
<td>14</td>
<td>88%</td>
</tr>
<tr>
<td>Vertical banded gastroplasty with stenosis at old stapling line</td>
<td>10</td>
<td>5</td>
<td>50%</td>
</tr>
</tbody>
</table>

The failure of dilatation on patients with stenosis or obstruction at transverse stapling line was due to mesh penetration into the channel of the gastric stoma or multiple operation with multiple rows of staple application to the stoma. The failure on patients with stenosis of vertical banded gastroplasty was due to tight band used by surgeon.

Motility Disorder After Gastroplasty

We have seen two different types of motility disorders in patients with gastroplasty. One is gastric atonia. It is a rare complication, only two patients were noted with this problem. Both had multiple transverse stapling gastroplasty. The other type of motility problem is very common in patients with vertical banded gastroplasty. The patients with this problem usually present with intermittent vomiting, tightness or pain over the epigastrium and chest. Sometimes they were able to eat solid foods, sometimes they cannot even drink liquid. The symptoms are usually aggravated by emotional stress. The endoscopic findings are usually unremarkable. Occasionally mild mucosal hyperemia or small erosion can be seen. We had done esophageal manometric study on some of the patients with this problem. Interestingly enough, all eight patients who had esophageal manometric study showed abnormal motility with high amplitude peristaltic contraction, simultaneous contraction and repeated contraction. Sometimes the pattern of vigorous achalasia was also noted.
Most of the patients with this problem were able to be treated with Nitroglycerin or Calcium Channel Blocker. The result is shown on Table II.

**TABLE II**

MEDICAL TREATMENT IN PATIENTS WITH MOTILITY PROBLEM

22 Cases--Vertical Banded Gastroplasty (VBG)

- Poor response to treatment——— 2
- Fair response to treatment——— 5
- Good response to treatment——— 15

13 Cases--VBG with previous transverse stapling gastroplasty

- Fair response to treatment——— 6
- Good response to treatment——— 7

Mesh Intrusion

Twenty-two patients were found to have mesh penetration into the channel of the gastric stoma by endoscopy. Mersilene mesh, which was used to reinforce the stoma from transverse gastroplasty, was most commonly seen (20 cases). We also experienced the intruded teflon mesh from the band of Mason's gastroplasty. We attempted to cut the mesh by endoscopic surgical scissors from Olympus in 12 cases. We were able to help some patients. The result is shown on Table III.

**TABLE III**

RESULTS IN CUTTING OF MESH

<table>
<thead>
<tr>
<th>NO. OF PATIENTS</th>
<th>PROCEDURE</th>
<th>RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Complete removal of mesh</td>
<td>doing well</td>
</tr>
<tr>
<td>2</td>
<td>Removal of large piece of mesh</td>
<td>doing well</td>
</tr>
<tr>
<td>9</td>
<td>Perforation or slicing of mesh</td>
<td>5 required surgery</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 no follow-up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 doing well</td>
</tr>
</tbody>
</table>
Foreign Body Obstructing the Gastric Stoma

We experienced 8 patients with foreign body obstructing the outlet of the gastric pouch. It is equally common in both transverse stapling gastroplasty and vertical banded gastroplasty. All of the patients were successfully treated with endoscopic removal of the foreign body by Basket Grasping Forceps and Alligator Jaw Grasping Forceps from Olympus. The foreign bodies which were removed included beef stew, baked bean, corn, water chestnut, peach and enteric coated medicine tablets.

Esophagitis, Gastritis and Ulcers

Inflammation and ulcers are very commonly associated with the gastric stomal occlusion either primary or secondary to mesh intrusion and/or foreign body obstruction. It was not counted into the number as cause of vomiting. We also saw 13 patients with severe inflammation or ulcer at upper gastric pouch, gastric stoma and esophagus. All of the patients took aspirin or other anti-inflammatory medicine for their arthritis. The treatment is to hold aspirin and other gastric irritants and to give antacid and/or H₂ antagonist.

Miscellaneous

We saw one patient with a large duodenal ulcer who did not have ulcer history before gastroplasty. We also experienced a patient with small bowel obstruction due to adhesion.

DISCUSSION

Vomiting after gastroplasty may be due to many different etiologies. Endoscopic examination can determine the accurate diagnosis. It may also provide the therapeutic maneuver.

Stenosis and obstruction of the gastric stoma is the leading cause of postgastroplasty vomiting. It might happen right after surgery or a few months later. The stenosis is probably due to scarring from the operation injury or inflammatory reaction around the mesh. Therefore, most patients with stenosis were able to be treated with endoscopic balloon dilatation.

Mesh penetration into the channel of the gastric stoma is also a very common problem in patients with transverse stapling gastroplasty with mesh reinforcement. It may occasionally happen in the band of Mason's gastroplasty. The cause of mesh penetration is probably due to
pressure and infection. The mesh can be removed by endoscopic scissors. However, the result is unpredictable and the operation is very time consuming. Further improvement in technique and instrument is needed.

Many patients who had vomiting after gastroplasty did not have endoscopic abnormality. We believe that these patients' problems are due to functional abnormalities. We were able to demonstrate abnormal esophageal motility in all of eight cases, which we did esophageal manometry. In patients suspected to have functional problem, 33 out of 35 patients showed clinical improvement from Nitroglycerin or Calcium Channel Blocker treatment. The esophageal abnormal motility may be only a part of manifestation. We propose that the vertical stapling line at the upper part of the stomach might interfere with the slow contraction wave at the gastric body or impair the migrating myoelectric complex in the stomach. It requires further study.

In conclusion, stenosis and obstruction of the gastric stoma, gastritis and ulcer, mesh intrusion, foreign body obstructing the gastric stoma are common causes of vomiting. Hypertensive motility in the esophagus and possibly in the stomach has to be considered in patients with vertical banded gastroplasty. Endoscopic examination can provide diagnosis and therapeutic maneuver.

BIBLIOGRAPHY

HEADLEY: (William Headley, Milledgeville, GA) I have had two male patients with motility problems. On endoscopy the stomas were wide open. I've tried everything, even Isordil, but nothing seems to work.

LEE: Did you try Procardia? It is a calcium channel blocker that works well. In my experience, about 50% of patients have a side effect from the Isordil such as severe headache, but people tolerate Procardia very well. Indeed, the Procardia is a capsule in which you can put a small hole and then have the patient place it under the tongue. Usually I give 10 mg three times a day, about one hour before meals.

SEINIGE: Another drug that you could use in patients with motility disorders is Reglan. Of course, you must be certain there is no distal obstruction. We recommend 10 mg by mouth half an hour before meals. We have used it on a large number of our patients and it works very well.

LEE: Are those vertical banded gastroplasty patients?

SEINIGE: Yes.

LEE: In my experience Reglan is not really that good in the patient with a vertical banded gastroplasty, but the response is better in the patients with horizontal gastroplasty. Patients with gastric atonia respond well to Reglan.
GASTROPLASTY REVISIONS AND THEIR ASSOCIATED COMPLICATIONS

Kenneth B. Jones, Jr., M.D.

ABSTRACT

Since the introduction of horizontal gastroplasty with greater curve stoma in the mid-70's, a number of patients having had these procedures have had technical failures involving either strictures or staple line failures, and have gradually regained their lost weight. Since June 1981 we have done 525 primary gastroplasties and 83 revision procedures; 74 for staple line failure and nine for stricture. The thrust of this report is to point out the markedly increased risk of doing revision gastric limiting procedures in patients who have had failed primary gastroplasties. Because of marked increased risks of leaks and/or intra-abdominal abscess formation and frequently associated gastrocutaneous fistulae, 12% of the patients having revision procedures required extensive hospital stays, which cost an additional $30,000 on the average compared to the standard $4,000-5,000 hospital bill associated with primary "virgin" gastroplasty. The reasons for these added risks and technical maneuvers to reduce the risks are enumerated in this paper.

Dr. Cesar Gomez made a major contribution to the field of gastric limiting procedures for morbid obesity in the mid-70's when he introduced his Gomez III procedure, a horizontal gastroplasty with greater curve stoma. We never did this exact procedure because we always felt that the three rows of sutures creating the "pseudo-pylorus" precipitated a considerable amount of mucosal ischemia and subsequent necrosis, and therefore loss of the integrity of the stomal ring. In the beginning of our series with horizontal gastroplasties, we merely tacked the Prolene ring to the end of the two TA-90 staple lines and placed it completely outside of the stoma with a Bougie in place for proper sizing to approximately 11mm in diameter. The Prolene ring was originally placed abruptly on the greater curve end of the staple lines, and then later on, the knot was moved back 1 cm from the stoma, which improved on staple line failure considerably. Because of the relatively high staple line failure rate, which has been almost 20% in our series with horizontal gastroplasty and greater curve stomata of one type or another, we moved the stoma to the lesser curve in 1983, and the staple line and stomal integrity has markedly improved.

We observed an interesting phenomenon in many of our patients whose original 50cc pouch became globular and greater than 100ccs as the greater curve portion of the pouch turn over clockwise, thereby creating
a "torque effect" of the greater curve stoma, and causing a relative narrowing due to extrinsic scarring. We feel that this is the prime reason for excessive vomiting early on in a significant number of patients, which causes stricturing early and/or staple line or stomal failure at a later date. We have observed much less vomiting with the thicker lesser curve stoma. Time will tell if this will represent a more stable ring. We would emphasize that we have continued to use a Prolene ring throughout this series, as our problems with failure have been at the attachment of the ring to the end of the staple line, not an erosion of the ring through the wall of the stomach, thereby losing stomal integrity. The history of the development of this procedure can be found in the literature\(^2,3\) and was presented at the poster session at the Iowa City meeting in 1985.

Our message in this paper is a simple one, that is, complications associated with revision gastroplasty procedures occur far more frequently than with original primary gastroplasty.\(^4\) This has always been a widely held assumption, but our message is to quantify the degree of risk associated with revision procedures.

MATERIALS AND METHODS

Since June 1981 we have done 525 primary gastoplasties, most of which contained greater curve stomata (see Table I). The overall 15% technical failure rate in primary gastoplasties is largely attributed to the greater curve stoma. This has dropped to 3% since September 1983 when the stoma was moved to the lesser curve and isolated from both upper and lower pouches, and stoma, similar to VBG (See Fig. 1). We have had three technical failures, or staple line dehiscence in this series of revision gastoplasties, two of which involved placement of the Prolene ring directly on top of a freshly repaired gastrogastrostomy on the lesser curve. We therefore feel that if it is necessary to remove a portion of an old intact staple line, one should be sure to place the inert ring at least 2cm away from this repair to avoid inward migration into the stomach and thereby loss of stomal integrity and technical failure (See Fig. 2c). It should also be noted that serious complications including leaks, abscesses, pulmonary emboli, and gastrocutaneous fistulae have occurred twelve times more frequently in revision than in primary procedures.
DISCUSSION

When doing revision gastroplasties, a major drawback is our lack of the ability to plan ahead. This decision can only be made at the operating table, after the abdomen is opened and the left lobe of the liver is carefully teased away from the anterior surface of the stomach. At this point, we must tailor the procedure to the anatomy at hand. Factors involved include: (1) the amount of thickening and scarring on the greater and lesser curves; (2) whether to place the stoma on lesser curve or greater curve; (3) whether to put the staple line above, below, or through the old partially intact residual staple line. (See Fig. 2)

When handling strictures, one can either do a Heinecke-Mikulicz type longitudinal opening with transverse closure, or simply wedge out the strictured area, do a lateral gastrogastrostomy and then place the Prolene or constricting band outside of the repair with a Bougie through the stoma, making sure that the constricting band of foreign material is not too snug as to recreate the stricture. Apparently, due to the thickness of the intact scarred old staple line, we have not had the problems of erosion of the Prolene ring through the freshly repaired area, and thereby a loss of stomal integrity in those patients requiring operative stricture revisions.

Our operative procedure includes removal of the old skin scar and the old autosuture fascia staples which can be done with ease, reopening the old left subcostal incision. We have used this incision exclusively for these procedures, as exposure is quite good and the rate of incisional hernia formation has been zero in this series, compared to 5% with a standard upper midline incision. Great care is exercised in taking down multiple adhesions in the abdomen, particularly those involving the liver and stomach. One can easily strip the posterior liver capsule in separating the stomach from the left lobe of the liver, thereby creating profuse hemorrhage and necessity for Surgicel®, Gelfoam®, etc., which when coupled with postoperative hematoma, could be an excellent culture media.

The self-retaining retractors are carefully placed to avoid splenic and liver injury, the left lobe of the liver being taken down and retracted to the right. Along the anterior inferior-lateral edge of the
spleen, there is almost always a naturally occurring adhesion, and if this is taken down using the electrocautery, one can expect marked decrease in hidden splenic injury during the operative procedure, once again decreasing the necessity for synthetic coagulant material. Few, if any, short gastric vessels should be taken down, as the essence of successfully performed revision procedures is to avoid trouble and go around, above, or below the scarring and gastroplenic attachments. This maneuver preserves vascular supply to the fundus, reducing the risk of leakage, staple line failure, or stricture.

Electrocautery instruments are very helpful tools, but we must make sure that the tip is seated into the base of the instrument, and there are no breaks in the insulating material, so that short-circuiting to the colon or the small bowel, producing hidden injury, will not occur. We still feel that 48 hours of total gastric decompression with revision procedures is very important to encourage sealing, and cut down on the risk of leakage and perforation. Our incisions are closed with two fascial layers, one of chromic and one of Prolene, reinforced with autosuture fascia staples. This technique, associated with the left subcostal incision, markedly reduces the risk of wound morbidity for a number of reasons which include: less pain (the lower 1/2 is anesthetic), encouraging more adequate deep breathing and coughing, and considerably less stress than with a midline incision. It is also well away from the frequently contaminated umbilicus. We use a small Penrose drain in the subcutaneous space for 48 hours, which has reduced our rate of seroma formation to virtually zero. Thorough lavage with saline and then Betadine solution, and the use of prophylactic antibiotics, has made wound sepsis negligible.

CONCLUSION

To recap some of the more important technical considerations, in an effort to cut down on risk involved with revision gastroplasties, we would emphasize: (1) bypass trouble, which includes unnecessary dissection of excessive adhesions and scarring, and further avoiding excessive devascularization, particularly to the upper greater curve of the stomach; (2) find a plane between the stomach and liver before starting sharp dissection; (3) place the stoma on the lesser curve if
reasonably accessible, however, in this series, a stoma placed high on the greater curve, which is now more stable because of permanent scarring, has made little, if any, difference in the successful outcome of the procedure, and the patient's ability to maintain weight loss; (4) use as little Gelfoam® and Surgicel® as possible, as this combination of synthetic material and postop hematoma formation appears to increase the risk of abscess formation (more careful surgery will reduce the necessity for this material); (5) don't "force staple" thickened tissue, remember the TA-90/4.8mm staples close down to about 2.0 mm, therefore, if we attempt to staple thickened, edematous stomach, 1-1/2 cm in thickness, we would expect the possibility of ischemia and necrosis, leakage or perforation; (6) do a good primary operation with a left subcostal incision; (7) use a headlight (a deep hole is hazardous; a deep, dark hole is treacherous).

We should emphasize to our patients that the risks of major complications with revision procedures are five to ten times greater than with the original gastroplasty. In this series, 12% of the patients developed a complication severe enough to markedly prolong the hospital stay with an average hospital cost of $30,000, compared to $4,000-5,000 with an original primary gastroplasty. Therefore, we should recheck the patient's hospitalization insurance, not only to protect the patient, but also to prevent the following scenario: "I had a perforation and subsequent abscess formation and hole draining from my stomach, and the extra three weeks I had to spend in the hospital cost $30,000 and I have no insurance. My surgeon obviously did something wrong, so I'll file suit, and his malpractice insurance company would gladly settle with me for that amount, rather than risk a much higher judgment in the courts."
### TABLE I

**COMPLICATIONS**

<table>
<thead>
<tr>
<th>Revision Procedures</th>
<th>Original Gastroplasty</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total #</strong></td>
<td>83 (74 for staple dehiscence; 9 for stricture)</td>
</tr>
<tr>
<td><strong>TECHNICAL FAILURES</strong></td>
<td>3 (4%)</td>
</tr>
<tr>
<td><strong>PULMONARY EMBOLUS</strong></td>
<td>2 (2%)</td>
</tr>
<tr>
<td><strong>LEAKS AND/OR ABSCESS</strong></td>
<td>6 (7%)</td>
</tr>
<tr>
<td><strong>GASTRO-CUTANEOUS FISTULAE</strong></td>
<td>4 (5%)</td>
</tr>
<tr>
<td><strong>WOUND INFECTIONS</strong></td>
<td>1 (1%)</td>
</tr>
<tr>
<td><strong>AVERAGE EXCESS WEIGHT LOSS @ 1 YR. POST-OP</strong></td>
<td>65%</td>
</tr>
<tr>
<td><strong>SERIOUS COMPLICATIONS WITH LONG HOSPITALIZATION</strong></td>
<td>10 (12%)</td>
</tr>
<tr>
<td><strong>LOST TO FOLLOW UP</strong></td>
<td>6 (7%)</td>
</tr>
<tr>
<td><strong>MORTALITY</strong></td>
<td>0</td>
</tr>
</tbody>
</table>

**FIGURE I**

[Diagram of Vertical Banded Gastroplasty and Horizontal Gastroplasty, Lesser Curve Stoma]
FAILURE or FAILURE

FIGURE 2

---

FAILURE A.

REVISION

New Stoma on Greater Curve Above Old Line

B.

FAILURE REVISION

Original Pouch Very Small

New Stoma on Greater Curve Below Old Line

C.

FAILURE REVISION I.

Little Scar

New Line Above Old (excised) or

>2cm.  

New Line Through Old Excised

D.

FAILURE REVISION I.

Little Scar

or

or

REVISION 2.
BIBLIOGRAPHY

HEADLEY: I am bothered by your use of a subcostal incision. Forty-four percent of patients have to have their gallbladders removed at the time of gastric reduction. Does the subcostal incision make that more difficult?
JONES: I haven't really found it that much tougher. We've not had to extend this incision or convert it to a bilateral subcostal incision. I don't think it's any tougher than a midline incision. We use a Balfour retractor that we just turn sideways. We've really had no problems getting the gallbladder out, which has been necessary in about one-third of the patients that I've operated on, either due to cholelithiasis or cholesterolosis.

TERRY: (Boyd E. Terry, Columbia, MO) I would like to comment about the basic principles that we've tried to follow with an original gastric procedure. It should be reversible. This holds true for revision procedures.
JONES: We've done reversals on nine patients overall, and basically all we do is a large anterior gastrogastrostomy. It's a very simple thing. We've had no leaks and no real problems except in one patient. In that patient the scarring was so thickened that I converted the operation to a Roux-en-Y gastric bypass.

QUESTION: Do you drain the left upper quadrant?
JONES: I have not.
GASTRIC VOLUME IN BILIOPANCREATIC BYPASS (BPB)
Nicola Scopinaro, M.D., Ezio Gianetta, M.D., D. Friedman, G. F. Adami, E. Traverso and V. Bachi

INTRODUCTION

The weight loss which occurs following the present type of BPB is largely due to a temporary food intake reduction caused by the transitory postcibal syndrome consequent to the creation of a little stomach. Different stomach sizes were then tried in order to determine the ideal one for obtaining the best weight loss with the minimum of untoward effects.

METHODS AND MATERIALS

Gastric volume was measured with the aid of a Blakemore tube. The gastric balloon was inflated and withdrawn against the cardias; saline was then instilled up to a pressure of 30 cm of water. In all cases the left gastric artery was ligated right distally to its junction with the lesser curvature, the stomach closed and sectioned using a TA 90 stapler and the gastroileostomy made on the left corner of the gastric stump. In a first series of 53 patients (little stomach or LS type) the dissection of the greater curvature was interrupted at the level of the last one or two short gastric vessels, thus leaving a measured gastric volume of 300 to 400 ml (mean: 317 ml). In the most recent series of 166 patients (very little stomach or VLS type) the complete dissection of the greater curvature and the abdominal esophagus from the spleen and the diaphragm allowed performing the gastroenterostomy at 250 cm from the ileocecal valve leaving a gastric volume of no more than 200 ml (mean: 120 ml). In order to allow an easier reproduction of gastric volumes, in several cases of the last series measurements were taken on the stretched greater curvature, 15 cm corresponding to a gastric volume of about 200 ml and 20 cm to about 400 ml.

RESULTS

As no correlation was found between gastric volume and weight loss within both the LS and the VLS series, the results were considered together for the patients in the two groups. The overall early complication rate was greatly reduced in the VLS group (4.2%) when compared with the LS group (13.2%), probably due to the improvement in technique.
and shortening of the operative time, while the overall specific late complication rate (anemia, stomal ulcer and peripheral neuropathy), with a minimum follow-up of four months, was identical in both groups (9.8%). The VLS BPB causes a much more profound and prolonged reduction of food intake, thus resulting in a greater weight loss than that following the LS type (86% of the excess in 50 cases at 12 months vs 84% in 51 cases at 18 months). If patients are divided into three ranges of initial percent overweight (up to 90, from 91 to 120, and over 120%), and recovery is defined as reduction under 40%, all patients in the two lower ranges of initial overweight were cured in both the LS and the VLS groups. In the over 120% range, 4 out of 10 patients (40%) at 18 months after the LS BPB and 6 out of 18 (33%) at 12 months after the VLS type were still obese. The last 6 patients, whose mean initial and residual percent overweight were 157±8 (S.D.) and 49±9, are still losing weight, and there is little doubt that they will also attain recovery. There was a 7.5% occurrence of transient protein malnutrition in the LS group, and 4% of patients had an excessive weight loss. The corresponding figures in the 50 VLS patients at 12 months were 20% and 14%. All patients with excessive weight loss were in the two lower ranges of initial overweight, while the incidence of protein malnutrition was comparable in the three ranges.

CONCLUSION

Based on the above data, our present policy is to submit all patients with overweight up to 120% to BPB with a 50 cm common tract, a 200 cm alimentary tract, and a gastric remnant of 300 to 400 ml, reducing the gastric volume to 100 to 200 ml in patients with overweight greater than 120%. This should result in no excessive weight loss and an about 10% incidence of a transient and easily manageable protein malnutrition, what is in our opinion a very acceptable price for obtaining a permanent recovery in all patients.

COMMENT: How do you define protein malnutrition?
SCOPINARO: Well, let's say that we have considered only the cases in which a rehospitalization for IV hyperalimentation has been necessary. I mean ... just a hypoproteinemia is more frequent than what I said. This percentage is referred only to the cases who needed rehospitalization.
EFFECT OF BILIOPANCREATIC BYPASS ON HYPERCHOLESTEROLEMIA AND HYPERTRIGLYCERIDEMIA

Ezio Gianetta, M.D., D. Friedman, G. F. Adami, E. Traverso, M. Castagnola, and Nicola Scopinaro

Alterations of lipid metabolism are considered the most important pathogenetic factors in the development of atherosclerosis. Obesity is often associated with hypercholesterolemia and hypertriglyceridemia.

Of 369 obese subjects submitted to total and various types of partial biliopancreatic bypass (BPB) abnormal high serum cholesterol levels were found in 74 cases (20%). There were 10 males and 64 females, mean age was 39 years (16 to 60), mean weight was 114 kg (79 to 173), with a mean overweight of 57 kg (22 to 118), corresponding to a mean percent overweight of 101 (42 to 216). Hypertriglyceridemia was present in 100 cases (27%). There were 37 males and 63 females, mean age was 36 years (14 to 57), mean weight was 123 kg (79 to 192), with a mean overweight of 62 kg (28 to 134), corresponding to a mean percent overweight of 105 (48 to 256). Thirty-six cases (10%) had both hypercholesterolemia and hypertriglyceridemia.

In Table I mean serum cholesterol and triglyceride changes following the different types of BPB are represented. After total BPB, there was an early 30% mean reduction of cholesterol with a further decrease with time, which led at long term to an average reduction of 45%. This progressive decrease was not observed following the various types of partial BPB, all patients having an average reduction of 40%, slightly greater following the very little stomach type (45%). All the 59 hypercholesterolemic patients submitted to partial BPB had normal cholesterol values one month after the operation and they remained normal at all subsequent examinations. Abnormally low serum cholesterol concentrations were found, regardless of the type and of the time elapsed from operation, in about 50% of subjects. After total BPB, a permanent mean 50% reduction of serum triglyceride was found. After partial BPB there was an average reduction of about 35% at one month, which increased to 50% at the fourth month and remained at about this value thereafter, without substantial differences among the various types. In the group of 88 patients with partial BPB the percentage of cured cases progressively
increased from the first to the twelfth month, when serum triglyceride concentration was normal in 35 out of 37 patients for whom values were available (95%) and sharply reduced in comparison with the preoperative in two (5%). In only two instances were abnormally high serum triglyceride values transiently observed at the subsequent examinations. Conversely, abnormally low serum triglyceride values were not found postoperatively.

The above described changes in serum triglycerides are quite similar to those observed following diets or gastric restriction procedures, and this suggests that they are simply consequent to the decreased fat absorption. On the contrary, the reduction of cholesterol caused by BPB is decisively greater than what should be expected from simple food restriction, and, in addition, the observation that serum cholesterol levels decrease also in patients with normal preoperative cholesterolemic values cannot be explained simply by the reduction of cholesterol intestinal absorption. Studies on enterohepatic bile salt circulation have demonstrated that after BPB a moderate bile salt loss into the colon occurs which evidently accounts for the greater reduction of serum cholesterol than what would result from simple decreased absorption. The observation that the various types of BPB, although causing greatly different weight losses, are followed by a quite similar reduction of serum cholesterol levels, and the lack of any correlation between weight loss and serum cholesterol lowering suggest a possible complication of one type of BPB in the surgical treatment of hypercholesterolemia not associated with obesity.
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Total BPB</th>
<th>&quot;half-half&quot; partial BPB</th>
<th>&quot;short loop&quot; partial BPB</th>
<th>&quot;little stomach&quot; partial BPB</th>
<th>&quot;very little stomach&quot; partial BPB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum Cholesterol (C)</td>
<td>275±21 mg%</td>
<td>297±58 mg%</td>
<td>276±12 mg%</td>
<td>279±27 mg%</td>
<td>281±25 mg%</td>
</tr>
<tr>
<td>(15 cases)</td>
<td>(7 cases)</td>
<td>(5 cases)</td>
<td>(8 cases)</td>
<td>(8 cases)</td>
<td>(36 cases)</td>
</tr>
<tr>
<td>1 month</td>
<td>32.6±12.2</td>
<td>43.4±9.9</td>
<td>34.0±10.7</td>
<td>39.4±13.9</td>
<td>45.3±10.4</td>
</tr>
<tr>
<td>4 months</td>
<td>31.0±22.5</td>
<td>38.9±14.5</td>
<td>33.1±14.6</td>
<td>37.8±11.6</td>
<td>37.8±11.6</td>
</tr>
<tr>
<td>1 year</td>
<td>43.8±18.5</td>
<td>33.5±4.3</td>
<td>37.6±11.7</td>
<td>48.5±8.7</td>
<td>48.5± 8.7</td>
</tr>
<tr>
<td>2 years</td>
<td>32.2±20.9</td>
<td>47.2±8.6</td>
<td>25.7±16.9</td>
<td>46.5±22.5</td>
<td>46.6±22.5</td>
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<tr>
<td>3 years</td>
<td>44.7±7.9</td>
<td>30.0±2.3</td>
<td>---</td>
<td>---</td>
<td>43.8±15.3</td>
</tr>
<tr>
<td>4 years</td>
<td>45.5±4.8</td>
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<tr>
<td>5 years</td>
<td>63.8</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>6 years</td>
<td>---</td>
<td>---</td>
<td>---</td>
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<td>---</td>
</tr>
<tr>
<td>Triglyceride (T)</td>
<td>269±75 mg%</td>
<td>248±103 mg%</td>
<td>197±21 mg%</td>
<td>240±70 mg%</td>
<td>256±73 mg%</td>
</tr>
<tr>
<td>(12 cases)</td>
<td>(7 cases)</td>
<td>(4 cases)</td>
<td>(7 cases)</td>
<td>(16 cases)</td>
<td>(57 cases)</td>
</tr>
<tr>
<td>1 month</td>
<td>46.7±11.4</td>
<td>24.2±37.6</td>
<td>36.6±24.9</td>
<td>35.1±25.6</td>
<td>37.2±26.3</td>
</tr>
<tr>
<td>4 months</td>
<td>35.1±27.7</td>
<td>47.6±30.8</td>
<td>33.1±12.8</td>
<td>44.1±19.6</td>
<td>51.9±22.6</td>
</tr>
<tr>
<td>1 year</td>
<td>52.1±13.4</td>
<td>44.9±21.4</td>
<td>45.2±12.8</td>
<td>47.3±18.4</td>
<td>61.9±22.6</td>
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<td>2 years</td>
<td>50.1±25.9</td>
<td>44.0±9.2</td>
<td>54.9±17.3</td>
<td>64.6±17.1</td>
<td>61.2±21.0</td>
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<tr>
<td>3 years</td>
<td>63.0±19.2</td>
<td>29.2±37.2</td>
<td>43.8±15.3</td>
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<tr>
<td>4 years</td>
<td>68.1±15.8</td>
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<td>5 years</td>
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<tr>
<td>6 years</td>
<td>63.2</td>
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</tr>
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</table>
QUESTION: Have you seen persistent hyperproteinemia, and what can you do to correct it?

GIANETTI: We have had 10-12 cases, and some of them have yet to be treated. What we have done was to lengthen the common tract, moving the enteroenteral anastomosis proximally along the biliopancreatic tract. In one case a 100 cm common tract and in another case a 150 cm common tract were obtained. This may be effective. Our experience is not yet big enough to state which is the right length of the common tract. In three cases we have completely reversed the operation, and that can be very easily accomplished by two or three enteroenteral anastomoses.

O'LEARY: Do you correlate the histology of the liver with the changes that you see in the cholesterol and triglyceride during the postoperative period?

GIANETTI: We have an impairment of liver function in the first four months with the last two types of biliopancreatic bypass, but then there is a real improvement at one year. In the first type we have no significant changes. We have no cases of hypotriglyceridemia. We have studied the VLDL production in some cases of the last type of biliopancreatic bypass and we have found an immense production in the first month of the VLDL and liver proteins. But it is only a transient effect and then they decrease and become less than before.

KRAL: Do you obtain HDL and cholesterol levels at one year?

GIANETTI: Yes, we have studied the 78 patients submitted to the VLS type of partial biliopancreatic bypass and we have observed a decrease of HDL in the first days after the operation. After about the tenth postoperative day there is an increase and at one year the level is the same as the baseline.

QUESTION: Has iron absorption been a problem with this procedure? Have you see iron deficiency anemias?

GIANETTI: The actual incidence of anemia after biliopancreatic bypass cannot be determined in these types of operation because we are treating it prophylactically. Whenever we see a low iron high-transferring CM concentration we give parenteral iron to the patients. So consequently our reported 5% incidence of anemia is not wholly true. In the first two types of biliopancreatic bypass we only treated the anemia when it
occurred. The real incidence then was about 35%. The deficiencies were either microcytic (just iron) or normocytic (both iron and folate). The deficiencies promptly responded to either iron or both iron and folate supplementation.
Dr. Kenneth B. Jones, Jr., Shreveport, LA: Horizontal Gastroplasty

JONES: Originally we used horizontal gastroplasty with a greater curvature stoma. We placed a Prolene ring outside the staple line. We now place the Prolene ring in between the two staple lines. It is held in place and separated from upper and lower pouch and from the stoma by 3-0 Prolene figure-of-8 type sutures. Our failure rate to date has been 3%.

SUGERMAN: I noticed on your poster that you had five leaks and three splenectomies. Do you think that taking down some of the short gastric vessels led to devascularization and some of these leaks? Don't you think that a vertical pouch is a little safer?

JONES: In the past year we've been taking down as few short gastric vessels as possible. However, as I say, we still have had a 3% leakage rate, which to me is not compatible with a good gastroplasty procedure. I think our high rate may have something to do with the preparation of the staples. We remove three staples, three of the pusher bars, and then a 4x8 mm segment of the plastic material. Perhaps some of this roughening of the plastic material could cause enough irritation to lead to some of these leaks.

BUCKWALTER: (Joseph Buckwalter, Chapel Hill, NC) Dr. Jones, in view of the fact that Prolene knots are insecure and tend to stretch, why not use nylon? It does not stretch as much and it has better knot security.

JONES: We've not had problems with the Prolene.

QUESTION: When the stomach distends, why doesn't the Prolene suture cut through? It would seem to me to be less secure than a Marlex band.

JONES: It would certainly seem that way. Nevertheless, all I can say is that in 95% of 83 revisions the Prolene ring was right where we left it originally. The problem was on the tip end of the staple line. I believe the ischemia created by taking down three, four or five short gastrics has led to a lot of failures of greater curvature stomal type procedures.

SUGERMAN: What do you have against the vertical banded?

JONES: I worry about what's going to happen to the Marlex at five to ten years after operation.
David H. Scott, University of Iowa: Vertical Banded Gastroplasty

SCOTT: We compared vertical banded gastroplasty with our Roux-en-Y gastric bypass and with horizontal gastroplasty as it was done from 1978 to 1980. The effects of different sizes of Marlex collars were also studied. We wanted to be able to present the best long-term results possible, so we limited our discussion to the patients that had been followed up for three years. Since 1980 we have done over 680 patients at The University of Iowa and San Francisco. All patients were at least 100 lbs over their ideal weight as determined by the 1983 Ideal Weight Tables. None of the patients had had prior surgical treatment of their morbid obesity. All patients received a pouch volume of less than 30 ml. One hundred eighty-two patients had vertical banded gastroplasty (VBG) with a 5.5-cm collar and the remaining VBGs received a 5.0-cm collar. The majority of the patients were hospitalized one day preoperatively and four days postoperatively. The operation time for the VBG averaged 50 minutes less, almost 2 hours to 3 hours, than for the Roux-en-Ys. The age and sex ratios of the patients were very similar in all the groups. The complication rate was lowest with the VBG. We went from a high of 18% for wound infections with the horizontal gastroplasties to a 3% with VBG. Three patients underwent incidental splenectomies and to date, there were three leaks with the VBG. The death rate was 0.5%. The weight loss in the VBG 5.0 group was 40 kg, or 61% of excess weight, at three years. Although the Roux-en-Y group lost a greater amount of absolute weight (52 kg), percent of excess weight loss was only 2% greater (63%). The horizontal plasties and the VBG 5.5 patients lost an average of 50% of excess weight by the third postoperative year. We found several factors to favor the use of VBG over the Roux-en-Y gastric bypass. One of them is the lower revision rate. The revision rate for the VBG group was 1.7% compared with 2.8% for the Roux-en-Y group.

SUGERMAN: I notice on your poster that you have a 78% follow-up rate, which means that you have a 28% failure to follow up your patients. If one believes, as I do believe, that the vast majority of patients who don't come back to your office are patients who are not doing well, this may be significant. What is your thought about your patients you've not been able to follow up?
SCOTT: The 78% figure is for the Roux-en-Y group. We have a 92% follow-up rate for our VBG 5.0 group. We did a survey recently with Dr. Doherty on eating habits. He contacted 20 of his patients (VBG 5.0) who hadn't been seen for quite a while. Out of those 20, only 1 of them had had a revision done elsewhere, the other 19 were doing well. Our statistics tend to indicate the opposite of what a lot of people are saying, that is, in our experience the patients are doing quite well. 

COMMENT: Regarding telephone polling, in my experience it has not been accurate. The patients say they weigh less than they do. Do you find the same discrepancy?

SCOTT: For Dr. Barrash's study, we contacted patients by phone and also had them come to the Clinic. We found a very high correlation in our patients between the weight they give us on the phone and the weight we obtain in the Clinic. They were off by perhaps 1 kg.

SUGERMAN: We've had patients that take large amounts of high-calorie liquids such as Kool-Aid and defeat the vertical banded gastroplasty. Would you recommend a smaller collar size for such patients?

SCOTT: I don't really know what you could do as far as limiting intake of Kool-Aid. The problem is that such patients are hard to identify preoperatively.

COMMENT: Such patients should have gastric bypass. The dumping syndrome will control the excessive intake of sweets.

SUGERMAN: I know in our experience about 80% of our patients as we identify them have a problem with sweets. We've had an occasional patient who has not had a problem with sweets before vertical banded who became a sweet eater afterwards.

COMMENT: I think we should always remember that the operation we do is on the intestinal tract, and that is not where the problem is. These patients need strong support in many different areas, and you have to make sure you have the support mechanisms available to them to help the operations work.

HALV E RSON: (John Halverson, St. Louis, MO) I don't believe you can rely on dumping syndrome alone to achieve long-term weight control. If you can identify a failure in advance, you shouldn't operate.
COMMENT: I think the key issue is patient selection and being able to screen patients well enough so we can recognize a patient like this preoperatively. Such a patient is not well-treated by gastroplasty. They'll beat the operation every time. There are other procedures, including perhaps Roux-en-Y gastric bypass and certainly the more radical operations such as biliopancreatic bypass, that will afford much better weight loss for this sort of patient.

SELINKOFF: (Paul Selinkoff, San Antonio) First of all, just because you do a Roux-Y gastric bypass doesn't mean the patient will have dumping syndrome. I have patients with Roux-en-Y gastric bypass who pack their esophagi with jellybeans and manage to beat that operation also. Not every patient is going to do what you hope they're going to do. We always have to remember the patient is the one who's sick. The operations cannot help somebody if they are making a determined effort to beat it. You have to discuss with the patients preoperatively the fact that high calorie liquids will beat the operation. They have to be the ones to make the decision whether or not they want to beat you.

COMMENT: Unfortunately, nobody so far has been able to provide preoperative test instruments that are going to be able to single out patients who, in fact, alter their feeding behavior after they've had their procedure.

Dr. Mathias Fobi, Compton CA: Vertical Banded Gastroplasty

FOMBE: I will report on Dr. Fobi's series. Unfortunately he could not be present himself. Over the last three years he has performed 463 vertical banded gastroplasties. Twelve percent of these patients were reoperations, that is, patients who have had other previous bariatric surgical procedures. There has been a significant weight loss in these patients with more than 50% of the overall group losing more than 40% of their excess weight at 36 months. Dr. Fobi has noted that patients with vertical banded gastroplasties lose weight at a slower rate than patients with gastric bypass procedures. Nevertheless, his impression is that over time the vertical banded gastroplasty will be the operation of choice for patients with morbid obesity. In regard to follow-up, 77% of the patients with vertical banded gastroplasties have been followed up.
for more than three years, and 79% of the patients who had the gastric bypass have been followed up for more than 36 months. Thus, both groups are similar.

LECHNER: (George Lechner, Dayton, Ohio) I'd like to make a comment. As surgeons we have the viewpoint that 100% of our patients should be cured. Yet we are dealing with a very difficult disease. I think we have to be satisfied with less than 100% success. Although we have to try to select the best operation and do it with the lowest complication and mortality rate, I don't think we should, at this point in time at least, exclude everyone. Furthermore, people speak a lot about success, but I have yet to hear a good definition of it.

FOMBE: I think the definition of success is something which should be scrutinized carefully. Some patients who do not lose a lot of weight experience remarkable improvement of the untoward medical conditions caused by morbid obesity. This is especially true in the patients who are above 50 years of age and have hypertension and diabetes. After smaller amounts of weight loss the hypertension and diabetes do tend to be under better control, and some of these patients no longer require medications for their medical conditions.

Dr. Lubomyr Kuzmak, Livingston, NJ: Gastric Banding

KUZMAK: Since January, 1983, I've performed 114 silicone gastric bandings. One hundred and seven patients were followed up, and the data was checked and evaluated by a computer expert. I used a silicone dacron-reinforced band which was made to my specification. For about a year I used a special tube to calibrate the pouch. It has an air chamber connected to the electronic sensor to calibrate the stoma. In gastric banding it is very important to calibrate the stoma and know how tight the band is around the stomach because no matter what we use it stretches and retracts, and will change the size of the stoma. About 10% of my patients had to be reoperated; either they were vomiting too much or they could eat too much. Before changing the size of the stoma, I did a gastrotomy and checked the stoma with a Hegar dilator. In about 90% of these patients who required reoperation, the stoma was 30 mm, which is the correct size. I don't know the reason why they could eat more than
the others could eat. I am designing now an inflatable percutaneous band which we will start using soon. The weight loss in all patients is about 75%; 70% of them are within the standard deviation curve. I used the silicone gastric banding in 37 operations as a revision for practically every kind of gastric restriction operation except for vertical banded gastroplasty. The weight loss is less in the revised patient, I don't know why.

QUESTION: How wide is your band?

KUZMAK: The band is about 1 cm wide. A wider band will produce a longer outlet channel with more chances of kinking and obstruction. I did not have much problem with obstruction in my patients.

SUGERMAN: What are your follow-up figures? Have you had any patients who can drink sweets and eat candy with the gastric banding operation?

KUZMAK: Out of 114 patients, 107 are followed up. This I don't present the whole number, just I was limited to revisions. In regard to sweets, we all will face this kind of problem and there is no solution to that.

COMMENT: There are so many new procedures being tried that it looks like we don't know what we're doing. Every time a new procedure comes along we have to present it and some surgeons may adopt it before it's been fully tested. We should conclude what new procedure works so we can let other colleagues respect us.

KUZMAK: I'm surprised that you are asking for a very specific answer. We still don't have the final decision. There is no question that the vertical banded gastroplasty is the most favored operation, but the gastric banding is gaining some recognition, too. It's simple and reversible. Talking about the gastric bypasses, there are some surgeons that have good results and still do, and you cannot stop them from doing them.

SUGERMAN: I think that to over-regulate what's being done would be a very dangerous thing to do. In the end the truth will out. With time we will learn the best of these procedures, just like we have for pancreatic surgery or gastric surgery for ulcers.
Dr. Darwin K. Holian, Santa Barbara, CA: Biliopancreatic Bypass

HOLIAN: Since this meeting in June, 1980, when I first heard Scopinaro talk about his biliopancreatic bypass, I have offered only that procedure to 249 patients. My mortality rate in this period of time is 0.8% (2 patients). I have only had to take down three patients, two of whom had previous J-I bypasses. I would warn you that if you're going to do this operation, don't do it on a former J-I bypass unless that individual has had the reversal for at least two years, and unless you've got a liver biopsy that looks very normal. I question whether or not the liver ever recovers after an old J-I bypass. Excess weight loss was 54% at six months, 69% at one year, and 75% by 18 months which has then been maintained for up to five years. My biggest problem is not, as Dr. Scopinaro mentioned this morning, stomal ulcer. I leave a 200 ml gastric pouch, and I do not see stomal ulcers. The biggest problem, I believe, is late hypoproteinemia which occurs two to three years after operation. It is a difficult problem to treat.

SUGERMAN: How severe has your protein malnutrition been? How low has their albumin fallen? Have you had to bring your patients in for total parenteral nutrition?

HOLIAN: I have two patients that have had to come in for hyperalimentation in the five-year time. I've been successful in being able to get these people to take that unpalatable aminoacid supplement fairly well. The early hypoproteinemias that occur around six months respond very well. It's the late ones with the albumins a little over 2 and total protein around 5 that concern me.

QUESTION: Have you reversed the procedure on patients with hypoproteinemia?

HOLIAN: I have never reversed a patient for hypoproteinemia.

QUESTION: How about the patients in whom you used hyperalimentation?

HOLIAN: I plan on reoperating to double their common channel length.

QUESTION: How long is your common channel now?

HOLIAN: About 50 cm. I do not believe that these individuals are digesting enough food in 50 cm, and I want to convert them to 100 cm.

SUGERMAN: And how long is your single channel, the alimentary channel to the common channel?
HOLIAN: It is 200 cm with a total ileum of 250 cm.

CABOT: (Ned Cabot, Boston, MA) Dr. Scopinaro implied that hypoproteinemia was related in some way to gastric pouch volume, and yet you say your gastric pouch size or remnant is only 200 ml. Can you explain that difference?

HOLIAN: I hate to disagree with my friend, but I must, because that has not been my experience. My experience is that in six months' time these people all eat great big full meals, and I do not think that a stomach that's 400 ml is going to end up any bigger than one that starts out at 200 ml. I have volume studies to show that they stretch to over 1000 ml in about a six-month period of time.

SUGERMAN: How do you measure your pouch volume?

HOLIAN: I did do volume studies initially, now I feel I can eyeball it.

Dr. Jack D. Ballard, Seattle, Washington: Surgical Procedures that Fit the Patient's Needs

BALLARD: Our thrust in presenting our poster was really threefold. We wanted to present material that we gleaned from experience and from a number of conferences here since 1979 in regard to setting up a program for bariatric surgery in a small community hospital. We wanted to emphasize in our poster that it is necessary to have a cadre of indoctrinated referring consultative physicians -- the internist, the cardiologist, the endocrinologist, etc. -- to produce a good and thorough patient indoctrination. We had developed patient information booklets that would cover the two procedures that we ultimately decided to offer to the patient, an indoctrination protocol for the operating room, and a strong emphasis upon follow-up study through the establishment of a bariatric surgery support group which we convene twice a month. We tailor the procedure to the patient. We use either vertical banded gastroplasty or biliopancreatic bypass. Most patients have the latter.

COMMENT: Is this owing to patient preference?

BALLARD: Yes. However, if there were contraindicating factors we would override patient preference.

QUESTION: Which procedure do you prefer?
BALLARD: Biliopancreatic bypass. However, at this point, we have only 18 months follow-up and a very small number of patients.

MOJZISIK: (Cathy Mojzisik, Ohio State) Are the family members and significant others involved in the prehospital education?

BALLARD: They are asked and encouraged to come, not only to the office for one-on-one visits with me and my nurse, but also to the support group.

SUGERMAN: Yes, sir?

COMMENT: I think patient education is very important. If we find a patient we can't educate, then maybe we ought not operate.

BOREN: (Gayle Boren, Seattle, Washington) I would like to emphasize the importance of developing a total bariatric surgical program. There are probably many physicians here who are contemplating entering the field of bariatric surgery. Once one commits himself to this field, it is necessary to develop a complete program. Obviously the technical part, i.e., the operation, is of primary importance. But the overall program should be a team approach. I would recommend a professional nurse, a dietitian, and support groups.

SCOPINARO: (Nicola Scopinaro, Genoa, Italy) Returning to the biliopancreatic bypass (BPB), in our total experience of 517 cases we did not have one single case of liver failure. Our 1500 liver biopsies showed there is not only no liver injury after BPB, but a striking improvement of liver morphology is seen in all cases. Dr. Ballard, why did you list the liver problems among the criteria for choosing the gastric surgery over the BPB?

BALLARD: It is the result of great concern about the resilience of the liver to tolerate this kind of procedure.

COMMENT: Dr. Ballard is suggesting that patients with preexisting liver conditions should not undergo BPB. Dr. Scopinaro, could you give us material to suggest that patients with preexisting liver conditions do well after the operation?

SCOPINARO: Yes, of course I can. We have very good results as far as the liver morphology is concerned with even early cirrhosis. We had three patients with early preoperative cirrhosis. Two of them have shown regression of symptoms after BPB. I know it is amazing because in theory
an early cirrhosis shouldn't regress, but it happened. The other patient who had frank Laennec's cirrhosis at the time of operation is perfectly well and his liver has simply stayed the same. His liver function tests are quite normal.
CONTINUOUS ABSORBABLE VS INTERRUPTED NONABSORBABLE SUTURE FOR MIDLINE FASCIAL CLOSURE

Paul M. McNeill, M.D. and Harvey J. Sugerman, M.D.

INTRODUCTION

Controversy exists regarding the best method for abdominal wound closure. Morbidly obese patients have increased risks of wound infection, dehiscence or hernia and represent an excellent group for randomized, prospective trials of wound closure techniques.

METHODS

In this study, we compared continuous, absorbable #2 Dexon® suture to interrupted, nonabsorbable #28 stainless steel wire in 106 patients for midline fascial closure following gastric surgery for morbid obesity. All wounds were irrigated with 1% neomycin; no subcutaneous sutures were used; a large subcutaneous suction drain was placed; and the skin was reapproximated with staples. The length of time for wound closure was recorded for the two groups. Wounds were screened for hernia, infection and dehiscence for one year to three years after surgery (X 14 mon).

RESULTS

There was no statistical difference in the wound complication rate between the interrupted, nonabsorbable (3.2% or 2/54) and the continuous, absorbable suture groups (3.9% or 2/51). Complications in the interrupted, nonabsorbable group included: 1 dehiscence, 1 incisional hernia (with 1 abscess) and 1 small, superficial abscess. Continuous closure was accomplished in significantly (p 0.001) less time (21.4 ± 7.7 min) than for interrupted closure (43.1 ± 19 min). After the randomized trial was terminated, an additional 80 patients have undergone fascial closure with continuous #2 Dexon® with a 3.8% wound complication rate (2 infections, 1 hernia) to date.

CONCLUSIONS

We recommend continuous, absorbable suture closure for laparotomy wounds for its economy of time and lack of significant difference from interrupted wound closures.
HEADLEY: (William Headley, Milledgeville, GA) We do not use drains, but we do place sutures in the subcutaneous tissue. We have not had problems. What is your opinion on this? How long do you leave in your skin staples and drains?

SUGERMAN: We take the staples out on the sixth day when the patients go home and the suction drain stays in for only a couple of days. I'm glad you haven't had a high rate of wound infection. Randomized animal studies have shown there is a statistically significantly higher incidence of wound infection with subcutaneous sutures.

BUCKWALTER: (Joseph Buckwalter, Chapel Hill, NC) Why don't you use PDS instead of Dexon? It's stronger, it lasts longer, and it's widely used in Europe.

SUGERMAN: In fact, I've been thinking of setting up a prospective randomized trial to see if there would be a lower incidence of incisional hernia. But our wound infection and hernia rates have been very low. I think we'd have to have a huge number in the several groups to prove a difference. One possible problem is that PDS is more slippery than Dexon and it would require more knot throws even though there aren't that many knots involved. I think that knots are a potential nidus for infection.

GRACE: (D. Michael Grace, Canada) For my last 100 gastroplasties I've used running #1 PDS with no problems and no hernias. It does last longer than Dexon. In a recent issue of Current Problems in Surgery, Ellis in England reviews incisions and wound closures, and he points out that Dexon at 30 days has only 4% of its original strength. In his closures using #1 Dexon there was a fairly high frequency of hernias, more than you've described, but perhaps you may see them with time. Theoretically at least the PDS has an advantage because of its monofilament nature and its delayed absorption.
INTRAOPERATIVE GALLBLADDER EXAMINATION WITH MICROSCOPIC BILE ANALYSIS
L. Michael Howell, M.D.

ABSTRACT

With an initial group of 300 gastric bypass patients, the need for cholecystectomy within two years postoperative was surprisingly high -- 10%. Therefore, intraoperative gallbladder aspiration and microscopic bile analysis was performed on the subsequent 800 gastric bypass patients. If microscopic bile exam revealed cholesterol crystals, abundant calcium bilirubinate granules or microspheroliths, then the gallbladder was considered abnormal and removed. These two groups were then compared.

This technique allowed more frequent recognition of gallstones -- 15% versus 20%. Abnormal microscopic bile was frequently discovered -- 30%. This resulted in a threefold increase of cholecystectomy as a secondary procedure to the gastric bypass. Also, there was a threefold decrease in the need for cholecystectomy within two years following obesity surgery -- 10% versus 3%.

INTRODUCTION

Obese patients have excessive biliary secretion of cholesterol resulting in cholesterol saturation in their bile. Also, approximately one-half of obese patients have marked reduction in bile acid secretion with rapid weight loss. Since the ability of bile to hold cholesterol in solution is dependent on bile salts, these patients have increased risk for stone formation. Rapid weight loss is lithogenic because bile salt concentration is relatively lower, thus bile cannot dissolve the cholesterol as well.

During follow-up observation of an initial series of 300 gastric bypass patients in which these patients experience very rapid weight loss, 10% of them developed acute cholecystitis with cholelithiasis within two years following gastric bypass surgery. This incidence is consistent with the four of forty patients reported by Wattchow.

Review of the literature reveals that extensive bile analysis has been performed in the past, beginning with Lyon in 1919. Salient studies with extensive literature review were done by Juniper and colleagues. They obtained bile for study by duodenal drainage, intraoperative gallbladder aspiration and autopsy. They concluded: "Cholesterol crystals, bile pigment granules and microspheroliths were the only microscopic matter found in bile which correlated with the
presence of hepatobiliary or pancreatic disease." The absence of abnormalities in the liver, pancreas or common bile duct strongly suggested and correlated with gallbladder abnormalities. These studies also provide valuable photographs of the microscopic findings. They also noted that "In general, examination of gallbladder bile aspirated at operation showed the presence of larger numbers of the same type of crystals found by duodenal drainage." Also, Reisberg has reported endoscopic biliary drainage for detection of gallbladder disease using similar microscopic findings.

Juniper's approach for microscopic examination of bile was adapted after the initial series of 300 gastric bypass patients. Aspiration and microscopic analysis was performed, and if gallbladders were found to have these lithogenic features, they were removed. Eight hundred patients with this approach were compared to the initial 300 gastric bypass patients.

PROCEDURE
Operative cholangiograms were not performed unless symptomatic cholecystitis was present preoperatively and definitive cholecystectomy was planned. The gallbladder was inspected for thickening of the wall, for significant adhesions, and for cholesterosis which was found to be commonly visible particularly in thin-walled gallbladders. Cholesterosis was seen transmitted through the gallbladder wall as a pale, pink, trabecular deposition deep to the vascular pattern, within the submucosa of the gallbladder. If these abnormalities were found, then cholecystectomy was usually done regardless of what the microscopic findings revealed. However, in general, visibly abnormal gallbladders were more likely to have microscopically abnormal bile. The gallbladder was aspirated empty with a 50 cc syringe and 14 gauge needle. The needle hole in the gallbladder was securely closed with a figure of eight 3-0 chromic suture. The empty gallbladder was then carefully palpated. Unless empty, the gallbladder contents could not be adequately palpated. Fifteen percent of gallstones were palpable only after emptying the gallbladder. The aspirated bile was then taken to the Pathology Department and centrifuged (2,000 RPMs for five minutes). Microscopic exam was then performed on the sediment and supernatent for evidence of
cholesterol crystals, microspheroliths, or abundant calcium bilirubinate granules. One or more of these three was strongly suspicious of gallbladder disease.5

**FINDINGS**

Considerable information has been obtained by visually examining the gallbladder bile. Normal gallbladder bile is dark green and homogenous without visible sediment. Normal common bile duct bile is light yellow-green and thin. A watery bile indicates a diseased gallbladder usually fibrosed because this means the gallbladder has lost considerable ability to concentrate the bile. A yellow to brick-brown sediment if seen in the bile generally indicates abundant calcium bilirubinate granules which is the most common microscopic abnormality. Calcium bilirubinate has been found to correlate with cholesterosis of the gallbladder. Cholesterosis is a deposition of cholesterol ester within the gallbladder submucosa and frequently has tiny cholesterol polyps associated with it.

On microscopic exam, cholesterol crystals are colorless, transparent, thin crystals with parallel edges often with a notched corner. They are optically active and indicate lithogenic bile even if present only in a small amount. No cholesterol crystals were found in 60% of the patients, a trace in 20%, a moderate amount in 15%, and a large amount were found in 5% of the patients' bile. (Table 1)

Microspheroliths are single organized crystalline structures varying from 7 to 50 microns in size. They may contain concentric laminations with alternation of colors and they are also optically active.5 These are significant even if present in trace amounts. They were found infrequently about 15% of the time. (Table 1)

Calcium bilirubinate granules are described in various colors ranging from pale golden yellow, to deep orange, to brick-red or dark brown. Generally, large amounts are definitely abnormal, and if on gross exam the bile has a yellow brick-brown hue to it, then the microscopic exam will invariably show large amounts of calcium bilirubinate granules. Trace to no calcium bilirubinate was found one-half of the time and considered normal. Moderate to large amounts were found one-half of the time. (Table 1)
Initially cholesterosis aggregates in the aspirated bile were not recognized microscopically. After examining cholesterosis deposits in the submucosa with a dissecting microscope, these deposits were removed for microscopic exam and found to look identical to what was frequently seen in the aspirated bile. These floating cholesterosis aggregates have a "Maltese cross" birefringent pattern. In subsequent exams they were found 25% of the time and thus indicated that cholesterosis was present.

If one or more of these lithogenic features were found by the pathologist, the gallbladders were then removed. The bile aspiration was done with the initial exploration of the abdomen. While awaiting the pathology report (about 20 minutes), the gastric bypass was performed so that at the end of the gastric bypass, the gallbladder if indicated could then be removed and thus no operating time was lost waiting for the pathology report.

After removal, the gallbladder was immediately opened and inspected closely by the surgeon. This immediate visual exam generally correlated with the bile analysis report and provided reassuring feedback, i.e., gross disease was usually visible within the opened gallbladder when the microscopic exam was positive. If abundant calcium bilirubinate was reported by the pathologist, then the bile had a yellowish brick-brown hue to its color. Also, cholesterosis was almost always present. With cholesterosis, frequently aggregates of cholesterol were seen floating free in the gallbladder lumen or very loosely attached to the mucosa. These were soft cholesterol polyps, usually tiny, 0.5 to 3.0 mm. They were occasionally large, 5.0 to 9.0 mm. The tiny ones were frequently later missed on the routine exam by the pathologist after the specimen was a few hours old.

Subsequent microscopic examination of these gallbladders typically revealed microscopic features of cholesterosis in the submucosa as well as a chronic lymphocytic infiltrate consistent with chronic cholecystitis. There was also associated thickening of the gallbladder wall.

If a few stones were palpable prior to the cholecystectomy, on opening the gallbladder usually a great many more stones were found.
This, of course, indicates the limitation of palpation compared to actually having the opportunity to open the gallbladder. At times, no stones were palpable despite an emptied gallbladder. Yet on opening the removed gallbladder, tiny stones were found.

Cholesterol crystals were commonly present both with and without stones. Also, cholesterol stones were present with and without cholesterol crystals. This reflects different stages of cholesterol stone formation which may or may not develop.

RESULTS

No clinical complications surfaced with this technique. There have been no leaks and no infections in the gallbladder area. No stones or problems have been associated with the chromic suture used to close the needle hole in the gallbladder. Patients commonly have some pain in the right upper quadrant during the first postoperative week.

Of the 300 patients, without bile aspiration and microscopic exam, 15% had a prior cholecystectomy, 15% were found to have gallstones and 70% had their gallbladder left in at the time of gastric bypass. Of these, 10% needed a cholecystectomy within the first two years postoperatively. (Table 2)

Of the 800 patients who have had bile aspiration and microscopic exam, 15% had a prior cholecystectomy, 20% were found to have gallstones. Thirty-five percent were found to have lithogenic bile or significant adhesions, and thus they had a cholecystectomy as a secondary procedure to their gastric bypass. Thirty percent had their gallbladders left in. Of these, 3% needed a cholecystectomy within the first two years postoperatively. This indicates a threefold decrease in the need for cholecystectomy in the first two years following gastric bypass.

DISCUSSION

This aggressive approach to discovering gallbladder disease in the operating room has been a safe uncomplicated procedure. These abnormal findings commonly indicate preclinical cholecystitis. Nonetheless, these abnormal gallbladders can and should be removed quickly without increased risk. This is particularly true with the wide exposure necessary for gastric bypass operations. The patients appreciate not having to have another operation in the future.
Cholesterosis of the gallbladder is the most common visible abnormality found, and with cholesterosis there is associated moderate to large amounts of calcium bilirubinate granules found within the bile. Cholesterosis is common but uncommonly symptomatic. Nonetheless, it is a well documented clinical entity which will on occasion cause typical acute cholecystitis.\(^9,10\)

This technique also provides specific intraoperative pathological information so the surgeon can decide if cholecystectomy is indicated as a second procedure. This method also enables the surgeon to discover serious gallbladder disease, i.e., stones or significant chronic cholecystitis which might otherwise be overlooked.

Particularly in the morbidly obese, concomitant gallbladder disease should be anticipated, investigated and eradicated along with the obesity operation.

This method has application to other upper abdominal operations where discovery of gallbladder disease would result in cholecystectomy as a secondary procedure.

BIBLIOGRAPHY


Table 1
Microscopic Findings on Aspirated Bile

<table>
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<td>Amount of cholesterol crystals found</td>
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<td>Amount of microspheroliths found</td>
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<td>Amount of cholesterosis found</td>
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Table 2
Comparison of gastric bypass patients
with and without bile aspiration and microscopic exam

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<th></th>
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<td>Number of patients</td>
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<td>Prior cholecystectomy</td>
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<td>Gallstones found with gastric bypass</td>
<td>15%</td>
<td>20% *</td>
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<td>Abnormal bile and/or visual exam</td>
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<td>35%</td>
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<tr>
<td>Gallbladder left in</td>
<td>70%</td>
<td>30%</td>
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<tr>
<td>(Percent requiring cholecystectomy within two years postop gastric bypass)</td>
<td>(10%)</td>
<td>(3%) *</td>
</tr>
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* This procedure resulted in more frequent recognition of gallstones.

** This caused a significant decrease in the need for postoperative cholecystectomy
TORRES: (Jose C. Torres, Jeffersonville, IN) Since 1982 we have obtained pathologic examination of the bile. Every patient who had positive crystals of cholesterol underwent cholecystectomy. About 60% of our patients are having cholecystectomy. We do not do cholecystectomy in patients with negative pathology reports. In 237 cases we have had just one patient who later had positive cholelithiasis at about one year after operation.
GASTRIC BANDING VS VERTICAL SILASTIC GASTROPLASTY: A THREE-YEAR FOLLOW-UP STUDY
L. Granström, L. Backman, C. Doherty and C. G. Doherty.

INTRODUCTION

Experiences have shown that one important factor for good weight loss after gastric operations for obesity is a small patent outlet from the upper pouch. Several different methods to reinforce the outlet have been tried, i.e., inverted running sutures or narrow bands. Unfortunately these reinforcements sometimes penetrate the gastric wall and disappear. Therefore broader bands have been used at both gastric banding and vertical banded gastroplasty. We have compared the results after gastric banding and vertical banded gastroplasty in the initial consecutive 55 patients in each series. Gastric banding has been performed at Danderyd Hospital, Sweden, and vertical banded gastroplasty at St. Francis Hospital, San Francisco.

MATERIAL

The mean age and bodyweight were similar in the two groups, for details see Table I. The mean observation time was 36 months for all patients operated in San Francisco and 23 months in Danderyd. Five patients were lost for follow-up at St. Francis Hospital and none at Danderyd Hospital.

METHOD

In vertical banded gastroplasty (Fig. 1) a window is made in the stomach near the minor curvature with an EEA stapler 8-9 cm from the cardia. A small gastric pouch is made from this opening using the stapling device, along the minor curvature to the angle of His. The opening from this narrow tube is reinforced with a 5 cm Marlex long mesh.

In gastric banding (Fig. 2) a 2 cm wide Marlex mesh band is applied around the upper part of the stomach with a gastric tube (F 25 - F 32) inside the stomach, resulting in a small upper gastric pouch and a narrow draining channel to the rest of the stomach. The size of the upper gastric pouch was measured with a thin latex balloon both in San Francisco and Danderyd. Special care was taken to measure the pouch size at a pressure above 40 cm of water in order to get better reliability in pouch size measurements.
RESULT

Both procedures result in an acceptable mean weight loss in a high proportion of operated patients. The change in Broca's index is similar in the two groups (see Fig. 3). There is a tendency, although not significant, for greater weight loss after gastric banding. There is no difference in the frequency of serious complications such as perforation of the stomach or the esophagus or intra-abdominal abscesses in the two groups (Table II), but moderate complications such as wound infection and incisional hernias seem to be more common after vertical banded gastroplasty (Table III). Reoperations related to the procedures were on the other hand more common after gastric banding (Table IV).

DISCUSSION

Both vertical banded gastroplasty and gastric banding result in adequate weight loss in a high proportion of patients and both procedures can be performed with enough safety. Especially gastric banding is easy to perform and also easily reversed. Serious complications are seen in similar frequency after both procedures, but reoperations secondary to malfunction are more common after gastric banding.

It was necessary to cut the band in four patients operated on with gastric banding and in two patients operated on with vertical banded gastroplasty, because the patients could not accept the limitation in postoperative food intake. It is interesting to find that the weight loss is similar in spite of a significant \( p < 0.001 \) difference in pouch size, 33 ml \( \pm 1.0 \) (SEM) for vertical banded gastroplasty and 130 ml \( \pm 10.5 \) for gastric banding. This may indicate that it is not the pouch size which is of greatest importance for weight loss after the operation. Our results seem to speak in favor of VBG, but longer follow-up is necessary for adequate comparison.
Table I. The clinical data before operation with gastric banding (GB) and vertical banded gastroplasty (VBG).

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<thead>
<tr>
<th></th>
<th>GB</th>
<th>VBG</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>men/women</td>
<td>12/43</td>
<td>4/51</td>
</tr>
<tr>
<td>age (year)</td>
<td>37 ± 1,1</td>
<td>33 ± 1,2</td>
</tr>
<tr>
<td>weight (kg)</td>
<td>126 ± 2,6</td>
<td>124 ± 3,2</td>
</tr>
<tr>
<td>Broca's index</td>
<td>1,87 ± 0,04</td>
<td>1,90 ± 0,04</td>
</tr>
</tbody>
</table>

Table II. Serious complications after gastric banding and vertical banded gastroplasty.

<table>
<thead>
<tr>
<th></th>
<th>GB</th>
<th>VBG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intraabdominal abscess</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Intestinal obstruction</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Stomach perforation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Esophageal perforation</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Death</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Table III. Moderate complications after gastric banding and vertical banded gastroplasty.

<table>
<thead>
<tr>
<th></th>
<th>GB</th>
<th>VBG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incisional hernia</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Wound infection</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Staple line disruption</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Ulcer</td>
<td>1</td>
<td>2/16</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>16</td>
</tr>
</tbody>
</table>

Table IV. Reoperations second to malfunction after gastric banding and vertical banded gastroplasty.

<table>
<thead>
<tr>
<th></th>
<th>GB</th>
<th>VBG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penetration of band</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>&quot;Kinking&quot;</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>&quot;Outlet stenosis&quot;</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Poor weight loss</td>
<td>1</td>
<td>0/5</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>5</td>
</tr>
</tbody>
</table>
Fig 1

Fig 2

Fig 3

The change in Broca's index after gastric banding and vertical banded gastroplasty.
DOHERTY: Thank you, Lars. Are there any questions?

QUESTION: Does the Marlex stretch one way but not the other?

GRANSTRÖM: No, it can't stretch.

QUESTION: You seem to have a fairly high incidence of pulmonary emboli for a relatively small series. Do you get your people up very quickly?

GRANSTRÖM: Yes, as soon as possible. They are treated prophylactically with heparin the day of operation and the day after, and then mobilized as soon as possible.
BANDED FUNDAL EXCLUSION
Douglas S. Hess, M.D.

In 1980, when Dr. Mason introduced the banded gastroplasty, there was a major change in restrictive procedures in this country. Since that time, some form of external support of the stoma has been used on nearly all gastroplasties. This procedure has solved the problem of stomal dilatation, and has increased the success rate of gastroplasties. There are still some problems with procedures for morbid obesity. The banded fundal exclusion may help to reduce some of these difficulties. This presentation compares the short, vertical gastroplasty with the long, narrow banded fundal exclusion.

METHODS
Banded Vertical Gastroplasty

The banded vertical gastroplasty (BVG) is performed without the use of an EEA instrument. After proper exposure and retraction of the liver, an opening is made in the gastrohepatic ligament, and the left hand is passed under the stomach and directed toward the avascular area at the angle of His. A passageway is made posterior to the stomach in preparation for placement of the stapler. Using a red rubber catheter along with the left hand as a guide, the stapler is advanced from the greater curvature to the lesser curvature.

Using a #18F Salem tube as a gauger abutting the lesser curvature of the stomach in the area where the stoma is to be placed, the stapler is tightened and the volume of the upper pouch is measured. The pin is advanced through the stomach, and the stapler is fired. The pin holes are closed with a figure-of-eight suture on both sides. The pin holes will not leak since they are distal to the obstruction, and in an area of low pressure. An "E" clamp is used (available through Mueller, for use with the Surgeon's Choice PI90 stapler), which allows placement of the staple rows without the use of the stabilizing pin, thereby eliminating the pin holes. A second row of staples is similarly placed, conterminous to the first row, leaving a space wide enough to cut between the staple lines at the distal end.

An incision of approximately 2cm is made between the staple rows, through and through the stomach. This incision results in a vertical...
window, stapled on two sides, through which a Marlex band will pass.* The band (1.5cm wide) is passed through this opening, around the lesser curvature stoma, beneath the vasculature, and sutured to form a 5cm circumference band. The result is a tubular stoma, 1.5cm in length and 1.2cm in diameter (inside measurement). A through-and-through suture at both the upper and lower end of the window completes the closure.

**Banded Fundal Exclusion**

The banded fundal exclusion (BFE), formed from two sets of vertical staple rows, results in a narrow, tubular upper gastric pouch, which is 12 to 14cm in length. Some specially-adapted instruments are used for this procedure.

The upper staple rows are placed first. A #34F Hurst, mercury-filled dilator (gauger) is passed into the stomach along the lesser curvature. The PI90 stapler is inserted from the top and directed toward the lower stomach using a red rubber catheter as a guide. This stapler, with the "E" clamp attachment, is positioned parallel and contiguous to this dilator, and the first row of staples is placed. The second row of staples is placed directly parallel to the first, using the same process. With the table in reverse Trendelenburg and with the use of the Gomez retractor,² there is good exposure and no difficulty positioning the stapler. Blood vessels are not transected, and the esophagus is generally not mobilized.

The lower staples are formed by advancing the stapler from the distal end of the stomach. The dilator is replaced with a #18F Salem tube, which is used as a gauger at the site of the stoma. An opening is made at the greater omentum along the antrum, and the lesser sac is entered. The stapler is directed up toward the previously placed staple rows so that its open end intersects the distal portion of the staples previously placed. The stapler is stationed against the #18F Salem tube at the area of stomal formation; it is tightened, and a staple row is formed. The specially-adapted stapler is notched at the heel where a portion of the antrum is positioned to avoid being stapled, creating an adequate channel to drain the fundus. The last row of staples is placed

---

* Presently using Dow Corning silastic band with Dacron reinforcement, 1.5cm wide and .020 inches thick.
in a position parallel to the previous one, leaving a wide enough space between the two rows at the distal end to cut a window for the Marlex band. The band emplacement is as described above.

**Banded Fundal Exclusion with Division**

A banded fundal exclusion with division of the stomach (BFED) involves a complete transection of the stomach between the staple rows, followed by a reapproximation. The operative procedure is similar to the banded fundal exclusion, except that the staple rows are wide enough apart (approximately 1 cm) to allow for the transection of the stomach. The stomach division begins at the vertical window and extends up toward the fundus. A running suture, taken on the cut side of the staple rows, holds the stomach in proper anatomical position. Care is taken not to place any of the sutures around the staple rows, especially on the pouch side. Generally, brisk bleeding results, which is controlled when the cut edges are sutured. Eversion of the cut edges prevents the possibility of them healing in continuity. This yields a stronger staple line, which is less likely to fail.

**DISCUSSION**

One hundred and seventy-five of the 350 gastroplasties performed at our hospital were banded gastroplasties. This discussion concerns only the banded gastroplasties. The patient profile data of the three groups compared (BVG, BFE, BFED) are listed in Table #1. Table #2 contains the procedural data of the same three groups. A difference in pouch lengths is the main distinguishing feature between the banded vertical gastroplasty and the banded fundal exclusion procedures.

A summary of the complications in these three procedures is listed in Table #3. In the group with the stomach divided, there were three gastric leaks. Two of these patients developed gastric fistulas which required surgical correction. All three patients recovered.

The leaks are believed to be primarily related to stomal obstruction, secondary to inflammation. At a later surgery, all patients with leaks required transection of the Marlex band to release the obstruction.
This obstruction, in addition to early postop gulping of food or liquid, and the sharp monofilament Prolene suture tail at the knot, very likely contributed to the leak formation in the upper gastric pouch. All of these leaks were anterior, approximately 1cm from the staple line, and approximately 2.5cm from the esophageal-gastric junction.

RESULTS

Results are evaluated from two perspectives: 1) a determination of the percentage of patients with satisfactory results based on individual weight loss; and 2) an evaluation of the average weight loss in patients of a given surgical procedure group. The BVG group have 100% follow-up, and the banded fundal exclusions have 98%. The patients are labeled as either satisfactory or unsatisfactory as described in Table #4. Table #5 reports the results of the banded vertical gastroplasty. These results are evaluated at both the point of maximum weight loss and at the last weight recorded. The maximum weight loss represents the best results that may be expected from this procedure. The last weight recorded gives an approximation of expected results over a longer period of time.

In Table #6, the banded fundal exclusions are grouped together. Data in this table cover a minimum postop period of eight months to a maximum of forty-two. These results are preliminary, and longer follow-up is needed. Early results, however, are encouraging.

The graph in Table #7 illustrates the percentage of excess and total body weight lost by the BVG, BFE and BFED groups. The number of patients included in each group at a particular point on the graph is represented by the number in the lower portion of the graph. For example: at eighteen months, the banded fundal exclusion manifested an excess weight loss of 68% in ninety-six patients.

Table #8 involves post-hospital data. Staple line failure occurs in 10% of the vertical gastroplasties, regardless of surgical procedure. Even in the cases with the stomach divided, there is a 5% staple disruption. It is evident that in procedures with non-dilating stomas, a primary cause of failure will be staple line failure.

SUMMARY

Prevention of late stomal dilatation unfortunately results in a continuous challenge to both the integrity of the gastric partition, and
the maintenance of a controlled pouch volume. The trend is toward smaller pouches and multiple staple rows. We postulate that the long, narrow tubular upper pouch resists dilation, and produces greater satiety due to the increased area of rich nerve supply along the lesser curvature of the stomach. At the same time, due to the configuration of the pouch, food should pass through slowly, with less esophageal reflux. The formation of a tubular banded stoma as opposed to a stoma with a ring-like band, may decrease the importance of maintaining an exact size stoma (which has been thought to be a critical factor in weight loss). Complete division of the stomach between the staple rows may further strengthen the partition.

BIBLIOGRAPHY


### TABLE # 1 PATIENT POPULATION

<table>
<thead>
<tr>
<th>PATIENT'S STATISTICS</th>
<th>VERTICAL G-PLASTY</th>
<th>FUNDAL EXCLUSION</th>
<th>STOMACH DIVIDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO OF PATIENTS</td>
<td>31</td>
<td>80</td>
<td>63</td>
</tr>
<tr>
<td>AVERAGE AGE</td>
<td>35</td>
<td>37</td>
<td>37</td>
</tr>
<tr>
<td>EXCESS WEIGHT</td>
<td>157</td>
<td>139</td>
<td>146</td>
</tr>
<tr>
<td>% OF IDEAL WT.</td>
<td>225</td>
<td>212</td>
<td>216</td>
</tr>
<tr>
<td>AVERAGE BMI</td>
<td>47</td>
<td>45</td>
<td>46</td>
</tr>
<tr>
<td>GENDER</td>
<td>MALE = 11% FEMALE = 89%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TABLE # 2 PROCEDURAL DATA

<table>
<thead>
<tr>
<th>TYPE OF DATA</th>
<th>VERTICAL G-PLASTY</th>
<th>FUNDAL EXCLUSION</th>
<th>STOMACH DIVIDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO OF PATIENTS</td>
<td>31</td>
<td>80</td>
<td>63</td>
</tr>
<tr>
<td>POUCCH VOLUME</td>
<td>40 cc</td>
<td>31 cc</td>
<td>31 cc</td>
</tr>
<tr>
<td>POUCCH LENGTH</td>
<td>7.5 cm</td>
<td>12.5 cm</td>
<td>12.4 cm</td>
</tr>
<tr>
<td>BAND CIRCUMFERENCE</td>
<td>5 CM</td>
<td>5.1 CM</td>
<td>5.1 CM</td>
</tr>
<tr>
<td>SURGERY TIME (MIN)</td>
<td>91</td>
<td>98</td>
<td>105</td>
</tr>
<tr>
<td>DAYS PO IN HOSP</td>
<td>6.4</td>
<td>7.1</td>
<td>7.6</td>
</tr>
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### TABLE #3 COMPLICATIONS

<table>
<thead>
<tr>
<th>TYPE OF COMPLICATION</th>
<th>VERTICAL</th>
<th>FUNDAL</th>
<th>STOMACH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>G-Plasty</td>
<td>Exclusion</td>
<td>Divided</td>
</tr>
<tr>
<td>NO OF PATIENTS</td>
<td>31</td>
<td>80</td>
<td>63</td>
</tr>
<tr>
<td>WOUND INFECTION</td>
<td>NONE</td>
<td>NONE</td>
<td>1</td>
</tr>
<tr>
<td>GASTRIC LEAKS</td>
<td>NONE</td>
<td>NONE</td>
<td>3</td>
</tr>
<tr>
<td>GASTRIC FISTULA</td>
<td>NONE</td>
<td>NONE</td>
<td>2</td>
</tr>
<tr>
<td>STOMAL OBSTRUCTION</td>
<td>5 (16%)</td>
<td>3 (4%)</td>
<td>3 (5%)</td>
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</table>

### TABLE #4 CLASSIFICATION

<table>
<thead>
<tr>
<th>GRADE BY PERCENT OF BODY WEIGHT LOSS</th>
<th>TOTAL BODY WT.</th>
<th>EXCESS WT.</th>
</tr>
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<tbody>
<tr>
<td>EXCELLENT = 35% OR 80%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GOOD = 30% OR 60%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FAIR = 25% OR 40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POOR = 15% OR 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FAILURE = LESS THAN 15% LOSS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<RESULTS USING THE ABOVE GRADES>

SATISFACTORY = EXCELLENT, GOOD, FAIR
UNSATISFACTORY = POOR, FAILURE, REDO
### TABLE # 5 RESULTS

<table>
<thead>
<tr>
<th>Banded Vertical Gastroplasty (31)</th>
<th>Maximum Weight Loss</th>
<th>Last Weight Recorded</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVE. MONTHS TO</td>
<td>19 MO.</td>
<td>37 MO.</td>
</tr>
<tr>
<td>Average Weight Loss</td>
<td>108#</td>
<td>86#</td>
</tr>
<tr>
<td>Good to Excellent</td>
<td>84%</td>
<td>55%</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>94%</td>
<td>77%</td>
</tr>
<tr>
<td>Unsatisfactory</td>
<td>6%</td>
<td>23%</td>
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</table>

### TABLE #6 RESULTS

<table>
<thead>
<tr>
<th>Banded Fundal (All) Exclusion (122)</th>
<th>Maximum Weight Loss</th>
<th>Last Weight Recorded</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVE. MONTHS TO</td>
<td>16 MO.</td>
<td>24 MO.</td>
</tr>
<tr>
<td>Average Weight Loss</td>
<td>100#</td>
<td>93#</td>
</tr>
<tr>
<td>Good to Excellent</td>
<td>80%</td>
<td>69%</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>97%</td>
<td>93%</td>
</tr>
<tr>
<td>Unsatisfactory</td>
<td>3%</td>
<td>7%</td>
</tr>
</tbody>
</table>
TABLE # 7 GRAPH OF WT. LOSS.
<table>
<thead>
<tr>
<th>TYPE OF COMPLICATION</th>
<th>VERTICAL G-PLASTY</th>
<th>FUNDAL EXCLUSION</th>
<th>STOMACH DIVIDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO OF PATIENTS</td>
<td>31</td>
<td>80</td>
<td>63</td>
</tr>
<tr>
<td>STAPLE FAILURE</td>
<td>3 (10%)</td>
<td>9 (11%)</td>
<td>3 (5%)</td>
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</table>
LONG-TERM RESULTS OF VERTICAL SILASTIC-BANDED GASTROPLASTY
Otto L. Willbanks, M.D.

Numerous techniques have been used to construct a small proximal gastric pouch for the purpose of limiting oral intake to achieve lasting weight loss in the morbidly obese patient since Mason first suggested this approach in 1963. As the general principles of pouch construction have been invoked, a small measured pouch, an accurately calibrated outlet of less than 12-mm, prevention of partition disruption and pouch stoma dilation, the efficacy of these procedures has progressively improved.

Currently, a vertical or lesser curvature pouch with an outlet calibrated over a 30-F or 32-F dilator and banded with a double staple line oversewn and reinforced has become the most popular. The most widely used technique is that of Mason which bands the outlet with a strip of Marlex mesh through an EEA window opening. A somewhat less involved banding with silastic was proposed by Laws and reported by him and Eckhout. In Eckhout's paper a combined series of 2,515 patients operated upon by nine surgeons in different areas of the country was reported with excellent results. However, for the purpose of assessing a specific procedure, such as this, a series of consecutive cases by a single surgeon would seem to offer more validity, even if the series is smaller. The present report proposes to do just that.

Of 1,836 patients operated upon for morbid obesity at Baylor University Medical Center in Dallas, Texas since 1967, 1,274 have been vertical gastroplasties and 914 have been vertical silastic banded gastroplasties. Of these, 347 are now two years post-surgery. If the patients are deleted from the series who were revisions or re-do procedures or those converted to a gastroplasty from a jejunoileal bypass, the series is, then, 305 consecutive patients, all of whom had vertical silastic banded gastroplasty performed for morbid obesity as the primary indication and are at least twenty-four months after surgery. It is this group of patients who are reviewed and reported in this study.

TECHNIQUE

All of the 305 patients were operated upon with, essentially, the same technique. The abdomen is opened through an upper midline incision
and the Upper Hand™ retractor is placed, elevating the sternum several inches. A rubber drain is placed around the esophagus for retraction and the lesser curvature of the stomach is exposed. The lesser sac is then entered through a bare area in the lesser omentum and the exploring finger is used to guide the posterior blade of the TA-90, armed with 4.8-mm staples, around the stomach from the angle of His down toward the lesser curvature, a 30-F dilator having previously been placed by the anesthesiologist being interposed between the TA-90 and the lesser curvature. The device is closed and the Gomez C clamp is substituted for the pin in the TA-90. An alternative technique involves placing a specially modified stapling device from the lesser curvature up toward the angle of His. These devices require special modification of the TA-90 by the manufacturer with a notch in the heel to accommodate the dilator. The device is fired, loosened, the cartridge replaced and a second application of the TA-90 is carried out. Following this, a 42-mm length of 0.125 inch O.D. silastic tubing is sutured around the pouch outlet with a 2-0 polypropylene suture by the technique of Laws, placed first through the lumen of the tubing, then through the stomach from anterior to posterior near the end of the staple line, back through the lumen of the tubing and back through the stomach and tied on the posterior wall of the stomach. The entire length of the staple line is then oversewn with 2-0 polypropylene suture in a through and through, over and over, continuous stitch to firmly suture it in place. Stomach adjacent to the pouch is plicated over the pouch anteriorly with interrupted seromuscular silk sutures. The dilator is removed and replaced with a nasogastric tube and the abdomen is lavaged with antibiotic solution and closed.

SPECIAL TECHNICAL POINTS

Several points of technique are very important and need to be emphasized for maximum weight loss with the lowest complication rate.

It is important to avoid traumatizing the stomach in the area of the pouch stoma since this predisposes to stomal scarring, cicatrix and stricture. Specifically, techniques that involve removal of staples from the cartridge must be avoided. All of the procedures reported here were performed with U. S. Surgical Corporation's TA-90 device, using 4.8-mm
staples. Either the Gomez C clamp\textsuperscript{8} was used or an instrument specially modified by the manufacturer to reinforce the heel of the device and provide a notch of the appropriate size to accommodate the dilator and the gastric wall in the area of the stoma.

Staple line disruptions, when they occur, most frequently originate at the top of the staple line near the angle of His, so this area commands special attention. While being reinforced, this area should be carefully inspected after firing the staples and interrupted sutures of 2-0 silk applied if it appears the area is insecurely stapled. Furthermore, when starting the 2-0 polypropylene suture, the top should be so sutured that a loop of suture encircles this area. This can be done by placing the first stitch over the angle of His and through the stomach on the pouch side of the partition from back to front, then placing the second stitch around the partition as high as possible. The remainder of the suturing can be simple over and over, through and through, continuous suture.

Early in his experience Eckhout\textsuperscript{5} encountered a ten percent incidence of erosion of the silastic ring intraluminally. Erosions were not encountered in this series and there are two technical points that have been used to protect against this complication. First and most important, the silastic ring must be loose at the end of the procedure to avoid pressure points that could lead to erosion. Eckhout\textsuperscript{5} was originally oversewing his ring tightly to cover it up and it was in this group that he encountered his erosions. In this series the oversewing was done very loosely and no erosions were produced. It now appears that it is not necessary to oversew the ring at all and there have been no untoward results from this. Secondly, it is important to allow at least 2-mm between needle holes and staple line and to tie the suture snugly but not tight enough to blanch the serosa in order to be sure the suture, itself, does not promote necrosis and subsequent erosion.

In applying the second row of the TA-90 staples, it is important that it be as close as possible to the first row. Eskind, et al\textsuperscript{9} showed that an interval of one centimeter between the staple lines predisposes to necrosis and leak and that the smaller the interval the safer the
procedure. A concerted effort is made to place the staple rows either superimposed or immediately adjacent to each other.

In the event that there appear to be compromised areas of gastric wall or extensive serosal denudation, such areas must be carefully oversewn and in some situations the surgeon might opt to cover the area with an omental flap for further protection.

SUBJECTS

Of the 305 patients in this series there were 269 females and 36 males. The females were younger, ranging in age from 15 to 67 years, averaging 32.3 years, while the males ranged from 17 to 68 years and averaged 38.0 years of age.

Average initial weight was 283 pounds or 214% of "ideal body weight" by the Metropolitan Life Insurance Company tables.

ASSOCIATED PROCEDURES

When other procedures were indicated, they were performed at the same time as the gastroplasty.

There were thirty-five cholecystectomies (11.5%) carried out for preoperatively demonstrated or intraoperatively palpated gallstones. A recent study has presented data that strongly suggests the gallbladder should be prophylactically removed even in the absence of demonstrated pathology but, as yet, this policy has not been adopted.

A Hill type hiatus hernia repair is carried out in the presence of demonstrated or symptomatic preoperative gastroesophageal reflux because post gastroplasty reflux, especially bile reflux, can be a most distressing development. This was required twenty-four times or in 8% of the cases.

Abdominal wall hernias were repaired in twelve patients and bilateral tubal ligation was performed six times at the request of the patient. Vagotomy and pyloroplasty for longstanding chronic peptic ulcer disease was performed one time. Proximal gastric vagotomy was not done because of the fear too much stomach might be devascularized and result in slough.

No splenectomies were required. In fact, of the total 1,274 vertical partitions constructed, there has been only one splenectomy, the
result of an unusual intraoperative misadventure when the circum-
esophageal penrose drain broke spontaneously and the end snapped down
into the splenic hilum, severely fracturing it.

RESULTS AND COMPLICATIONS

Two year follow-up was obtained in 253 cases (83%). An intensive
effort to secure follow-up was employed, including telephone calls and a
questionnaire that was mailed. This effort resulted in, among other
things, the development of twenty-eight patients that would have
otherwise not been included. Of these twenty-eight, only four were
displeased with their surgery and only two were displeased because they
could not eat what they desired. So, only two (7%) of twenty-eight
patients "displaced" to follow-up had failed to return because of a poor
result. The other 93% did not return because they were doing well.

At two years the average patient had lost 101 pounds or 35.7% of
their initial body weight.

Fourteen patients (5.5%) failed to lose significant weight. Of
these, four (1.3%) had demonstrated partial staple line disruption and
required reoperation. There were no cases of stoma dilatation or of
intraluminal erosion of the silastic ring. The remaining ten patients
failed, then, because of dietary indiscretion, usually the ingestion of
simple sugars or alcohol.

There was one frank wound abscess and four patients developed
incisional hernias.

Nine patients (3%) required readmission to the hospital for vomiting
and were endoscoped, usually with removal of an ingested foreign body.
Several of these were treated with dilatation with balloon dilators but
in only one case was there a definite stricture. This was a patient with
arthritis, requiring indomethacin and salicylates and because of
recurrent stricture due to the chemical irritation it was ultimately
necessary to dismantle her gastroplasty.

One patient bled into the stomach two weeks after surgery, requiring
reoperation and one other bled into the lesser sac, requiring
percutaneous, sonographically directed, drainage of the hematoma.

There were no perforations, intra-abdominal abscesses, pulmonary
emboli or deaths in this series.
CONCLUSIONS

Vertical mesh banded gastroplasty as described by Mason\textsuperscript{3} has been a reasonably safe and effective operation to restrict intake in order to produce weight loss in the morbidly obese patient. Based on this study and the report of Eckhout,\textsuperscript{5} it now appears banding with a silastic ring is at least as safe and effective and, furthermore, offers the technical advantage of not removing a plug of the stomach and, theoretically, reducing the risk of infection. The technical advantages offered by vertical silastic banded gastroplasty are, then, sufficient to advance it as a reasonable and, possibly preferred, option in the stoma limitation of vertical gastroplasty.

SUMMARY

Three hundred and five vertical silastic banded gastroplasties performed for morbid obesity are reviewed. All patients are two years or more postsurgery. Average weight loss was 101 pounds or 35.7\% of initial total body weight. Fourteen patients (5.5\%) failed to lose an adequate amount of weight and, of these, four (1.3\%) failed due to breakdown of the gastric partition and required reoperation. There were no deaths, pulmonary emboli or gastric perforations in the series. Banding of the vertical gastroplasty stoma with silastic is safe and effective and offers distinct technical advantages over other methods of banding.
### SUMMARY TABLE

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Initial Weight</td>
<td>283 lbs (241% of i.b.w.)</td>
<td></td>
</tr>
<tr>
<td>Average Weight at Two Years</td>
<td>182 lbs</td>
<td></td>
</tr>
<tr>
<td>Average Pounds Lost</td>
<td>101 lbs</td>
<td></td>
</tr>
<tr>
<td>Percent of Initial Weight Lost</td>
<td>35.7%</td>
<td></td>
</tr>
<tr>
<td>Failure to Lose Adequate Weight</td>
<td>14 (5.5%)</td>
<td></td>
</tr>
<tr>
<td>Staple line disruption</td>
<td>4 (1.3%)</td>
<td></td>
</tr>
<tr>
<td>Stoma dilatation</td>
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<td></td>
</tr>
<tr>
<td>Erosion of silastic ring</td>
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<td></td>
</tr>
<tr>
<td>Dietary failure</td>
<td>10</td>
<td></td>
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<tr>
<td>Wound</td>
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<td></td>
</tr>
<tr>
<td>Abscess</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Hernia</td>
<td>4</td>
<td></td>
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<tr>
<td>Readmission</td>
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<td></td>
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<tr>
<td>Vomiting</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Stricture requiring reversal</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Hemorrhage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intragastric</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Lesser sac</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Splenectomy</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Perforation, Abscess</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Pulmonary Emboli</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
BIBLIOGRAPHY


SHAMBLIN: (James Shamblin, Shreveport, LA) My brother and I have done almost 500 of these operations, essentially the way Dr. Willbanks does them. Our patients have a 71% excess weight loss at one year and a 73% excess weight loss at two years. To this point we have had no serious complications and no deaths.

WILLBANKS: Last year Dr. Eckhout reported that nine surgeons had done about 2,500 of these operations. By now the total is probably close to 5,000.
QUESTION: Are your silastic rings marked radiographically so you can actually x-ray to see if they're still there? As Dr. Linner reported already in this meeting, our symptomatic erosion rate was only 2% but as we studied all patients radiographically including those without symptoms, the rate rose to about 35-40%.

WILLBANKS: No, sir, our rings were not radiographically marked.
ONE-, TWO-, AND THREE-YEAR WEIGHT LOSS AND COMPLICATION RATES IN VARIOUS OVERWEIGHT CATEGORIES AFTER VERTICAL BANDED GASTROPLASTY

W. John Hollingsworth, M.D. and Burns J. Larson, M.D.

Two major operations regarding vertical banded gastroplasty surgery could not be answered by early statistical results: Would weight loss following surgery be sustained for more than two years; and, could patients more than 200 pounds overweight preoperative expect to lose more than 50% of their excess weight? It was also thought complication rates for vertical banded gastroplasty surgery varied considerably depending on the preoperative excess weight of the patient.

Three hundred and sixty-eight vertical banded gastroplasties were performed by two surgeons at the Cardston Municipal Hospital (Cardston, Alberta, Canada) from June, 1981 to December, 1984 utilizing the following techniques:

- 1.5 cm wide marlex mesh was secured with either clips or suture for stomal wrap
- Pouch size was measured at 22-25 cc volume at 50 cm of height pressure
- Stomal size was calibrated by wrapping the unstretched mesh snug to an intraluminal #32 French mercury bougie (11mm in diameter). We feel this method more uniformly calibrates the internal diameter of the stoma than the alternate method of using a specified length of mesh because gastric wall thickness varies between individuals.
- The vertical staple line is produced utilizing two applications of the TA-90 stapler.
- Gastric fenestration is produced utilizing the number 25 EEA staple cartridge.

The cases have been divided into three preoperative excess weight categories; under 100 pounds, 100-200 pounds and over 200 pounds. Each category has been studied to compare:

- Complication rates and
- Weight loss 6, 12, 24 and 36 months postoperative.

Table 1 shows the general results for vertical banded gastroplasty in this series 1-3 years postoperative. The series has a 90% success rate at three years, with 65.7% of patients losing more than 60% of excess weight by three years postoperative.
Failures were considered to be those who lost less than 40% of their preoperative excess weight. In our experience the majority of failures could be directly attributed to noncompliance to the "basic rules" i.e. overindulgence in high calorie fluids, sweets and junk foods.

Average weight loss for the series from 6 months to 3 years postoperative is shown in Table 2. Weight loss appears to stabilize at one year with an insignificant change in the average weight loss between one and three years postoperative. The number of cases available was large enough to make the results statistically significant.

Figure 1 breaks the series into three preoperative overweight categories and yields some interesting results.

As predicted by early results, the percent of excess weight lost was significantly greater in the lowest weight category than in the higher two categories. Weight loss stabilized after 12 months in the two lower weight categories as early results indicated, however patients in the highest weight category (over 200 pounds excess weight) continued to lose weight significantly following two years postoperative. The weight loss for this group reaches the same percent of excess weight loss seen in the 100-200 pound category by three years postoperative.

Though the number in our series for this heaviest category is too small to be statistically significant it does at least indicate a hopeful trend of satisfactory weight loss for patients with preoperative excess weights of 200 or more pounds.

The following complications were seen in the series: (Table 3). Total complication rate including major and minor complications is 17.9%.

Table 4 compares the complication rates in the three overweight categories. The two lower weight categories have essentially the same rate for both major and minor complications. The highest weight category however showed a significantly higher complication rate. This was disturbing until closer examination revealed all the complications in this category were "minor." Most of these complications were mild postoperative atelectasis or wound infections of little clinical significance.

In our experience the vertical banded gastroplasty has proven to be an effective operation for every preoperative overweight category and
should not be considered inadequate for the heaviest category prior to three years postoperative.

An acceptably low complication rate was seen in all preoperative overweight categories.

Weight loss was seen to continue or be sustained successfully to three years postoperatively for all weight categories.
### TABLE 1
**1-3 YEAR RESULTS FOR VERTICAL BANDED GASTROPLASTY**

<table>
<thead>
<tr>
<th></th>
<th>1 YEAR</th>
<th>2 YEARS</th>
<th>3 YEARS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL DONE</strong></td>
<td>289</td>
<td>195</td>
<td>92</td>
</tr>
<tr>
<td><strong>FAILURES (%)</strong></td>
<td>7.6</td>
<td>8.4</td>
<td>10</td>
</tr>
<tr>
<td>less than 40%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>excess weight loss</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GOOD RESULTS (%)</strong></td>
<td>32.4</td>
<td>27.1</td>
<td>24.2</td>
</tr>
<tr>
<td>40-60% excess</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>weight loss</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EXCELLENT RESULTS (%)</strong></td>
<td>59.9</td>
<td>64.4</td>
<td>65.7</td>
</tr>
<tr>
<td>more than 60%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>excess weight loss</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**AVERAGE POSTOPERATIVE HOSPITAL STAY** ——— 6 days

### TABLE 2
**WEIGHT LOSS FOLLOWING VERTICAL BANDED GASTROPLASTY**

<table>
<thead>
<tr>
<th></th>
<th>6 MONTHS</th>
<th>1 YEAR</th>
<th>2 YEARS</th>
<th>3 YEARS POSTOP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CASES</strong></td>
<td>355</td>
<td>289</td>
<td>195</td>
<td>92</td>
</tr>
<tr>
<td><strong>% EXCESS WEIGHT LOST</strong></td>
<td>52</td>
<td>67</td>
<td>69</td>
<td>68</td>
</tr>
<tr>
<td><strong>% FOLLOW UP</strong></td>
<td>96</td>
<td>90.6</td>
<td>85.1</td>
<td>76</td>
</tr>
<tr>
<td>MAJOR COMPLICATIONS</td>
<td>MINOR COMPLICATIONS</td>
<td>MINOR COMPLICATIONS NOT SEEN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------</td>
<td>--------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEATHS</td>
<td>PULMONARY MINOR i.e.</td>
<td>Electrolyte Disturbance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WOUND DEHISCENCE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STOMAL STENOSIS</td>
<td></td>
<td>Pulmonary Embolus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(required revision)</td>
<td></td>
<td>Subphrenic Abscess</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENLARGEMENT OF STOMA</td>
<td></td>
<td>Peritonitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PANCREATITIS</td>
<td></td>
<td>Liver Failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEAK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MESH INFECTION</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPLENECTOMY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAPLE LINE FAILURE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MAJOR COMPLICATIONS NOT SEEN**
- Pneumonia
- Pulmonary Embolus
- Subphrenic Abscess
- Peritonitis
- Liver Failure

**MINOR COMPLICATIONS NOT SEEN**
- Electroyte Disturbance
- Renal Tract Stones

**TOTAL MINOR COMPLICATIONS** - 43
**TOTAL MAJOR COMPLICATIONS** - 31
**NUMBER OF REVISIONS** - 20
**TOTAL CASES IN SERIES** - 368
**% CASES WITH COMPLICATIONS** - 17.9%
Figure I

PER CENT EXCESS WEIGHT LOST FOR VARIOUS OVERWEIGHT CATEGORIES

excess weight lost

- 100* excess
100-200* excess
+ 200* excess

no. months post op
6 12 24 36
<table>
<thead>
<tr>
<th>Preop excess weight category</th>
<th># CASES</th>
<th>Complication Rates (%)</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>UNDER 100 LBS</td>
<td>92</td>
<td>19</td>
<td>8.6</td>
<td>10.8</td>
<td></td>
</tr>
<tr>
<td>100-200 LBS</td>
<td>259</td>
<td>16.2</td>
<td>5.5</td>
<td>10.6</td>
<td></td>
</tr>
<tr>
<td>OVER 200 LBS</td>
<td>17</td>
<td>35.2</td>
<td>0</td>
<td>35.2</td>
<td></td>
</tr>
</tbody>
</table>
QUESTION: What size is your band?
HOLLINGSWORTH: The band is calibrated by snugging it unstretched to an enclosed 32 mercury bougie, which is 11 mm in diameter.
QUESTION: Then it's not measured?
HOLLINGSWORTH: No, it's not measured.
QUESTION: What is your weight criterion for an operation?
HOLLINGSWORTH: Patients must be either twice ideal weight or 100 lbs overweight. There are a few exceptions. If a patient has arthritis in a weight-bearing joint, or diabetes or hypertension, we may make an exception.
RELIANCE ON SUBJECTIVE ESTIMATES OF POUCH VOLUME
L. Granstöm and L. Backman

INTRODUCTION
Two technical factors are important for good result after gastric surgery for obesity, a small upper pouch and a narrow outlet. The answers to a questionnaire held at the annual meeting of the American Society for Bariatric Surgery in Iowa City in 1984 showed that many surgeons do not measure the size of the upper pouch, but make a subjective estimate of the size.

If we want to evaluate the procedures, we have to document as many details as possible.

The aim of this study was to examine if it is adequate to make a subjective estimate of the size of the upper pouch or if it is necessary to measure it in a standardized way.

METHOD
At gastric banding in 18 patients the size of the upper pouch was measured with a thin latex balloon at a pressure of 40-45 cm of water. Before measurement the size of the upper pouch was subjectively estimated by two surgeons, without knowing each other's results. Both surgeons were trained in bariatric surgery.

RESULT
The result in absolute figures showed that both surgeons often underestimate the size (Table I). Surgeon B who is more experienced in bariatric surgery has a slightly better result. The difference is however not significant. In figure 1 the estimated volume is related to the objectively determined volume. In only two patients both surgeons have estimated the same volume as with measurement with a thin latex balloon, and in another five patients, one of the surgeons estimated almost exactly the same volume as with measurement with a balloon. Six estimations were too great and 21 were too low.

DISCUSSION
This study shows that it is very difficult to estimate the size of the upper pouch at gastric banding. There is a strong tendency to believe that the volume is smaller than it actually is. The difficulties in estimation of the volume may partly be due to anatomical variations of
the proximal part of the stomach. There are studies which have shown that the height of the fundus may differ greatly, from 1-7 cm (fig 2). There may also be a difference in how much the fundus bulges into the lesser sac (fig 3). One must also remember that the stomach is an elastic organ and the distention capacity may differ from individual to individual. Another explanation may be that we underestimate the pouch size by psychological reasons, because we all know that the size should be small. The estimated volume therefore more reflects a desired volume than a real volume.

The conclusion from this study is that it is very important and necessary to measure the size of the upper pouch in an objective way, because it makes postoperative evaluation of the result easier.
Tabell I  Estimated and measured volume (ml) of the upper pouch in 18 extremely obese patients operated on with gastric banding.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Surgeon A</th>
<th>Surgeon B</th>
<th>Measured volume</th>
<th>Pressure (cm H$_2$O)</th>
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<tr>
<td>1.</td>
<td>175</td>
<td>225</td>
<td>175</td>
<td>41</td>
</tr>
<tr>
<td>2.</td>
<td>30</td>
<td>175</td>
<td>180</td>
<td>40</td>
</tr>
<tr>
<td>3.</td>
<td>30</td>
<td>50</td>
<td>80</td>
<td>45</td>
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<td>30</td>
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<tr>
<td>5.</td>
<td>75</td>
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<td>6.</td>
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<td>42</td>
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<td>7.</td>
<td>125</td>
<td>50</td>
<td>100</td>
<td>44</td>
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<tr>
<td>8.</td>
<td>100</td>
<td>150</td>
<td>125</td>
<td>41</td>
</tr>
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<td>9.</td>
<td>30</td>
<td>80</td>
<td>120</td>
<td>43</td>
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<tr>
<td>10.</td>
<td>80</td>
<td>50</td>
<td>180</td>
<td>41</td>
</tr>
<tr>
<td>11.</td>
<td>50</td>
<td>70</td>
<td>80</td>
<td>44</td>
</tr>
<tr>
<td>12.</td>
<td>250</td>
<td>175</td>
<td>250</td>
<td>43</td>
</tr>
<tr>
<td>13.</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>44</td>
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<tr>
<td>14.</td>
<td>150</td>
<td>120</td>
<td>60</td>
<td>40</td>
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<td>15.</td>
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<tr>
<td>16.</td>
<td>100</td>
<td>80</td>
<td>130</td>
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<tr>
<td>17.</td>
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<td>75</td>
<td>75</td>
<td>44</td>
</tr>
<tr>
<td>18.</td>
<td>40</td>
<td>120</td>
<td>80</td>
<td>44</td>
</tr>
</tbody>
</table>

mean = SEM 80 ± 14 94 ± 12 116 ± 11
Fig 1
Estimated volume of upper pouch in per cent of measured volume in 18 patients operated on with gastric banding (A=●, B=○).

Fig 2
Anterior view of stomach

Fig 3
Lateral view of stomach
EVOLUTION OF GASTRIC BYPASS IN PRIVATE PRACTICE
Sheldon M. Solocek, M.D.

Our gastric bypass series started in January 1976, and just as there has been an evolution in the original procedure nationally, so has there been in my practice. This paper documents my search for a procedure that gives optimum weight loss with the least complications.

The series reported on consists of 1172 patients operated on from January 1976 to June 1985. The average age was 34.4 with a range of 13-63, average weight was 267 pounds, average percent was 218% of their ideal weight with an average of 145 pounds over their ideal weight. (See Tables I and II)

The original procedure performed was the original bypass described by Dr. Mason in 1967. Three of these transection procedures were performed from January 1976 to October 1976. Starting in June 1977, the Alden type bypass with a stapled pouch, 60-90 cc volume and 1 cm stoma with loop gastroenterostomy, was performed until late 1979 and early 1980 when 28 Gomez gastroplasties were performed and finally abandoned by May 1980. The reasons for abandonment were too much post surgical emesis secondary to stomal stenosis and poor weight loss secondary to stomal dilatation; all but five have now been converted to bypass.

Another change which was adapted in early 1979 was to apply two superimposed staple lines to try and improve on an unsatisfactory staple-line disruption rate of 20%. Since that change, only 4 documented staple-line disruptions have occurred for a 0.34 percentage.

From 1980 to June 1982, the only change in the procedure had been reduction of the pouch to 30-40 cc. Starting in June 1982, all patients had a 75 cm Roux-en-Y, instead of a loop gastroenterostomy. These patients comprise Group IV on the slides (see Table II). This was done for two reasons. For one, there were about 12 people with postoperative distention of the distal stomach who responded to placement of a distal gastrostomy. No apparent cause for this was found, but it was noted that no patients with Roux-en-Y developed this complication. Secondly, a few patients, about 2%, were developing bile reflux gastritis which was alleviated by the long Roux-en-Y limb. Also patients with preoperative symptoms of esophagitis were cured by performing a Roux-en-Y.
No change occurred in the procedure until June 1983. At that time a radical change occurred. First, no longer were any gastric vessels ligated, instead, the pouch was fashioned by placing the 90 stapler across the mobilized esophagogastric junction, and then bringing the anterior wall of the stomach through the jaws of the stapler until a 30 cc pouch was fashioned, and then firing two superimposed rows of staples. Secondly, the anastomosis was made with 21 mm EEA and thirdly, the stoma was reinforced with 8F radiopaque silastic tubing which was threaded on a 2-0 prolene suture and tied around the stoma. This procedure takes less than 60 minutes to perform and has many obvious advantages. For one, the pouch is anterior and is easier to work on. Secondly, there is little risk of gastric ischemia or injury to the spleen and thirdly, if the anastomosis or pouch look problematic, it is easy to cover the area with redundant stomach from each side of the pouch. (See Table III)

This new procedure is represented by Groups V and VI on all statistical slides. There are only 6 months and 1 year of results for Group VI, but as one can see on the slide, the 6 month percent of excess weight lost has increased steadily with each change in procedure. In Group I, 46.6% excess weight was lost in 6 months, which increased to 54% in Group III and IV and 60% in Group V and 59.3% in Group VI.

One year weight loss has improved from 59.7% in Group I to 68-69% in Groups III and IV. At one year, weight loss is 77.3% in Group V and 84.5% in Group VI, though only 8 patients have been tallied so far. As one can see, there is a slight steady improvement at all yearly increments as the procedure has been refined. (See Table III)

Early perioperative mortality was 0.5% for Groups I and II and 0% for Groups III, IV and V. There was one death in Group VI from necrotizing pancreatitis. Late related mortality was 0.25% for Groups I and II and was 0.48% for Groups III, IV and V. Total early mortality is 0.3% and also 0.3% for late related deaths. Two deaths were related to pulmonary emboli, 3-1/2 weeks and 6 months postoperatively and one 21-year-old female died suddenly 3 months postoperatively.

Early perioperative complication rates requiring emergency operation were 3.5% in Group I, 1.2% in Group II and 5.8% in Group III, but 1.9%
were due to distal stomach distention which has now been totally alleviated in the Roux-en-Y groups. The percent emergency reoperation rate for Group IV is 5% and in Group V is 2.3% and 2.6% in Group VI, though 2 were negative laparotomies. If one disregards the 1.9% reoperation rate for distal gastric distention in Groups I through III, then the emergency reoperation rate for distal gastric distention in Groups I through III is 1.6%. It should be pointed out that since the stomas in Group V have been reinforced with 3-0 silk Lemberts, the emergency reoperation rate is only 1.6% in 180 cases. There were two perforations of the pouch and one subphrenic abscess without a demonstrated leak. (See Table IV)

It was the high revision rate, mainly due to stomal enlargement, that has led to the use of silastic tubing to reinforce the stoma starting June 1983. In Group I, the revision rate is 43%, but this includes 21% staple line disruption which has now been almost completely alleviated since the utilization of double superimposed stapling. The revision percent without restapling is approximately 30%.

The revision rate for Group II is 23.2% and as time passes I'm sure all revision rates will increase. Hopefully, the rate for Group V will be low, perhaps less than 10%, but we'll have to wait at least 3-4 years to really know. There have been 15 ring erosions in Group V for a 8.7%. One was found at autopsy in the patient who died 6 months postoperatively from massive pulmonary emboli; six were found during endoscopy on patients with large marginal ulcers; and one was found in a patient with chronic stenosis who underwent frequent dilation. The other 5 were found during endoscopy on patients admitted with frequent emesis. Most patients with ring erosion were chronic overeaters and many had psychological problems. In three patients, the rings passed without difficulty, the other 7 still have theirs and are basically asymptomatic. Because of the erosion problem, flat oval silastic tubing has been used since May 7, 1984. Two widths are available, 7 mm and 10 mm, but only the 7 mm tubing is being used now because of erosions of the 10 mm ring. Hopefully, pressure on the bowel will be distributed over a wider area, thereby decreasing the incidence of erosion.
I should also mention that I did try Marlex mesh in 14 patients undergoing stomal revision, and the results were disastrous. Almost all have had problems with stenosis, 12 requiring repeated dilatation, 7 of those requiring removal of the mesh.

I don't know the problems that others have had with mesh, though I suspect it is substantial, but the problem seems to arise because the mesh grows into the wall of the bowel setting up inflammation and scarring. In the majority of cases, silastic tubing does not cause inflammation and is easily removed if necessary. More of our patients with externally reinforced stomas have stenosis problems, but I feel that the reasons for this are obvious since the stomas by virtue of their reinforcement will not dilate on their own.

Of course, as in physics, every action has an opposite reaction and if one paraphrases this concept into the field of bariatric surgery, we would expect some kind of negative result to every supposedly positive change that we make in our particular bypass procedure.

Two things concern me about gastric bypass. One is the failure to easily visualize or x-ray the distal stomach. The other is the 10% vitamin B12 deficiency and 10% iron deficiency that we have found so far on our followed patients. I'm sure the incidence is higher because of the 30-35% of patients lost to follow-up. We are taking aggressive steps to alleviate these deficiencies, which I feel will also occur in vertical banded gastroplasty patients.

In conclusion, I feel that the best partitioning procedure will never be perfect, but will be a procedure where the positives far outweigh the negatives, and I feel that the anterior placed pouch with silastic reinforced stoma is currently one of those procedures. It is simple, safe and can be used for bypass or gastroplasty. I, myself, favor bypass because I feel that weight loss is faster, stays off in a greater percentage of patients than gastroplasty and has an equally acceptable complication rate. I realize that there is an advantage to being able to visualize the distal stomach, but I feel that since safe maximum weight loss is the name of the game, then bypass is the better procedure as long as the stoma is reinforced.
If in the future I feel that other procedures offer the same weight loss, with less risk, I will then switch. Until then I will continue with my present procedure and keep trying to improve it.
<table>
<thead>
<tr>
<th>Group</th>
<th>Date Range</th>
<th>Number of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>January 1, 1976 thru December 31, 1979</td>
<td>141</td>
</tr>
<tr>
<td>II</td>
<td>January 1, 1979 thru May 30, 1981</td>
<td>249</td>
</tr>
<tr>
<td>III</td>
<td>June 1, 1981 thru June 15, 1982</td>
<td>259</td>
</tr>
<tr>
<td>IV</td>
<td>June 16, 1982 thru May 30, 1983</td>
<td>177</td>
</tr>
<tr>
<td>V</td>
<td>June 1, 1983 thru May 15, 1984</td>
<td>173</td>
</tr>
<tr>
<td>VI</td>
<td>May 16, 1984 thru present</td>
<td>173</td>
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6-5-85
## Table II

**Patient Statistics**

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<thead>
<tr>
<th>Category</th>
<th>Value</th>
<th>Notes</th>
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<tr>
<td>Average Age</td>
<td>34.4 (Range 13-63)</td>
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</tr>
<tr>
<td>Average Weight</td>
<td>267.5 ± 47.8 Lbs.</td>
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</tr>
<tr>
<td>Average Per Cent of Ideal Weight</td>
<td>218.4 ± 34%</td>
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<tr>
<td>Average Pounds Over Weight</td>
<td>144.6 ± 41 Lbs.</td>
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6-5-85
### Pre-operative Medical Problems

(1172 Patients)

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<thead>
<tr>
<th>Condition</th>
<th>Number</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Diabetes</td>
<td>79</td>
<td>6.9%</td>
</tr>
<tr>
<td>Insulin</td>
<td>19</td>
<td>1.7%</td>
</tr>
<tr>
<td>Oral Agents</td>
<td>7</td>
<td>0.6%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>317</td>
<td>27.7%</td>
</tr>
<tr>
<td>On Meds.</td>
<td>144</td>
<td>12.6%</td>
</tr>
<tr>
<td>Cardiac Disease</td>
<td>24</td>
<td>2.1%</td>
</tr>
<tr>
<td>Asthma</td>
<td>51</td>
<td>4.5%</td>
</tr>
<tr>
<td>Other Pulmonary Disease</td>
<td>13</td>
<td>1.1%</td>
</tr>
<tr>
<td>Arthritis</td>
<td>78</td>
<td>6.8%</td>
</tr>
<tr>
<td>GROUPS</td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>---</td>
<td>-----</td>
</tr>
<tr>
<td>MASON WITH LOOP</td>
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<tr>
<td>ALDEN WITH LOOP</td>
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<td>ALDEN WITH R-N-Y</td>
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<td>19</td>
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<tr>
<td>LINNER R-N-Y 7mm SILASTIC</td>
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<td></td>
</tr>
<tr>
<td>LINNER R-N-Y 10mm SILASTIC</td>
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</tr>
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<td>3</td>
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<td>JIB TO ALDEN R-N-Y</td>
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<td>2</td>
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<tr>
<td>JIB TO LINNER 8F SILASTIC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JIB TO LINNER 7mm SILASTIC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JIB TO LINNER 10mm SILASTIC</td>
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<td></td>
</tr>
<tr>
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<td>4</td>
</tr>
<tr>
<td>GASTROPLASTY TO ALDEN R-N-Y</td>
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</tr>
<tr>
<td>GASTROPLASTY TO LINNER R-N-Y</td>
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<td>VBG TO LINNER R-N-Y</td>
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<td>BYPASS REVISION</td>
<td></td>
<td></td>
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<tr>
<td>BYPASS REVISION WITH 8F SILAS</td>
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<td></td>
</tr>
<tr>
<td>BYPASS REVISION WITH 7mm SILAS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BYPASS REVISION WITH 10mm SILAS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BYPASS REVISION TO LINNER R-N-Y</td>
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6-5-85
Anterior gastric bypass with silastic stomal reinforcement
<table>
<thead>
<tr>
<th>GROUPS</th>
<th>III (259)</th>
<th>IV (177)</th>
<th>V (173)</th>
<th>VI (173)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 MONTHS</td>
<td>71.5% ± 22</td>
<td>71.2% ± 26.6</td>
<td>77.0% ± 20.3</td>
<td>73.2% ± 18.5</td>
</tr>
<tr>
<td></td>
<td>46.6% ± 13</td>
<td>49.9% ± 26.5</td>
<td>54.0% ± 12.8</td>
<td>54.2% ± 13.5</td>
</tr>
<tr>
<td></td>
<td>24.9% ± 6.6</td>
<td>± 5.9</td>
<td>28.3% ± 5.5</td>
<td>28.2% ± 5.5</td>
</tr>
<tr>
<td>1 YEAR</td>
<td>71.9% ± 29.4</td>
<td>90.1% ± 25.6</td>
<td>98.5% ± 28.1</td>
<td>95.2% ± 28.3</td>
</tr>
<tr>
<td></td>
<td>59.7% ± 16</td>
<td>65.0% ± 33.7</td>
<td>69.0% ± 16.0</td>
<td>69.6% ± 16.1</td>
</tr>
<tr>
<td></td>
<td>31.9% ± 8.7</td>
<td>± 8.2</td>
<td>36.6% ± 7.5</td>
<td>36.3% ± 7.6</td>
</tr>
<tr>
<td>18 MONTHS</td>
<td>97.2% ± 37.9</td>
<td>93.3% ± 26.2</td>
<td>102.7% ± 29.7</td>
<td>95.1% ± 29.4</td>
</tr>
<tr>
<td></td>
<td>62.9% ± 19</td>
<td>67.0% ± 34.9</td>
<td>73.7% ± 16.2</td>
<td>71.4% ± 16.8</td>
</tr>
<tr>
<td></td>
<td>33.7% ± 10.2</td>
<td>± 8.2</td>
<td>38.5% ± 7.7</td>
<td>36.8% ± 8.4</td>
</tr>
<tr>
<td>2 YEARS</td>
<td>96.6% ± 39.2</td>
<td>91.5% ± 30.4</td>
<td>98.0% ± 34.5</td>
<td>103.9% ± 38.0</td>
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<tr>
<td></td>
<td>62.9% ± 20</td>
<td>65.9% ± 34.1</td>
<td>68.9% ± 19.4</td>
<td>70.7% ± 16.7</td>
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<tr>
<td></td>
<td>32.4% ± 12.9</td>
<td>± 10.5</td>
<td>36.3% ± 9.7</td>
<td>37.9% ± 9.2</td>
</tr>
<tr>
<td>3 YEARS</td>
<td>89.6% ± 42</td>
<td>89.3% ± 33.6</td>
<td>97.9% ± 36.2</td>
<td>98.0% ± 34.5</td>
</tr>
<tr>
<td></td>
<td>58.6% ± 22</td>
<td>63.1% ± 32.9</td>
<td>65.6% ± 18.8</td>
<td>68.9% ± 19.4</td>
</tr>
<tr>
<td></td>
<td>30.9% ± 13.3</td>
<td>± 11</td>
<td>35.3% ± 9.7</td>
<td>36.3% ± 9.7</td>
</tr>
<tr>
<td>4 YEARS</td>
<td>92.0% ± 38</td>
<td>85.5% ± 31.9</td>
<td>97.9% ± 36.2</td>
<td>98.0% ± 34.5</td>
</tr>
<tr>
<td></td>
<td>58.4% ± 22</td>
<td>61.8% ± 31.2</td>
<td>65.6% ± 18.8</td>
<td>68.9% ± 19.4</td>
</tr>
<tr>
<td></td>
<td>31.2% ± 12.8</td>
<td>± 13.0</td>
<td>35.3% ± 9.7</td>
<td>36.3% ± 9.7</td>
</tr>
<tr>
<td>5 YEARS</td>
<td>93.1% ± 39.8</td>
<td>91.4% ± 34.2</td>
<td>98.0% ± 34.5</td>
<td>98.0% ± 34.5</td>
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<tr>
<td></td>
<td>61.0% ± 20.7</td>
<td>64.1% ± 32.3</td>
<td>68.9% ± 19.4</td>
<td>68.9% ± 19.4</td>
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<td></td>
<td>31.2% ± 13.0</td>
<td>± 13.0</td>
<td>36.3% ± 9.7</td>
<td>36.3% ± 9.7</td>
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<tr>
<td>6 YEARS</td>
<td>93.2% ± 42</td>
<td>93.2% ± 39.8</td>
<td>93.2% ± 39.8</td>
<td>93.2% ± 39.8</td>
</tr>
<tr>
<td></td>
<td>59.0% ± 23.7</td>
<td>61.0% ± 20.7</td>
<td>61.0% ± 20.7</td>
<td>61.0% ± 20.7</td>
</tr>
<tr>
<td></td>
<td>28.7% ± 16.1</td>
<td>± 13.0</td>
<td>31.2% ± 13.0</td>
<td>31.2% ± 13.0</td>
</tr>
<tr>
<td>7 YEARS</td>
<td>138.5% ± 14.4</td>
<td>138.5% ± 14.4</td>
<td>138.5% ± 14.4</td>
<td>138.5% ± 14.4</td>
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<tr>
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<td>79.7% ± 17.7</td>
<td>± 16.1</td>
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</tr>
<tr>
<td></td>
<td>33.3% ± 2.8</td>
<td>± 13.0</td>
<td>33.3% ± 2.8</td>
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### TABLE IV

**EMERGENCY OPERATIVE**
**PROCEDURES (1172 PATIENTS)**

<table>
<thead>
<tr>
<th>GROUPS</th>
<th>I (141)</th>
<th>II (249)</th>
<th>III (259)</th>
<th>IV (177)</th>
<th>V (173)</th>
<th>VI (173)</th>
<th>TOTAL</th>
</tr>
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<tbody>
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<td><strong>DIAGNOSES</strong></td>
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</tr>
<tr>
<td>UCH LEAK</td>
<td>1 (.7%)</td>
<td>2 (.8%)</td>
<td>5 (1.9%)</td>
<td>1 (.6%)</td>
<td>2 (.12%)</td>
<td>1 (.6%)</td>
<td>12 (1.0%)</td>
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<tr>
<td>STAL GASTRIC</td>
<td>2 (1.4%)</td>
<td>---</td>
<td>11 (4.3%)</td>
<td>1 (.6%)</td>
<td>1 (.6%)</td>
<td>---</td>
<td>15 (1.3%)</td>
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<td>TENSION</td>
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</tr>
<tr>
<td>UPHRENIC</td>
<td>3 (2.1%)</td>
<td>1 (.4%)</td>
<td>2 (.9%)</td>
<td>1 (.6%)</td>
<td>2 (.12%)</td>
<td>1 (.6%)</td>
<td>10 (.9%)</td>
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<tr>
<td>OBCESS</td>
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</tr>
<tr>
<td>OMAL LEAK</td>
<td>1 (.7%)</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>3 (1.7%)</td>
<td>3 (1.7%)</td>
<td>1 (1.7%)</td>
</tr>
<tr>
<td>MORRHAJE</td>
<td>---</td>
<td>1 (.4%)</td>
<td>---</td>
<td>2 (1.2%)</td>
<td>---</td>
<td>---</td>
<td>3 (.3%)</td>
</tr>
<tr>
<td>OMAL</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>2 (8%)</td>
<td>(PLASTY)</td>
<td>---</td>
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<td>OBSTRUCTION</td>
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<td></td>
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</tr>
<tr>
<td>CHEMIA</td>
<td>1 (.7%)</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1 (.1%)</td>
</tr>
<tr>
<td>OCULATED</td>
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<td>---</td>
<td>1 (.4%)</td>
<td>1 (.6%)</td>
<td>1 (.6%)</td>
<td>---</td>
<td>4 (.3%)</td>
</tr>
<tr>
<td>FUSION</td>
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</tr>
<tr>
<td>TAL</td>
<td>5 (3.5%)</td>
<td>3 (1.2%)</td>
<td>15 (5.8%)</td>
<td>9 (5.1%)</td>
<td>4 (2.3%)</td>
<td>4 (2.6%)</td>
<td>40 (3.5%)</td>
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### WEIGHT LOSS COEFFICIENT VS TIME

<table>
<thead>
<tr>
<th>GROUPS</th>
<th>I (141)</th>
<th>II (249)</th>
<th>III (259)</th>
<th>IV (177)</th>
<th>V (173)</th>
<th>VI (173)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 MONTHS</td>
<td>143 (112)</td>
<td>147.6 (160)</td>
<td>159.5 (189)</td>
<td>155.6 (138)</td>
<td>175.5 (145)</td>
<td>177 (73)</td>
</tr>
<tr>
<td>1 YEAR</td>
<td>183.5 (100)</td>
<td>188.8 (148)</td>
<td>204.1 (210)</td>
<td>201.1 (137)</td>
<td>229.2 (121)</td>
<td>232 (8)</td>
</tr>
<tr>
<td>18 MONTHS</td>
<td>192.5 (61)</td>
<td>195.2 (117)</td>
<td>214.9 (162)</td>
<td>203.3 (105)</td>
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<tr>
<td>2 YEARS</td>
<td>191.9 (54)</td>
<td>191.5 (182)</td>
<td>203.2 (200)</td>
<td>212.4 (98)</td>
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</tr>
<tr>
<td>3 YEARS</td>
<td>178.7 (72)</td>
<td>185.3 (177)</td>
<td>198.8 (141)</td>
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<td>4 YEARS</td>
<td>181.4 (82)</td>
<td>178.5 (147)</td>
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</tr>
<tr>
<td>5 YEARS</td>
<td>185.3 (75)</td>
<td>184.4 (44)</td>
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<tr>
<td>6 YEARS</td>
<td>180.9 (45)</td>
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</tr>
<tr>
<td>7 YEARS</td>
<td>251.5 (6)</td>
<td></td>
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</tr>
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</table>
POUNDS LOST

YEARS

GROUPS

I
II
III
IV
V
VI

0
20
40
60
80
100

0
1
2
3
4
5
6
7

6-5-85
## BYPASS REVISIONS

<table>
<thead>
<tr>
<th>Groups</th>
<th>Group I (141)</th>
<th>Group II (249)</th>
<th>Group III (259)</th>
<th>Group IV (177)</th>
<th>Group V (173)</th>
<th>Group VI (173)</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Revisions</td>
<td>45.4% 64</td>
<td>23.2% 58</td>
<td>11.6% 30</td>
<td>4.5% 8</td>
<td>9.8% 17</td>
<td>3.5% 6</td>
<td>15.6% 183</td>
</tr>
<tr>
<td>Decrease Stoma</td>
<td>34.8% 49</td>
<td>18.4% 46</td>
<td>7.3% 19</td>
<td>4.0% 7</td>
<td>1.7% 3</td>
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</tr>
<tr>
<td>Decrease Pouch</td>
<td>27.0% 38</td>
<td>16.9% 42</td>
<td>4.6% 12</td>
<td>1.1% 2</td>
<td>0.6% 1</td>
<td></td>
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</tr>
<tr>
<td>Add Roux-en-Y</td>
<td>24.8% 35</td>
<td>15.3% 38</td>
<td>10.0% 26</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Increase Stoma</td>
<td>2.1% 3</td>
<td>1.2% 3</td>
<td>6.4% 11</td>
<td>2.9% 5</td>
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</tr>
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<td>Restaple Pouch</td>
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6-5-85
UNRELATED POST BYPASS OPERATIONS

HYSTERECTOMY 9
THYROIDECTOMY 3
PARATHYROIDECTOMY 1
MAMMALECTOMY 2
INGUINAL HERNIA REPAIR 2
VEIN STRIPPING 3
THORACOTOMY 1
CORONARY BYPASS 3
JOINT REPLACEMENT 2
LAMINECTOMY 1
ILEAL CONDUIT 1
TOTAL PROCTOCOLECTOMY 1
URETEROLITHOTOMY 1
OVARIAN CYSTECTOMY 3
EXPLORATORY LAPAROTOMY GYN 3
MARSHALL-MARCHETTI 2
EXCISION CA OF RENAL VEIN 1
EXCISION ENDOMETRIOMA 1
HEMORRHIOIDECTOMY 1
EXPLORATORY LAPAROTOMY (PANCREATITIS) 1

6-5-85
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<th>GROUPS</th>
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<th>II (249)</th>
<th>III (259)</th>
<th>IV (177)</th>
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6-5-85