Physical Therapy may Promote Resolution of Lymphatic Cording in Breast Cancer Survivors

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ABSTRACT

Background and Purpose: Surgical removal of axillary lymph nodes may cause lymphatic cording that has been reported to resolve in about 3 months. The purpose of this study was to retrospectively investigate the effectiveness of physical therapy as a treatment. We hypothesized that lymphatic cording resolves in less than the expected 3 months with skilled physical therapy.

Subjects: Thirty-one lymphatic cording cases were identified. Methods: Information from patient records was collected describing cancer treatment, lymphatic cording, and physical therapy care. Results: The average approximate time to onset was 35.9 weeks. Shoulder abduction range of motion improved, on average, 52° in 4 weeks. The average length of physical therapy care was 10.1 ± 9.5 weeks. For those who attended physical therapy regularly, length of care was 7.3 ± 3.4 weeks. A higher frequency of therapy cancellations was strongly correlated to a longer therapy length of care. Length of care for patients undergoing concurrent cancer treatment was significantly longer (17.0 ± 14.8) compared to those who were not (6.5 ± 3.3 weeks). Discussion: Our data suggest that physical therapy may shorten cording resolution time and that this recovery time is influenced by other factors such as attendance or concurrent care. Further research is needed. Conclusion: Physical therapy appears to shorten resolution time of lymphatic cording from the expected 3 months without therapy to 10 weeks.

INTRODUCTION

Breast surgery, radiation, and chemotherapy are standards in breast cancer treatment that may contribute to posttreatment morbidities such as pain, decreased range of motion, weakness, swelling, neuropathy, radiation fibrosis, fatigue, and lymphatic cording.1,3-6 Pain is the most frequently reported symptom after breast cancer treatment.7 Arm symptoms occur in about 80% of women who undergo lumpectomy with axillary dissection and radiation.8 Five years after axillary lymph node dissection, 25% of breast cancer survivors report pain9 which may be caused by fibrotic changes, nerve damage, tissue tightness, swelling, lymphatic cording, or seromas.10-12 Postoperative deficits following axillary lymph node dissection can become chronic conditions for most breast cancer survivors.13

Lymphatic cording is thought to occur from lymphatic disruption following breast or axillary surgery resulting in a visible and palpable web of tissue that overlays observable cording when the patient abducts her arm.2 This condition has been defined by Moskovitz et al2 as an early postoperative morbidity following surgical removal of lymph nodes.

The pathophysiology of lymphatic cording, or ‘axillary web syndrome’ has been investigated and described by Moskovitz et al.2 Of 4 axillary web syndrome cases that underwent biopsy with light microscopy, a fibrin clot was observed in the superficial vein of 3 cases and the lymphatic vessel of the fourth.2 Following this analysis, several etiologies were proposed.2 First, during axillary lymph node dissection, the tissues in the axilla are retracted and the patient’s arm is positioned to allow the surgeon to work in the axilla; Moskovitz et al proposed this shoulder position sustained during surgery may cause lymphovascular injury.2 Secondly, it was proposed that the tissues may release their own hypercoagulability factor following the surgical procedure which then causes the clotting.2 Third, the removal of nodes in the axilla may impede the flow of lymph, thus causing lymphovenous stasis.2

Regardless of origin, signs and symptoms of lymphatic cording include axillary pain radiating down the arm, limited shoulder range of motion, as well as the characteristic “cording.”2 Clinically, it is important to differentiate the cords from the border of the pectoralis major muscle, which will be superior and anterior to the cords. In addition, soft tissue may give a cordlike appearance due to increased tension between the skin of the upper arm and adherence of an axillary scar to underlying fascia.

The study by Moskovitz et al reported that treatment for this condition, including physical therapy, does not shorten or change the course of the syndrome.2 The number of patients receiving physical therapy, description of physical therapy sessions, or home exercise program was not provided. Resolution of this condition occurs within 3 months according to studies by Moskovitz et al2 and Leidenius et al.11

Despite prior reports that physical therapy does not assist in resolution of this condition,2 physical therapy and specific treatment techniques for lymphatic cording have since been described in the literature.13 To our knowledge, there are no data or research specifically focused on the effectiveness of physical therapy as a treatment for lymphatic cording. The purpose of this study is to further describe lymphatic cording from a clinical perspective and to investigate the effectiveness of physical therapy treatment through retrospective analysis of patient charts. Our hypothesis is that lymphatic cording resolves in less than 3 months with skilled physical therapy treatment.

METHODS

Procedures

Chart review took place at a private physical therapy clinic.
whose sole focus is cancer survivor care. This retrospective research project was approved by the sponsoring institutions IRB.

Initially 180 physical therapy medical charts of patients seen between January, 2003 and September, 2004 were screened. Ninety-three percent of patients seen during this time were breast cancer survivors and, of these, 31 (19%) episodes of lymphatic cording were documented. All subsequent data collection was from these 31 charts, ie, n=31. Our definition of the term "breast cancer survivor" is anyone living with the diagnosis during or after cancer treatment.

Data collected from review of these charts included: cancer diagnosis, cancer treatment (surgery, chemotherapy, and radiation), location and severity of lymphatic cording (mild, mild to moderate, moderate, or moderate to severe), and lymphedema. The terms used to describe severity of cording (mild, mild to moderate, moderate, moderate to severe, and severe) were used by the therapist as a subjective description and do not reflect any objective measurements. Other data included range of motion of the shoulder at the time of evaluation and periodically throughout treatment (as measured with a goniometer), physical therapy treatment type, start date of physical therapy care, physical therapy cancellations, and date of discharge from physical therapy. Not all charts included all data sets.

All patients were evaluated by the same therapist. All evaluations, treatments, and discharges from therapy occurred between January, 2003 and September, 2004.

Approximate time to onset of lymphatic cording was calculated as the time elapsed between the most recent surgery and the physical therapy evaluation. The term “time to onset” is used loosely in that chart documentation did not include the date of symptom onset, but rather the date the patient first presented to therapy.

Length of care was calculated as the number of days from the evaluation to the last physical therapy visit. In some cases, the discharge summary was completed at a later date than the last visit. In such cases, the last day of physical therapy was used to calculate length of care. In 2 cases the patient died, and in 4 other cases the patient did not schedule a follow up appointment and therefore was discharged. These 6 cases were excluded from Length of Care calculation. One patient was seen twice during the January 2003 to September 2004 timeframe for initial cording, and later for reoccurrence of cording. Length of care was calculated for each course of therapy.

Statistical Analysis
Because of small sample sizes and differences in variance (ie, SD) between groups, we used more conservative nonparametric, compared to parametric techniques for our data analysis. The Mann Whitney statistic was used for between group unpaired comparisons. Bivariate correlations between length of care and cancellation numbers were performed with Spearman Rho correlation coefficients because a lower limit in one variable was observed in many subjects. The Fisher exact test was used to test for differences in proportionality of cancellations. Results are presented as mean ± SD with exact p if significant at p < 0.05.

RESULTS
Cancer Diagnosis and Treatment
Concurrent care
Few charts included the type of breast cancer. Twenty-eight of the 31 charts clearly indicated whether or not the patient was undergoing current treatment of cancer (chemotherapy or radiation) during her course of physical therapy. Forty-three percent (n=12) of the patients were undergoing cancer treatment during their course of physical therapy, while the other 57% (n=16) had completed their cancer treatment at the time of the initial evaluation, or were not receiving chemotherapy or radiation as part of their treatment.

Surgical type
All charts included a description of what type of surgical treatment was received (Table1). One patient was seen twice between January 2003 and September 2004, therefore the total number of surgical procedures done was 30.

Lymphatic Cording
Approximate time to onset
Approximate time to onset was calculated as the time lapsed between the most recent surgery and physical therapy evaluation. Seven charts either listed a season or no date at all. Nineteen patients gave the exact date of surgery while 5 others reported a month and year. If a month and year was given, the last day of that month was used as the 'surgery date' to calculate time to onset. On average 35.9 ± 66.9 weeks elapsed between surgery date and physical therapy evaluation with a range of 14 days to 5.8 years. Seventeen percent of the cases with available data had an approximate time to onset of one year or more.

Two cases included recurrence. In the first chart, only one episode was reviewed because the first onset occurred in 2002. In the second instance, both episodes were reviewed because the patient had 2 occurrences of cording between January, 2003 and September, 2004.

Severity and location
Of the 31 charts reviewed, 30 indicated the severity of the cording. Severity was documented as mild, mild to moder-

| Table 1. |
|-----------------|-----------------|
| Surgical Type   | Number of Subjects |
| lumpectomy alone| 7                |
| lumpectomy followed later by a 2nd lumpectomy | 1 |
| lumpectomy followed by a mastectomy | 4 |
| mastectomy alone | 8                |
| mastectomy followed later by reconstruction | 4 |
| mastectomy with immediate reconstruction | 6 |
ate, moderate, moderate to severe, or severe. This subjective description of the condition took into account pain intensity, loss of range of motion at the shoulder, and reactivity or increase in symptoms during functional activity and gentle stretching. The most common severity of cording was mild (40%) followed by moderate (30%), mild to moderate (13%), and moderate to severe (10%). There were no reports of severe lymphatic cording. Although subjective, all ratings were performed by the same therapist (LW).

Twenty-nine charts indicated the areas of cording involvement. Areas involved included one or more of the following: axilla, medial upper arm, antecubital region, volar forearm, and wrist or posterior/medial hand. Seventeen percent (n=5) of the cases exhibited signs of cording at the axilla alone. Twenty-one (n=6) percent of the cases had no cording at the axilla and instead experienced cording at a more distal site (Figure 1).

### Physical Therapy Intervention

#### Treatment

All patients were treated with therapeutic exercise including stretching of the involved region. Home exercise programs typically included 4 supine exercises involving cane-assisted shoulder flexion, active abduction, horizontal abduction, and a trunk rotational stretch with shoulder abduction. In some instances patients or family members were instructed in soft tissue stretching techniques. Treatment may have also included progressive resistance exercises for the involved extremity, and use of the Airdyne (Schwinn Airdyne Nautilus health & Fitness Group, Louisville, CO) bicycle. The Airdyne bicycle exercises both upper and lower extremities and may have been chosen for its upper extremity range of motion benefits, or for treatment of cancer related fatigue as appropriate. Manual therapy, compressive bandaging, and compression pump (Lymphia Press, Israel) were used as indicated if the patient also had lymphedema or persistent swelling.

![Figure 1. The patient is in the supine position with her right upper extremity in 90° of shoulder flexion. Her left hand is applying distally directed skin stretch over her forearm to reveal lymphatic cording in the antecubital region of her right elbow.](image)

#### Range of motion

Range of motion was reported in degrees of flexion and abduction measured in the supine position. Analysis was completed on all charts that included more than one numeric documentation of range of motion. Data was converted to describe range of motion, such as ‘within normal limits.’ Data was also excluded if the range of motion at the initial evaluation was 170° or more in shoulder flexion and abduction (n=4), as this may be considered a normal amount of motion. Thirteen charts included numeric data for range of motion at evaluation and at least one other time during the first 4 weeks of care. The average improvement for shoulder flexion in the first 4 weeks of care was 39 ± 20° from an average of 111 ± 19° at evaluation. The average improvement for shoulder abduction was 52 ± 21° in the first 4 weeks, with an average of 84 ± 17° at evaluation.

#### Length of care

The first and last days of physical therapy were used to calculate length of care. Six charts were excluded from all length of care calculations because these patients died or were discharged after the patient did not follow up with therapy. Of the remaining 25 charts, reasons for discharge included meeting goals, dramatic improvement (ie, “patient reports 95% improvement in pain”), range of motion being within normal limits or equal to the noninvolved arm, patient had returned to preoperative activities, or patient did not feel she needed to return to therapy.

The average length of physical therapy care was 10.1 ± 9.5 weeks. The charts reviewed were then separated into 2 groups. The first group included all patients who attended physical therapy regularly (n=18). Regular attendance was defined as not missing more than 2 consecutive weeks of therapy due to cancellations. The second group included those patients who missed 2 consecutive weeks due to cancellations (n=7). The average length of care for those who attended physical therapy regularly was 7.3 ± 3.4 weeks, those that cancelled or did not show to therapy for more than 2 weeks averaged 18.0 ± 17.1 weeks. This difference was statistically significant (p = 0.012). There was a positive correlation between those patients who cancelled more frequently and length of physical therapy care (r_s=0.54, p = 0.002) (Figure 2a). Because we were concerned about the influence of an apparent outlier on our correlations we also analyzed our data without the single patient who had 25 cancellations and length of care of 53 weeks. Even without this patient the correlation was still significant (r_s= 0.49, p = 0.007) (Figure 2b).

The average length of care for women who were receiving concurrent cancer treatment and physical therapy averaged 17.0 ± 14.8 weeks of therapy. Those women who had completed their treatment averaged 6.5 ± 3.3 weeks of therapy. This difference was statistically significant (p = 0.009). Patients who presented to therapy more than one year after surgery averaged 3.6 ± 1.04 weeks for physical therapy length of care.

### Physical therapy cancellations

Of patients receiving concurrent cancer treatment (n=12), 8 missed more than 2 weeks of physical therapy due to cancellations. The proportion of those who missed more than 2 weeks of
physical therapy was significantly greater in patients currently undergoing treatment than those patients not receiving concurrent cancer treatment (n = 16), where only one missed more than 2 weeks of therapy due to cancellations (p = 0.001, Fisher exact).

DISCUSSION

Our data suggests that physical therapy promotes resolution of lymphatic cording in less than 3 months in contrast to prior reports.\textsuperscript{2,11} Additionally, our data suggest that that lymphatic cording may be more chronic than has been described.\textsuperscript{2,11}

Cancer Diagnosis and Treatment

Concurrent care

Forty-three percent of the women being seen in therapy were undergoing their cancer treatment at the same time. This high percentage suggests that physical therapists treating this patient population should be familiar with acute cancer treatment side effects and contraindications to therapy. For example, low white blood cell or red blood cell counts may limit the type of activity the patient can tolerate. Likewise radiation treatment and possible burns should be taken into consideration when doing any direct hands on manual therapy.

Concurrent cancer treatment should affect the physical therapists’ prognosis and estimation of length of care. In our study, women receiving concurrent cancer treatment required over 8 more weeks of treatment than those who had completed their cancer regiment prior to physical therapy evaluation and treatment. We cannot conclude that these women should wait until after cancer treatment to start physical therapy. Prospective research is needed to compare subjects receiving concurrent cancer care and physical therapy to those who are undergoing cancer treatment without physical therapy, rather than compare subjects receiving concurrent care to those who have completed their cancer treatment.

Lymphatic Cording

Approximate time to onset

Lymphatic cording has been described in the literature as an early postoperative morbidity, with symptoms developing within the first 8 weeks postoperatively in 95% of the population.\textsuperscript{2,11} The term “time to onset” was used loosely in our study to define the time between the most recent surgery and first physical therapy visit. The average approximate time to onset in our patient population was 35.9 weeks. This substantial difference from what previous studies suggest may in part be due to the delay between when a patient visits her physician and her physical therapy evaluation. Additionally, a patient may only become concerned when the symptoms do not dissipate on their own. Those women who experience resolution of symptoms within 2 months of surgery may be less likely to complain of symptoms or seek out treatment for the problem. As the problem lingers on, a woman may be more likely to mention it to a health care provider. Even with these considerations, the average time to onset seen in our study suggests that lymphatic cording may be more than an acute, self-resolving problem in many cases. Given the 35.9 average time to onset, one can postulate that either the condition did not occur within the first 8 weeks after surgery, or the condition did not resolve in 3 months.

We are not aware of any published cases that describe lymphatic cording as a recurring condition. Two cases in our study involved recurrences. While this is equivalent to only 6% of the reviewed cases, it again suggests that lymphatic cording can be more complex than an acute, self-resolving condition.

Severity and location

The evaluating therapist in this study used a subjective rating of mild to severe to describe the involvement of cording. Our data most commonly documents the condition as mild. While to our knowledge there is no, as yet, validated severity scale for lymphatic cording, our subjective description of the condition took into account pain intensity, loss of range of motion at the shoulder and reactivity or increase in symptoms during functional activity and gentle stretching.

The majority of subjects in this study (79%) had symptoms that were not limited to the axilla. Additionally, many subjects did not have any symptoms at the axilla. Both lymphatic “cording”\textsuperscript{14} and “Axillary Web Syndrome”\textsuperscript{2} have been used in the literature to describe this condition. We propose that the term “lymphatic cording” is a more accurate description of the condition, as compared to “axillary web syndrome” in that the condition is not limited to the axilla, and may occur outside the axilla all together.
Physical Therapy Intervention

Treatment

The physical therapy used in this study included treatment for more than lymphatic cording alone. Because of the retrospective nature of this study, patients may have been treated for tissue tightness, lymphedema, fatigue, and muscle weakness as consequences of cancer treatment, but not related to lymphatic cording. Therefore, it is difficult to differentiate the single best treatment for lymphatic cording. Ideally, future research in this area should include women presenting with lymphatic cording alone, without other conditions.

Range of Motion

The data in this study reveals an average of 84° of abduction at the time of evaluation with an average 52° improvement in shoulder abduction within 4 weeks of physical therapy care. The significance of this number may be questioned because there is no control group for comparison and other literature has not reported how much improvement is made without physical therapy within the first month. Regardless, a 52° increase in shoulder abduction from 84° is functionally significant and would give a person sufficient range of motion to complete most activities of daily living.

Length of care

Both Moskovitz and Leidenius studies suggest that the condition usually is self-resolving within 3 months. The average length of physical therapy care in this study was 10.1 weeks, or 2.5 months. In cases where the patient came to therapy consistently (as defined by not missing more than two weeks due to cancellations) the physical therapy length of care average dropped to less than 2 months (7.3 weeks) and range of motion improved within 4 weeks. Once again, because of the retrospective nature of this study, patients may have been treated for tissue tightness, lymphedema, fatigue, and muscle weakness as consequences of cancer treatment, but not related to lymphatic cording. These other deficits may have increased the required length of care, or underestimate the effects of physical therapy on lymphatic cording alone. The strong positive correlation between frequency of cancellations and physical therapy length of care suggests that physical therapy may have a positive effect on the lymphatic cording resolution or just that the patients who cancelled were sick or still undergoing treatment.

The data used to describe length of care did not include cases in which the patient was discharged due to a lack of follow up. In these cases, the status of the patient and the lymphatic cording is unknown. The remaining data may therefore be skewed because the patients not following up with therapy may have experienced less success with the treatment. On the other hand, patients may not return for therapy if they feel they have made enough progress to manage on their own.

Seventeen percent of the patients with appropriate data presented to therapy more than one year post operatively and were on average treated with a short (3.6 weeks) course of therapy. These patients with ‘late onset’ lymphatic cording must have experienced either an onset over 8 weeks postoperatively, or self-resolution of the condition did not occur in 3 months. The short length of care suggests that physical therapy promoted resolution of the condition.

Physical therapy cancellations

The retrospective nature of this study has allowed for a unique analysis of the patients who cancelled appointments more frequently. In prospective research, a subject who misses more than 2 weeks of interventions is often considered a ‘drop out.’ However, it is crucially important to know why this subject group, who may have overwhelming medical demands, discontinue physical therapy treatments, and what is their functional outcome. In this study, those who missed physical therapy were much more likely to be undergoing concurrent care. Additionally, those who missed therapy more frequently required a longer length of care. Physical therapists should take this into account when developing a plan of care. In future prospective research, survivors who miss intervention should perhaps be considered as a separate subject group, rather than a group that has dropped out of the study.

This study suggests that lymphatic cording can be resolved with skilled physical therapy in less than 3 months. If the patient is not receiving concurrent cancer care, the resolution may occur in a much shorter time span of about 6 weeks or less.

SUMMARY

Lymphatic cording has been described as an acute, self-resolving problem occurring after axillary dissection. Our data suggest that the condition may be more complex with the possibility of a late onset or with lack of resolution in 3 months from surgery.

Those women receiving concurrent cancer care required a longer length of care and cancelled appointments more frequently. As a physical therapist determines the plan of care and prognosis, it may be helpful to consider those who have completed their cancer treatment as a separate patient population to those who are concurrently receiving cancer treatment.

Finally, physical therapy may promote resolution of lymphatic cording on average faster than without physical therapy (as based on prior reports of resolution without treatment). On average, patients gained 52° of abduction from 84° of average abduction at evaluation with 4 weeks of therapy. Prior studies have suggested that treatment does not improve the resolution of the condition and that resolution occurs within 3 months of surgery. The improvement of 52° of abduction in 4 weeks may suggest that therapy can improve resolution. Prospective research is needed to investigate specific physical therapy treatment techniques and their effectiveness in lymphatic cording resolution.

REFERENCES