



Critical Care in Obstetrics:

***An Innovative and Integrated Model for
Learning the Essentials***

The Morbidly Adherent Placenta

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Professor and Chairman

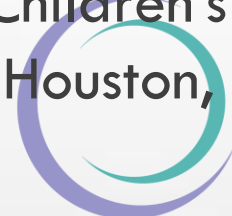
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Society for Maternal • Fetal Medicine

Disclosures



- I am the co-inventor of the Ebb balloon Tamponade system
- I hold stock in Glenveigh Medical which is the licensee of the device
- I will mention an off-label use of this device that has been reported



- Learning Objectives
- Incidence & Causes
- Pre-delivery Diagnosis
- Management
- Summary
- Evidence

Learning objectives



- Discuss incidence and causes of morbidly adherent placenta
- Discuss methods used for diagnosis during pregnancy
- Discuss optimal management: preparation, medical and operative management, and alternative approaches
- Discuss anatomic considerations



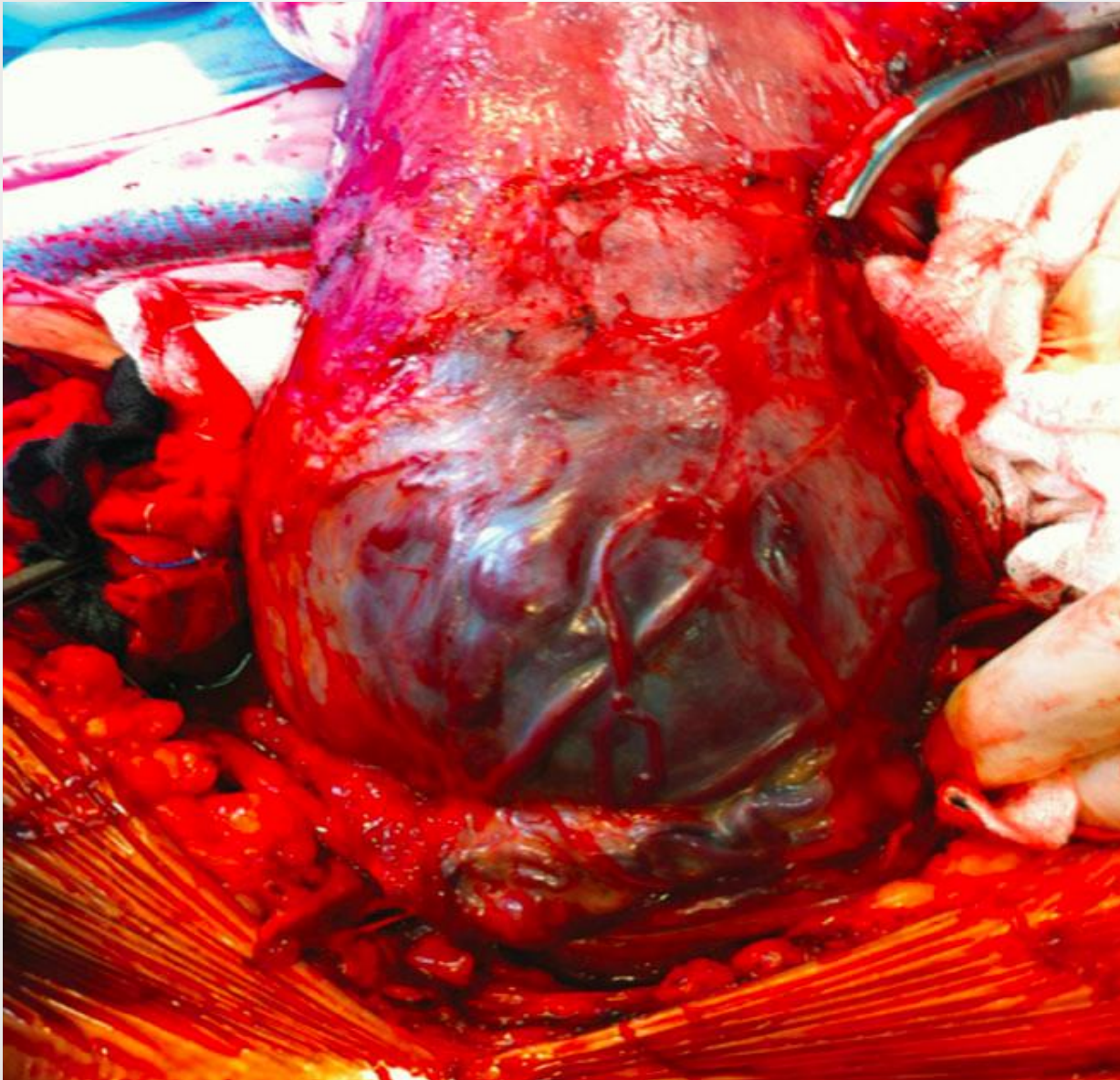
Incidence & Causes

Morbidly Adherent Placenta



accreta, increta & percreta

Morbidly Adherent Placenta

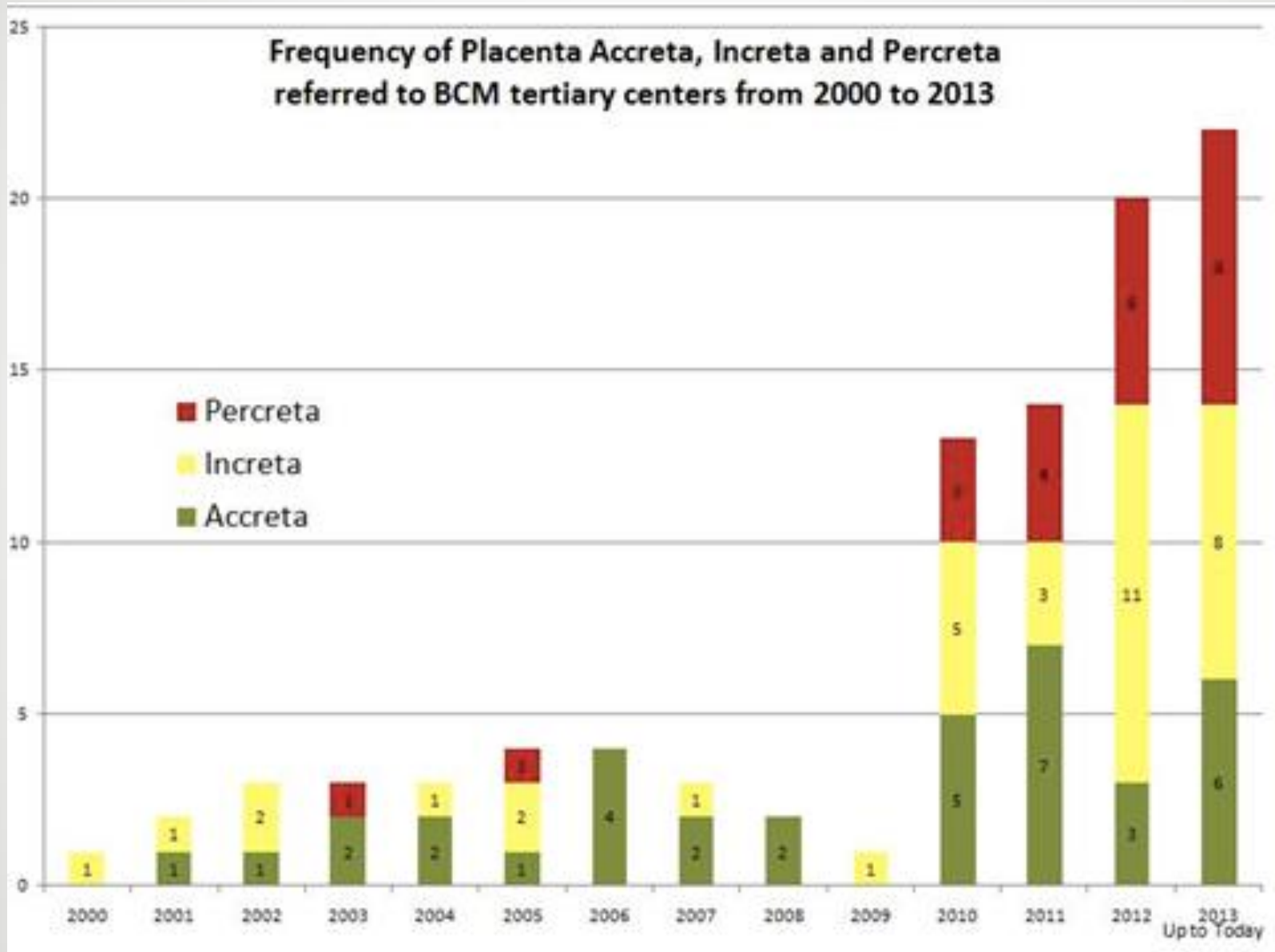


Risk factors



- **Placenta previa – 75%**
- **Prior cesarean section - 66%**
- Prior accreta
- IVF (OR 13.2, $p < 0.0001$)
- Prior uterine surgery/inflammation:
 - myomectomy, manual placental removal, D+C, cornual resection (even endometritis)
- Prior hysteroscopic surgery
- Prior pelvic irradiation
- Rudimentary horn with no connection to uterus

Frequency- Rising!





Risk Factors

- Prior C/S alone is a risk factor

TABLE 5

Factors that are associated with placenta accreta: results from multiple logistic regression analysis with backward elimination

Variable	OR	95% CI	P value
Year of birth	1.06	1.03–1.09	< .001
Maternal age	1.00	0.97–1.03	.79
Recurrent abortions	1.51	0.91–2.50	.11
Second-trimester bleeding	2.15	0.44–10.36	.33
Prior cesarean delivery	5.11	3.42–7.65	< .001
Placenta previa	50.76	35.57–72.45	< .001

CI, confidence interval; *OR*, odds ratio.

Eshkoli. Placenta accreta. Am J Obstet Gynecol 2013.

Consequences



- Profuse hemorrhage (vaginal and/or intra-abdominal)
- Uterine rupture
- Abnormal fetal growth/oligohydramnios
- Maternal death as high as 5%
- Fetal/Neonatal death ~10%



Pre-delivery
Diagnosis



- Morbidly adherent placenta is not diagnosed antenatally in 50% of cases
- Antenatal diagnosis of increta or percreta
 - Reduced levels of hemorrhage
 - Reduced need for transfusion

USN Features Percreta (2008)



- Obliteration of retroplacental hypoechoic “clear space”
- Myometrial thickness < 1 mm
- Vessels bridging placenta/ uterine margina
- **Disruption of hyperchoic placenta/ uterine wall interface (“bladder line”)**
- **Vessels crossing sites of interface disruption (hypervascularity)**

Main discriminators are last 2

USN Features Percreta (2013)



- Thinning/interruption of hyperechoic vesico-uterine “bladder line”
- Turbulent placental lacunae + high velocity flow (>15cm/s)
- Irregular intraplacental vascularization with tortuous confluent vessels across the placental width
- **Loss/irregularity of echolucent uteroplacental “clear space”**
- **Hypervascularity of uterine serosa-bladder wall interface**

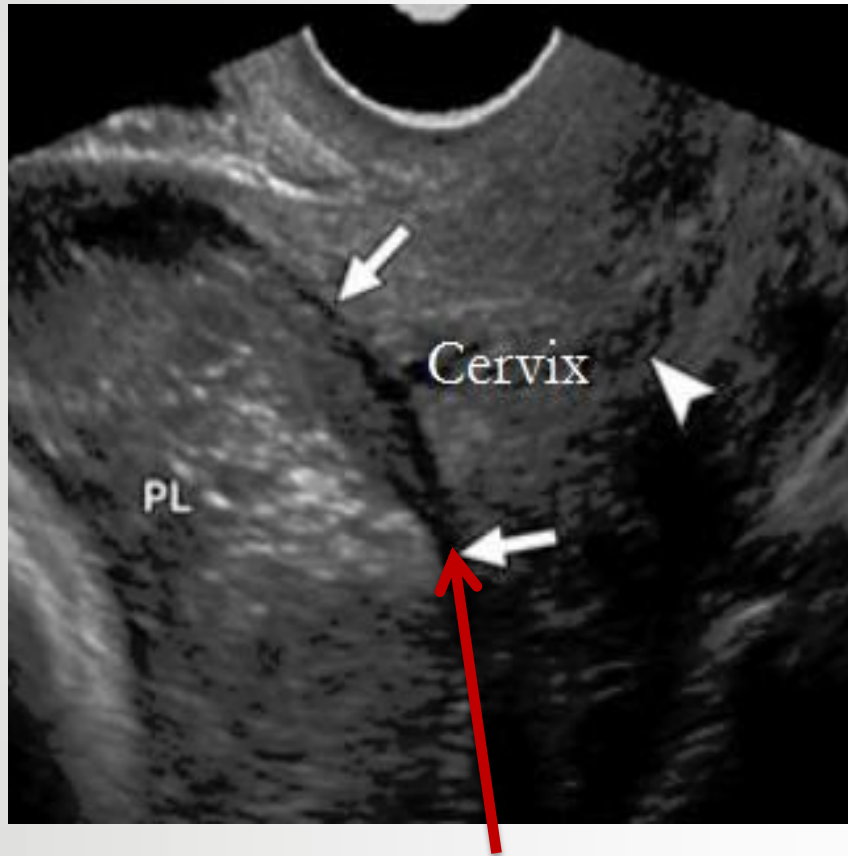
Main discriminators are last 2

NPV of 96.7% and 97%, respectively

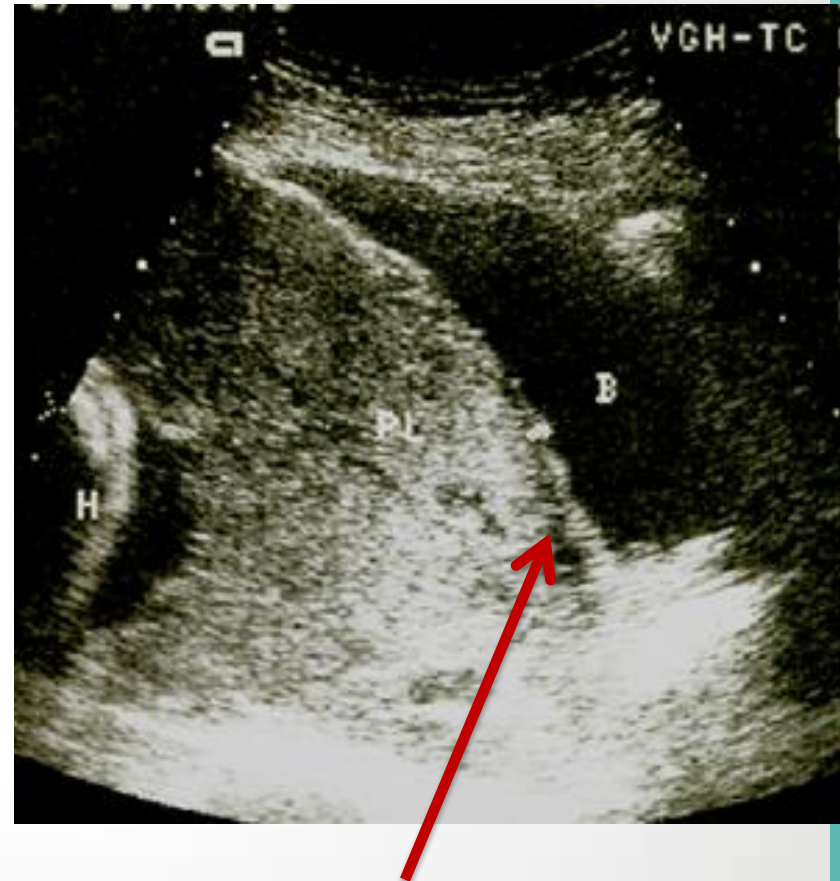


Loss of “clear space”

- Loss/irregularity of echolucent uteroplacental “clear space”



Visible echolucent uteroplacental “clear space”

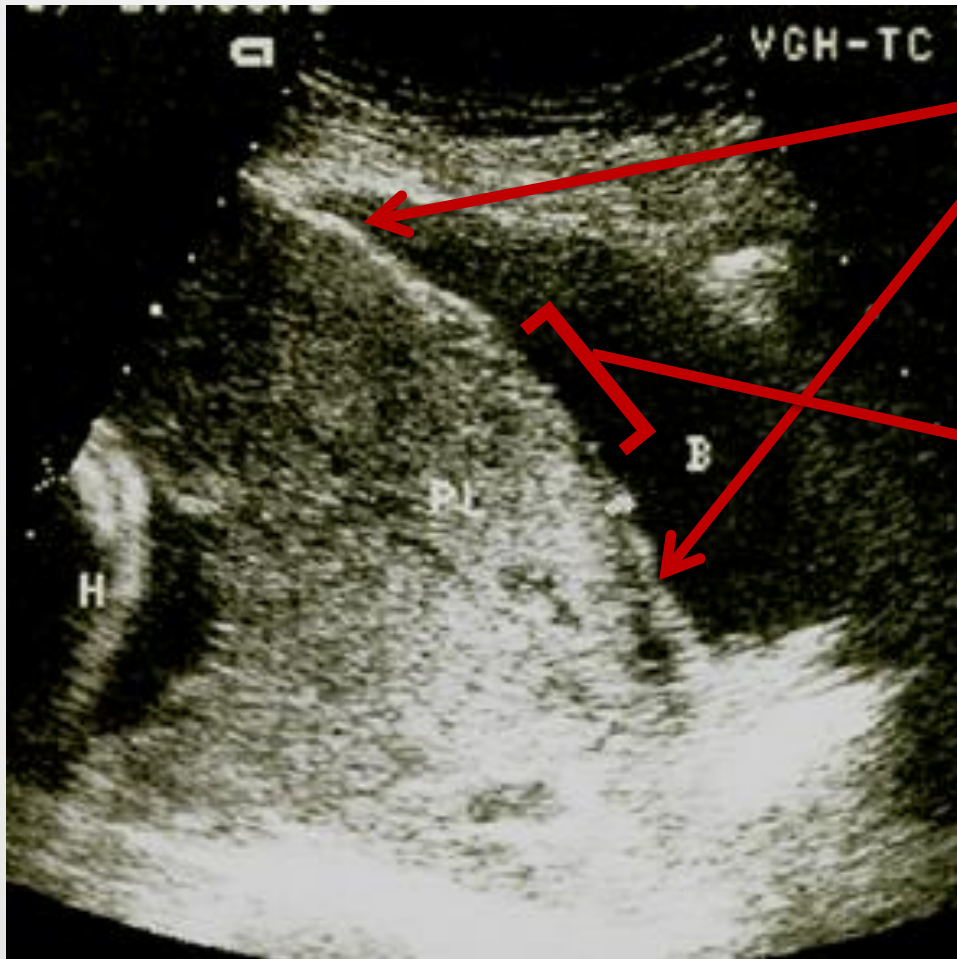


Note **LACK** of echolucent uteroplacental “clear space”



Loss of “bladder line”

- Thinning/interruption of hyperechoic vesico-uterine “bladder line”



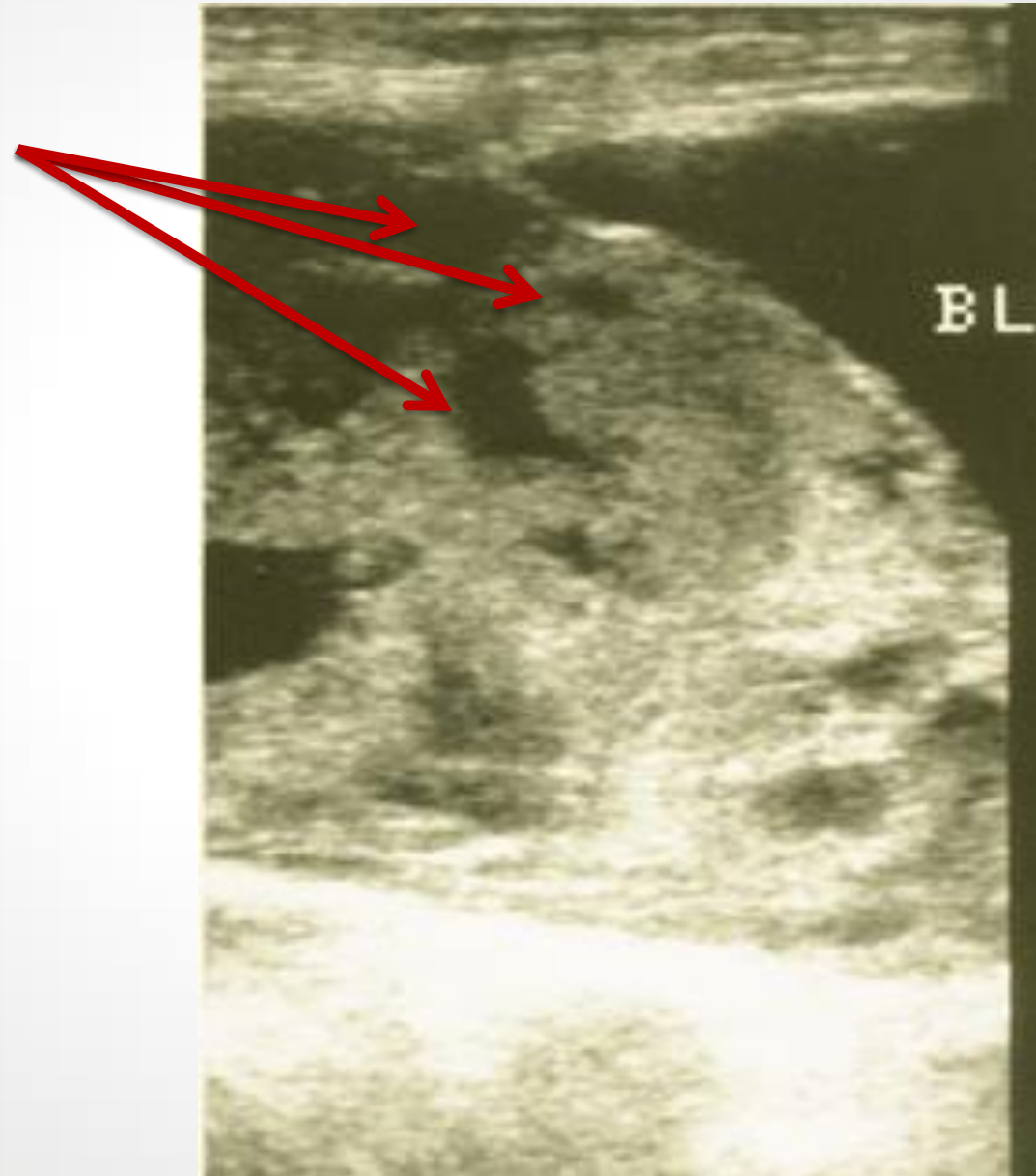
**Visible
“bladder line”**

**Interruption of
bladder line**

USN Features- Lacunae



- Turbulent placental lacunae



USN Features- Doppler

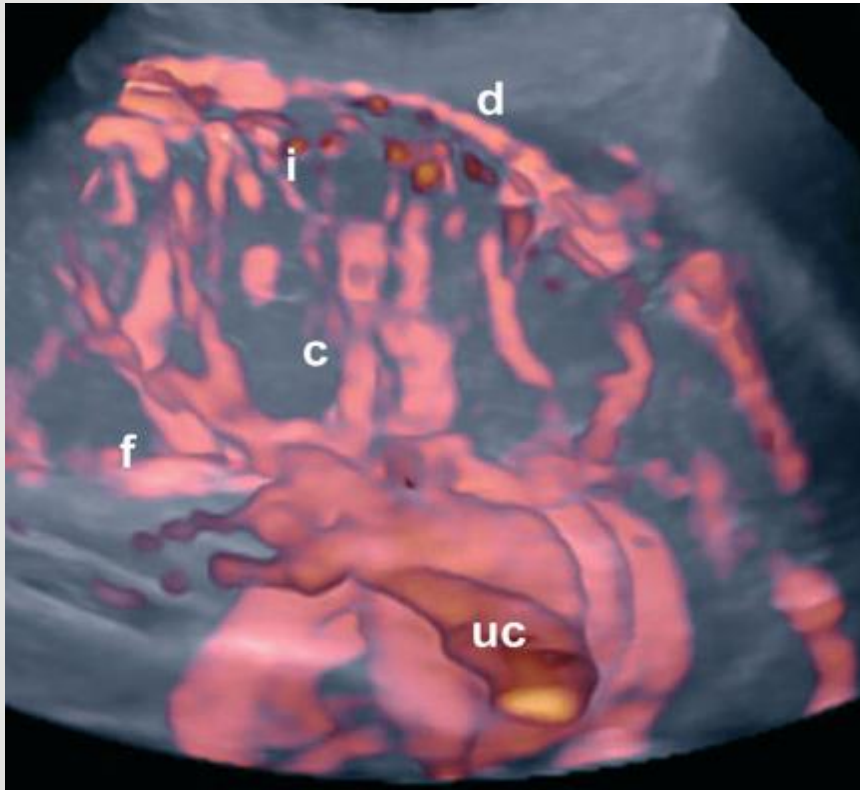


- 3 features best seen by 3D power Doppler
 - Hypervascularity of uterine serosa-bladder wall interface
 - Turbulent placental lacunae + high velocity flow ($>15\text{cm/s}$)
 - Irregular intraplacental vascularization with tortuous confluent vessels across the placental width
- Significant associations with percreta
 - Numerous coherent vessels
 - Sensitivity 97%; Specificity 92%; PPV 76%

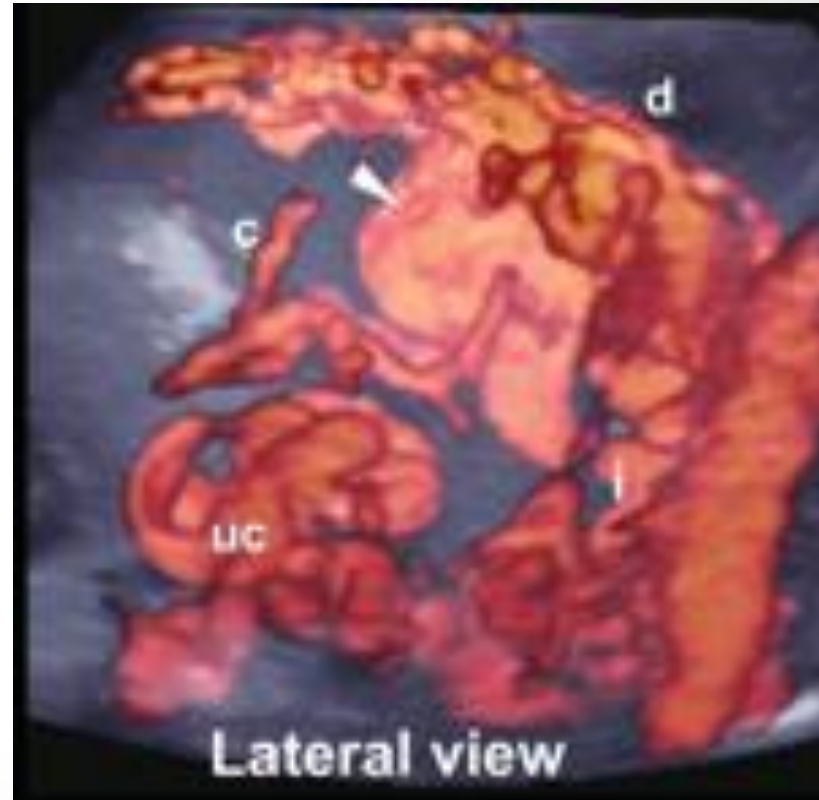
USN Features- Power Doppler



Normal



Percreta





**Management:
Pre-Op**

Multidisciplinary Team



- OR Staff and Blood Bank Staff
- Anesthesia
- Urology
- Vascular Surgery
- GYN Oncology
- Interventional Radiology
- Neonatology / NICU



- Steroids as appropriate
- MgSO₄ for cerebral protection if delivery anticipated <32 weeks
- In-house management?
 - Individualize (depending on bleeding)
- If stable: admit 33 weeks, deliver 34–35 weeks
 - O'Brien (1996): 93% >35 weeks hemorrhaged
 - Warshack (2010): 44% >36 weeks hemorrhaged
 - Robinson (2010): decision analysis, 34 weeks
 - Belfort (2011): 34 -35 weeks (NIH Workshop)

Prepare for Blood Loss



- Vitamins, iron, iron-dextran \pm EPO
 - venofer – 300mg in 250cc NaCl (0.9%) over 2-3hrs IV every other day
 - darbopoeitin 100 μ g after second dose
- Can expect 2g% increase in two weeks
- Preop transfusion if necessary - $<$ 30%
- Factor VIIa availability
 - direct effect on Factor X leading to “thrombin burst”

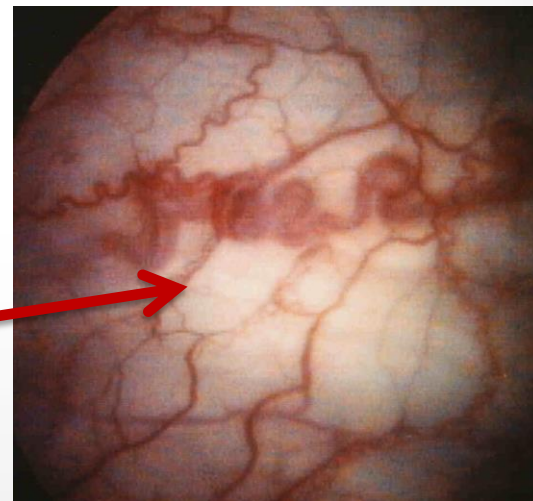


**Management:
Intra-Op
Preparation**

OR Preparation- Maternal Prep



- Adequate IV access, A-line, central line Quad sheath
- General endotracheal anesthesia +/- epidural
- DVT prophylaxis (“plexipulse”) - thigh high
- Shock trauma blood infusers and cell saver
- Control OR & maternal body temperature
- Cystoscopy & ureteral stents (Eller et al, BJOG 2009)



OR Preparation- Blood loss Prep



- Arterial catheters? (balloons not advised, sheath for SAE may be reasonable)
- Auto-transfusion (cell saver)
- Pelvic pressure pack equipment
- Vascular sets and other specialized equipment

Prepare for embolization

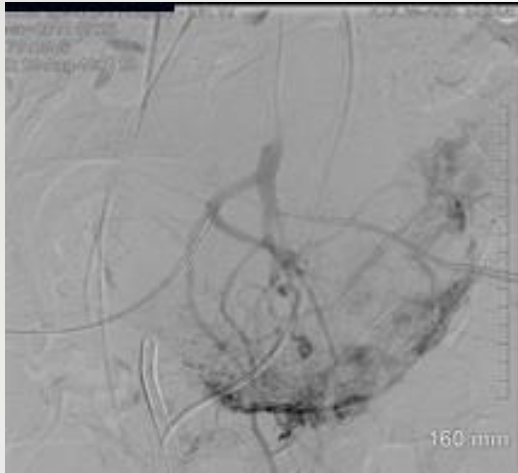


Embolization



- Interventional Radiology & Vascular surgery
 - Necessary part of team
- Discuss equipment needs and positioning requirements
 - C arm, fluoroscopy monitors, infusion and pump devices, etc.
 - Have embolectomy catheters (Fogarty) readily available
- Anticipate, look for and deal with complications of embolization
 - Doppler devices to monitor perfusion
 - Ischemic legs, renal ischemia, bowel infarction

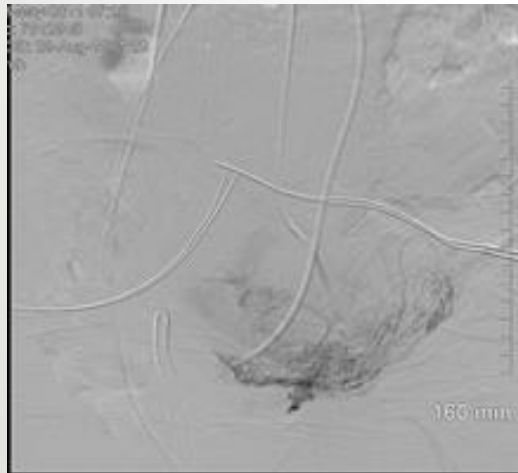
Post delivery embolization



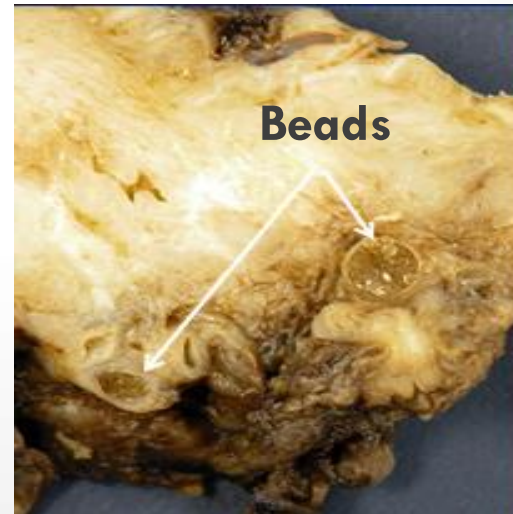
Left hypogastric placental blush



Cessation of flow to placenta



Left uterine artery placental blush



Uterine Artery Balloons



- Controversial
- Retrospective case-control study, 1990- 2011
 - Uterine artery balloons (UAB, n=59) vs. no UAB (n=58)
- Results:
 - Lower EBL with UAB: 2165 vs. 2837 ml ($p = 0.02$)
 - More EBL >2500 ml in no-UAB group
 - More massive transfusion $>6U$ in no-UAB group
 - 2 patients (3.3%) had complications of UAB



**Management:
Operative**

Management: Approaches



- Staged hysterectomy with embolization
- Cesarean hysterectomy without placental removal
- Conservative treatment
 - Cesarean section, close up & wait (preservation of fertility)
- Post-surgery



Staged Hysterectomy

- Femoral artery catheterization → Classic C/S → Uterine/placental embolization → Hysterectomy
- Cohort study of retrospective & prospective data
 - n=26 total, n=8 staged procedures

	Cases N = 8	Controls N = 18	P
Estimated blood loss (ml)	533+/-119	4517+/-711	0.0001
Transfused PRBCs	0.5+/-0.38	7.9+/-1.8	0.001
Need for transfusion	2/8 (25%)	16/18 (89%)	0.001
Intensive care unit	1	7	0.16
Operating time	2.7+/-0.3	2.9+/-0.4	NS
Anesthesia time	6.6+/-0.4	2.7+/-0.3	0.0001
Days in hospital	6.6+/-0.8	8.3+/-0.5	NS



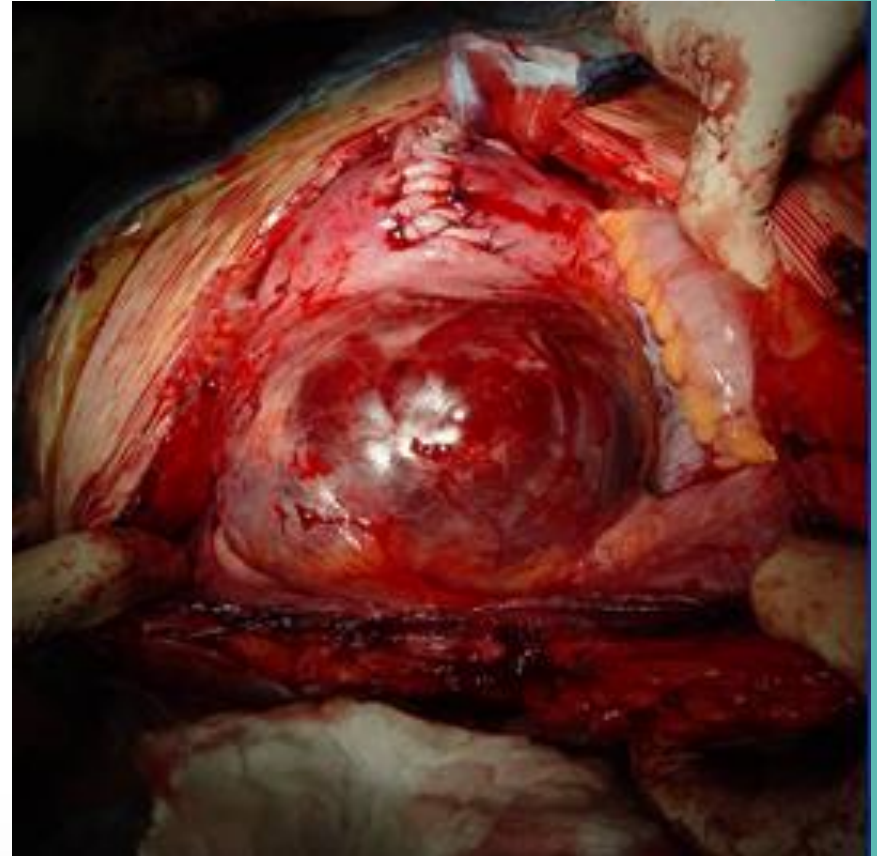
Placental Removal at C/Hyst

- C/Hyst without vs. with attempted placental removal
 - Retrospective review
 - 76 cases, 1996 – 2008
- Less early morbidity without vs with attempted removal
 - 67% vs. 36%, $P = 0.038$
- Less early morbidity with vs. without ureteral stents
 - 18% vs. 55%, $P = 0.02$
- Hypogastric artery ligation did not reduce maternal morbidity

Conservative Treatment



- Leave placenta in situ (partially or totally) in order to preserve fertility
- Retrospective review
 - 1993-2007
 - n=167
 - Conservative tx. successful in 78.4%
- Likely more risky- individualize to patient desires/risks



Conservative Treatment

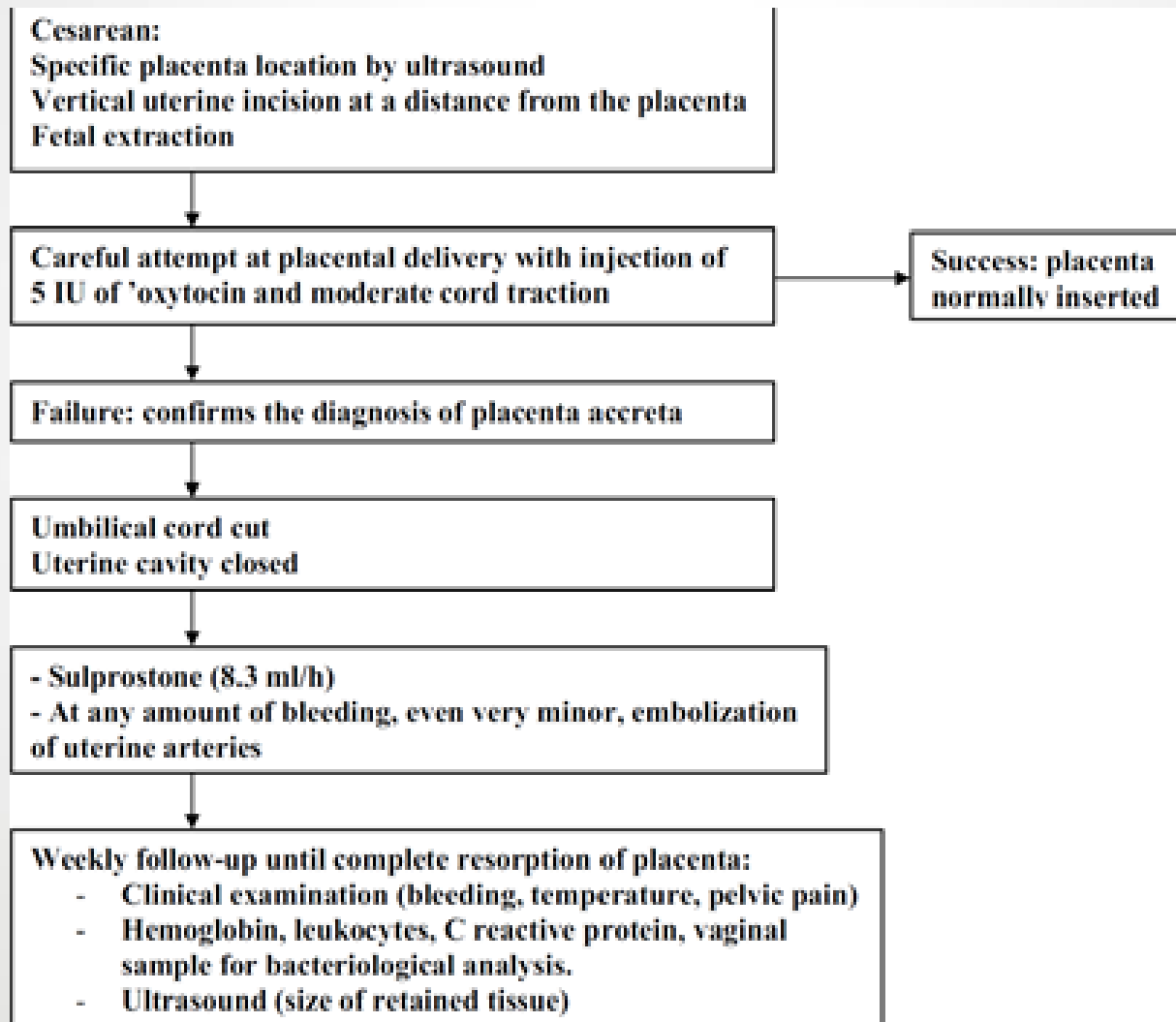


	N= 167
> 5U packed red blood cells	25 (15%)
ICU admission	43 (26%)
Primary hysterectomy/secondary	18 (11%)/18 (11%)
Sepsis	7 (4%)
Pelvic infection	17 (14%)
Severe maternal complication	
Pulmonary oedema/renal failure/venous thrombosis	5 (3%)
Uterine necrosis/vesico uterine fistula	3 (2%)
Death in conservative cases: 1/167	1 [0% IC95 (0-3)]
Death in cases of cesarean hysterectomy: 0/228	0 [0% IC95 (0-2)]

Conservative Treatment



■ Algorithm



Post-Surgery Hemobate



- Carboprost tromethamine
- F₂ α analogue
- 250 micrograms
- Inject directly into myometrium
- Contraindications:
 - Severe CV, hepatic, renal Dz
 - Asthma/airway dz, epilepsy

Post-Surgery- Methotrexate



- Anti-folate metabolite
- Halts rapid cell growth
- Three words: **Don't do it**
 - Toxicity without benefit
- Placental cells
 - No longer dividing rapidly
 - Huge tissue mass



Suggested
Approach

Suggested Approach



- Be prepared!



Suggested Approach

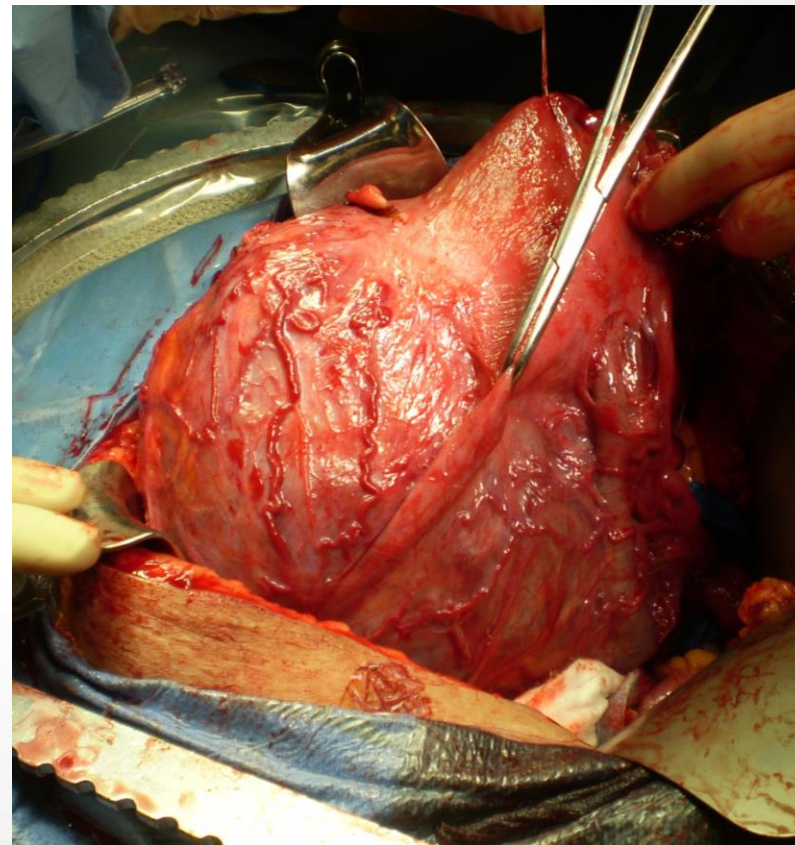


- Anesthesia
 - Regional for stents/cesarean
 - General after baby delivered
- Positioning
 - Modified lithotomy with low legs
 - Allows vaginal access
 - Adequate operative field exposure: midline/paramedian incision
- Cystoscopy & Ureteral Stents prior to start
- Delivery of Baby
 - Exteriorize uterus with baby inside – wide margin from placenta
 - ??posterior approach

Suggested Approach- Hyst



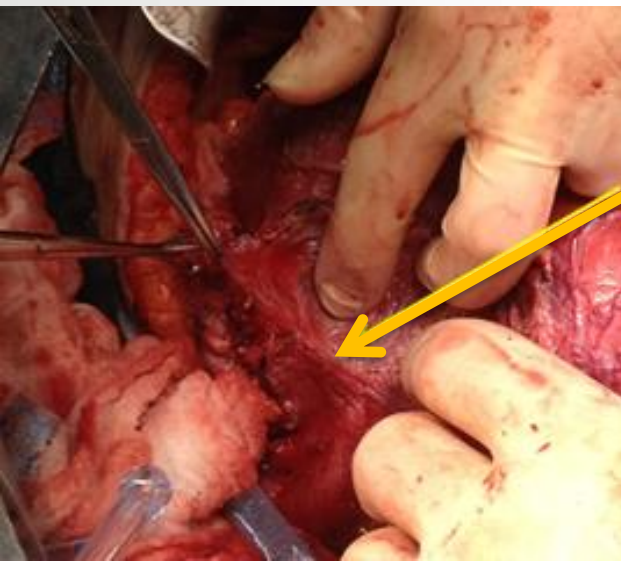
- Leave placenta *in situ* and close hysterotomy
- Modified radical hysterectomy technique – wide margins





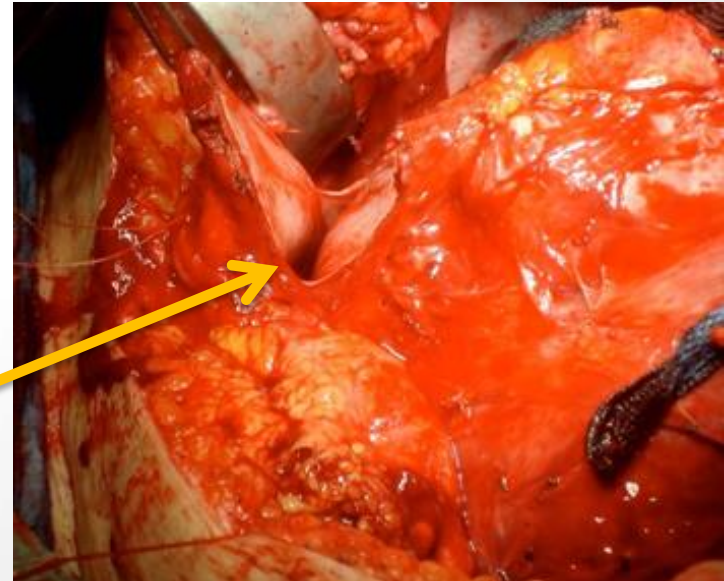
Suggested Approach- Bladder

- Resect bladder invasion rather than extensive dissection
- Control blood supply before dissection from uterus
 - Uterine/iliac/superior vesical & collaterals
 - +/- retroperitoneal dissection
 - If cannot control uterine arteries before dissection try posterior approach - be careful of ureters (stents!!)
- If necessary open bladder & dissect under direct visualization
 - Limits danger of damaging the ureters/trigone
 - leave Foley in for 7 – 10 days



**Adherent
bladder**

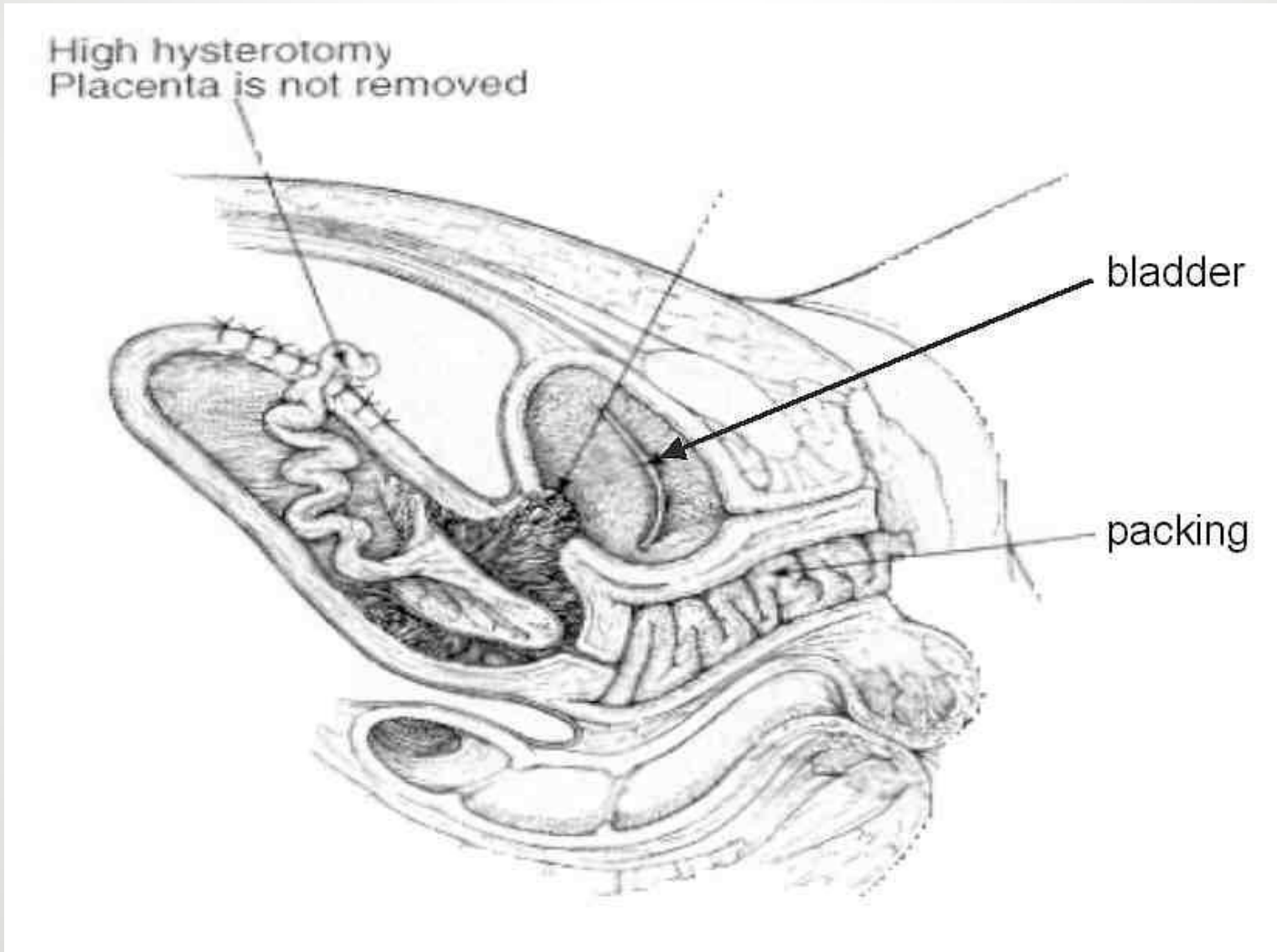
**Deliberate
Cystotomy**



Suggested Approach- Packing



- Pack vagina (Pelosi 1999) or “EEA” device (unpublished)





Summary

Summary

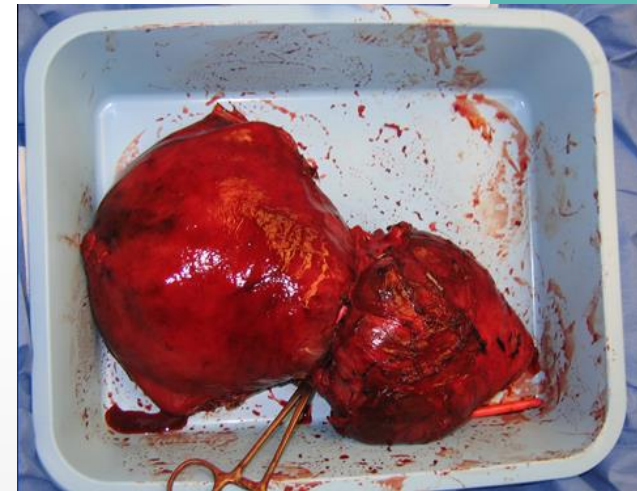


- Morbidly adherent placenta is an increasingly common problem
- Prior cesarean with previa greatest risk
- Pre-delivery diagnosis is important for planning, optimal management
- Optimize patient well-being: anemia rx
- Optimize fetal well-being: MgSO₄, steroids
- Keys: multi-disciplinary team, adjunctive care

Summary- MAP



- Only 50% will be diagnosed before delivery
 - Prior c/s & previa are the biggest risk factors
 - Watch for ultrasound signs
- Delivery between 34-35 weeks
 - No substitute for staff preparation!
- Variety of approaches- suggested:
 - Ureteral stenting, midline incision
 - Uterine incision away from placenta
 - Do not attempt to remove placenta
 - Modified radical hysterectomy





Evidence



Ultrasound diagnosis (Level II-3)

- Wong, J Clin Ultrasound 2008; 36:551-559 (Level II-3)

3D power Doppler diagnosis (Level III)

- Shih et al. Ultrasound Obstet Gynecol. 2009 ;33:193-203 (Level III)

Ex of Evidence



- **U.S. Preventive Services Task Force (USPSTF)**[\[edit\]](#)
- Systems to stratify evidence by quality have been developed, such as this one by the [United States Preventive Services Task Force](#) for ranking evidence about the effectiveness of treatments or screening:^[30]
- Level I: Evidence obtained from at least one properly designed [randomized controlled trial](#).
- Level II-1: Evidence obtained from well-designed controlled trials without [randomization](#).
- Level II-2: Evidence obtained from well-designed [cohort](#) or [case-control](#) analytic studies, preferably from more than one center or research group.
- Level II-3: Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled trials might also be regarded as this type of evidence.
- Level III: Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

Thank You for Your Attention!

Planning Committee

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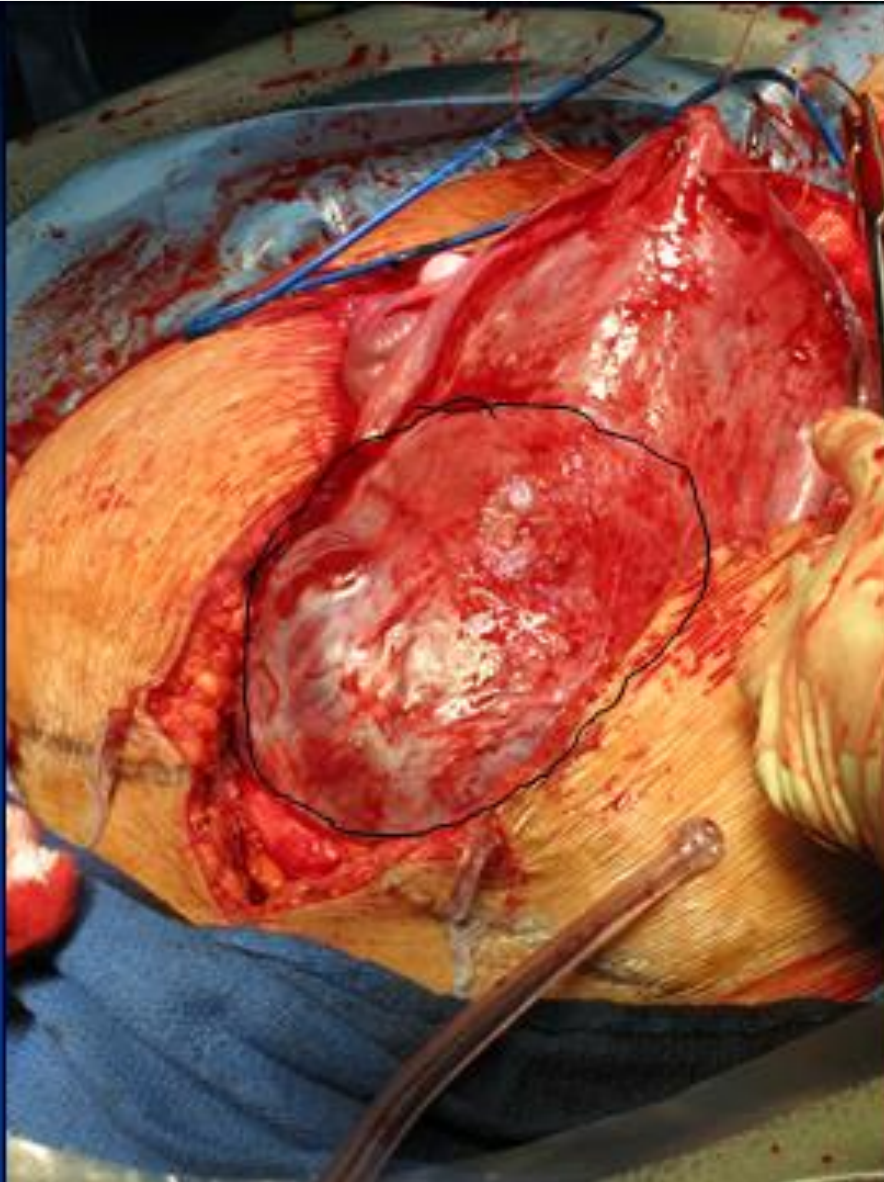


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Additional materials

Morbidly Adherent Placenta



USN Features



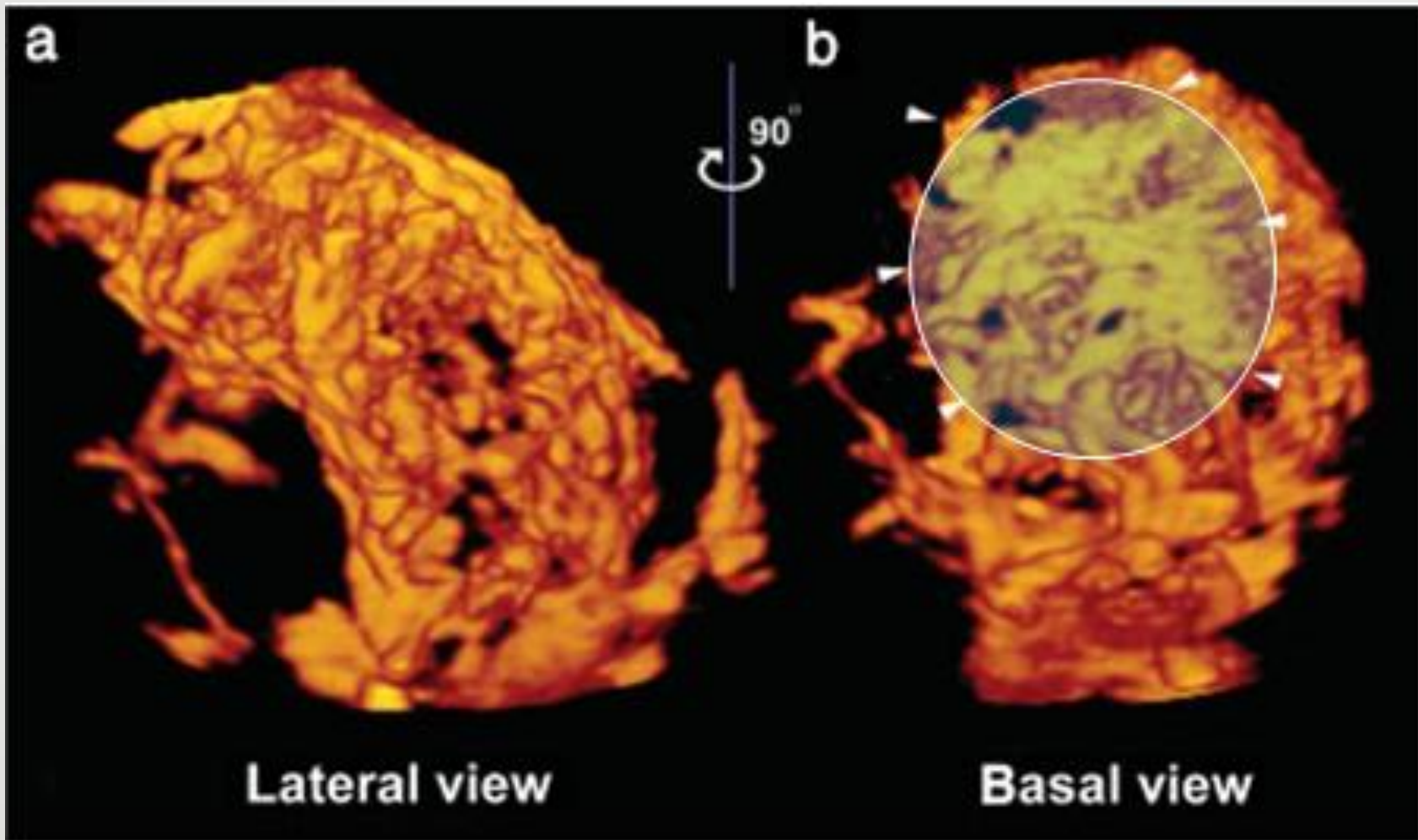
- Please name finding (loss of clear space? No bladder line?)



USN Features



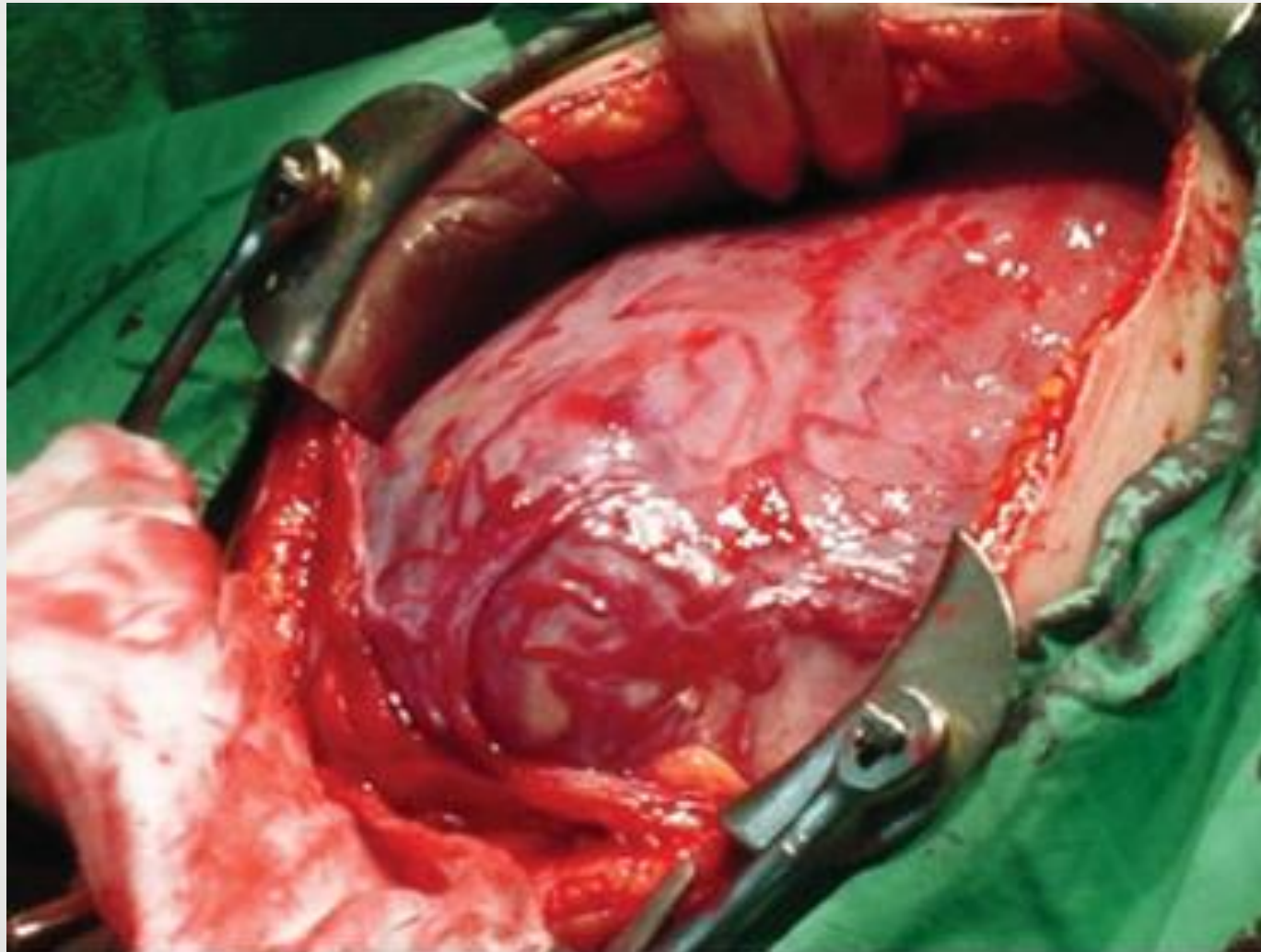
- 3D power color Doppler: percreta



USN Features



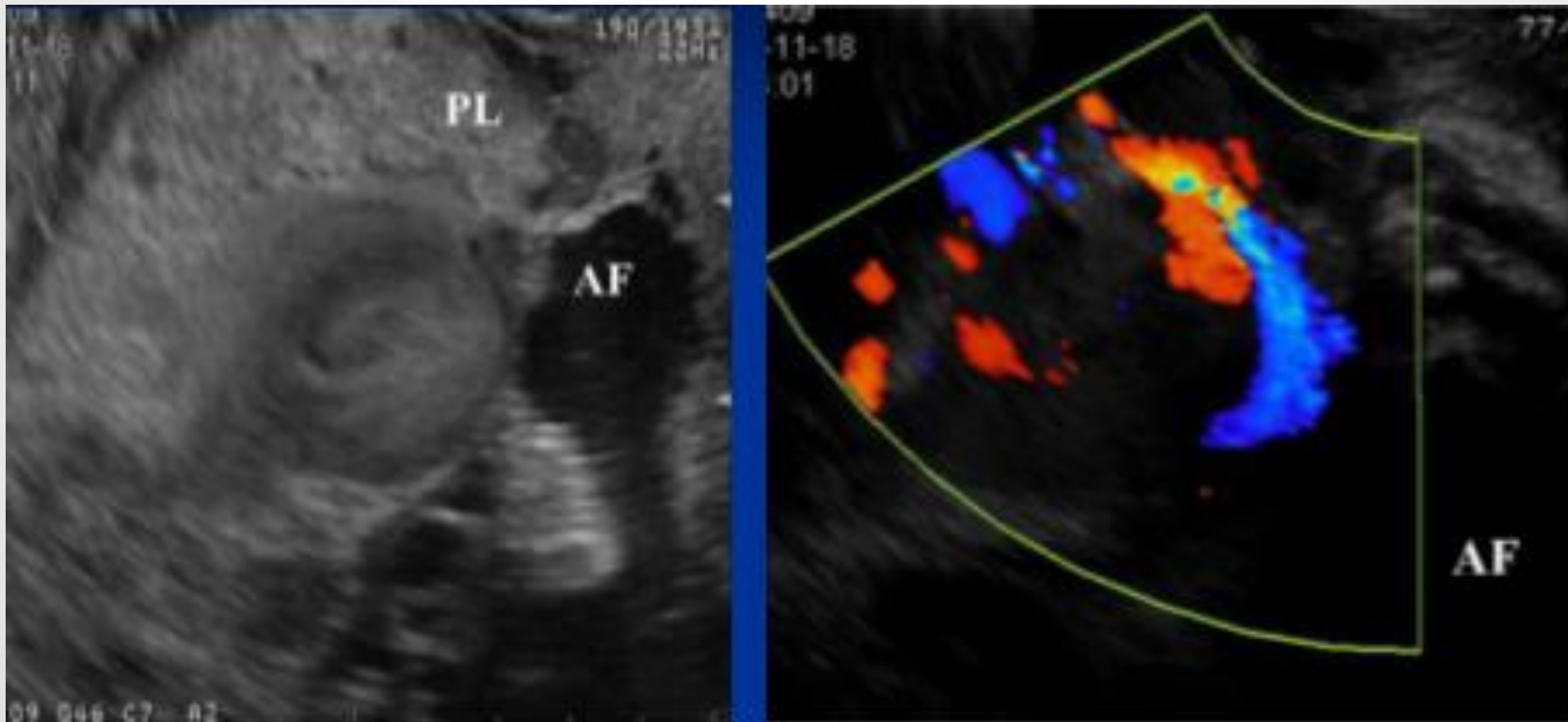
- Gross pathology (same patient): percreta



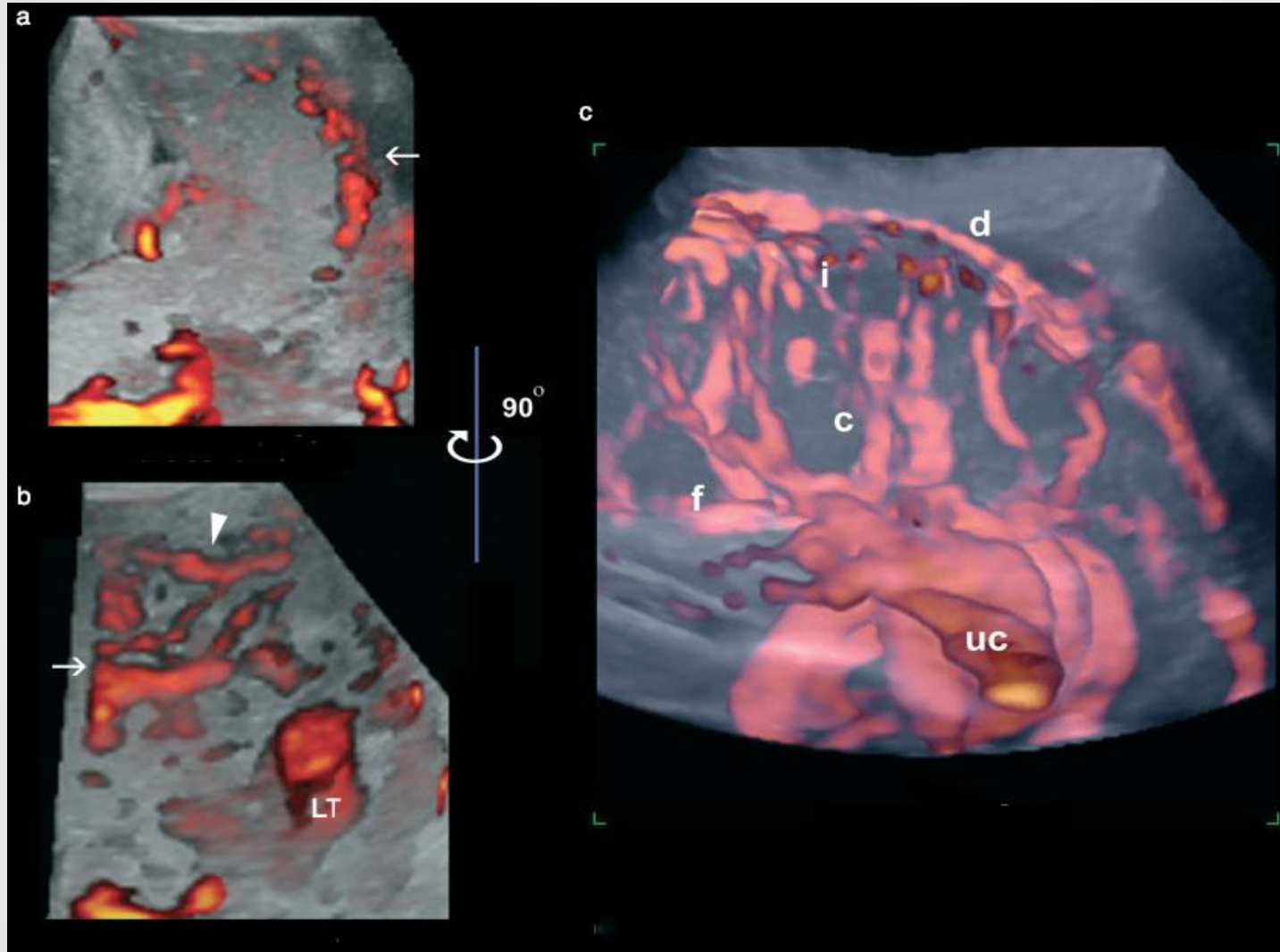
USN Features



- “Eye of the Typhoon”



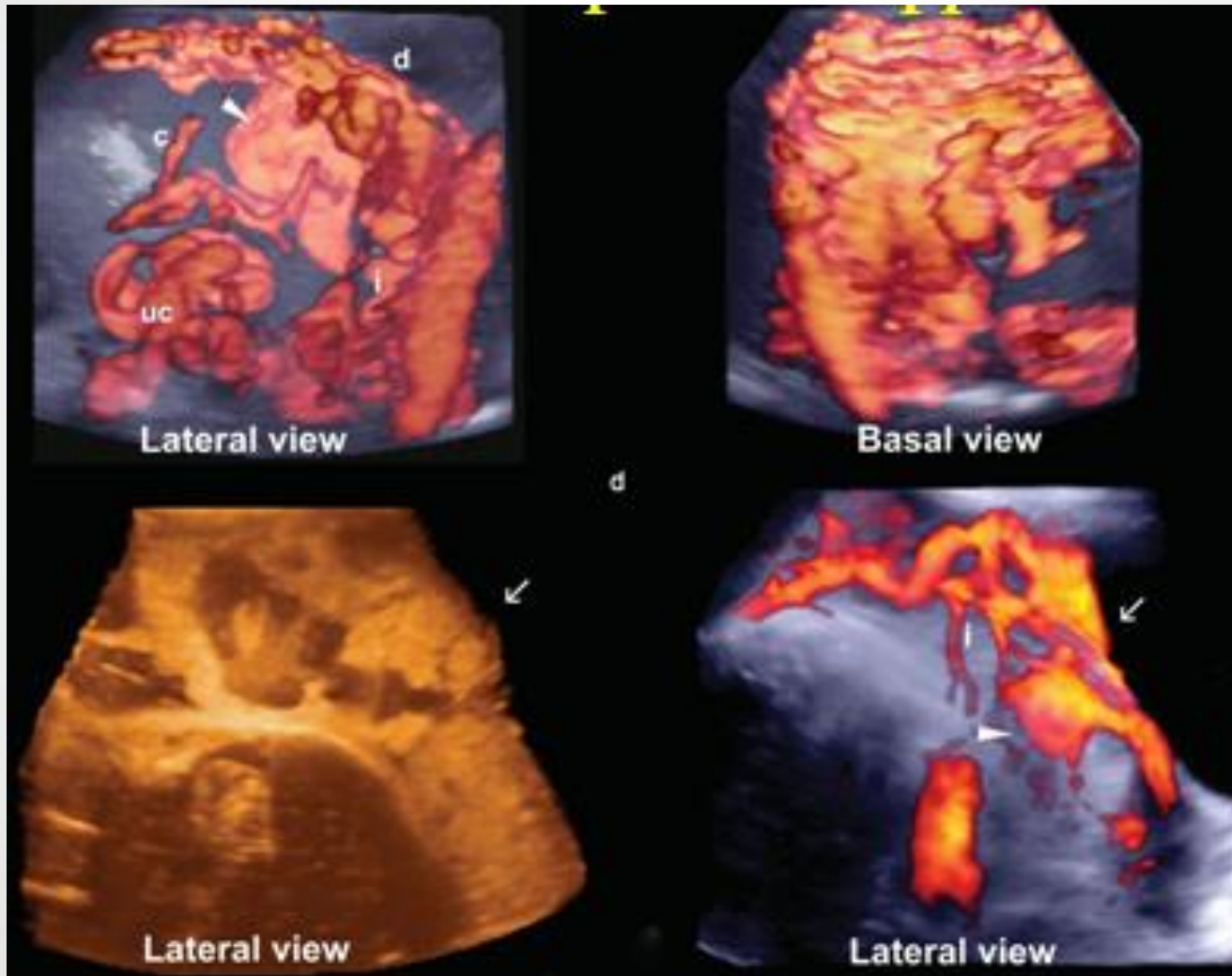
USN Features- Normal Doppler



USN Features- Percreta Doppler



- 3D power color Doppler: percreta



Post-Surgery Hemobate



- Hemabate (Carboprost tromethamine)
 - F₂α analogue
 - 250 micrograms
 - Inject directly into myometrium
 - Contraindications: Severe CV, hepatic, renal Dz
 - Asthma/airway dz, epilepsy

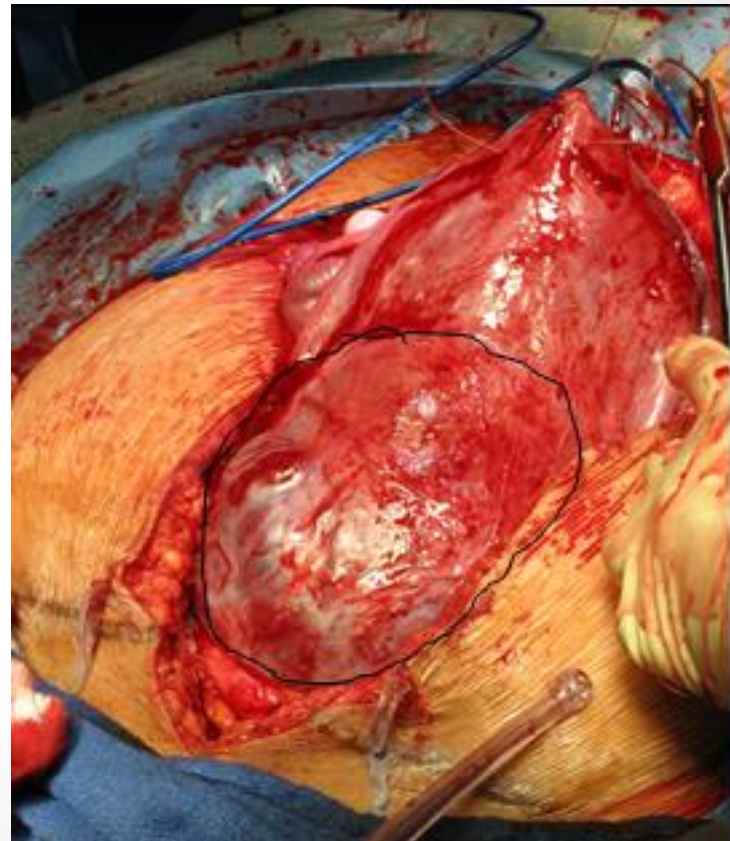


Post-Surgery Hemobate

- Tromethamine salt of the 15 methyl analogue of prostaglandin F2 α
- 250 micrograms (1 ampule) in 20cc sterile saline
- Long 22G spinal needle
- Inject into myometrium (after withdrawing to check for vascular injection)
- Contraindicated:
 - Severe CV, hepatic, renal Dz
 - Asthma, epilepsy



Suggested Approach

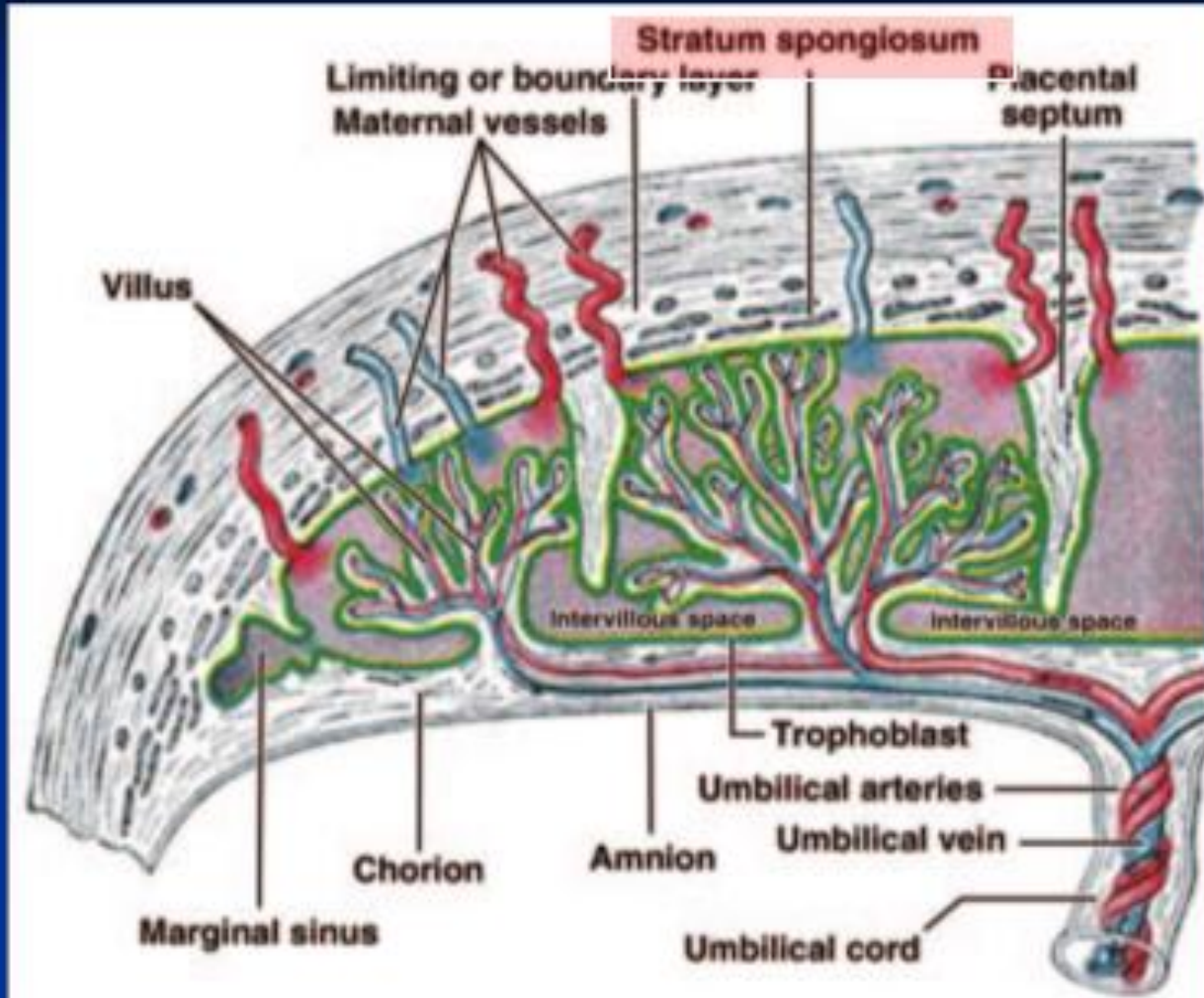


OR Preparation





Retroplacental echolucent Zone





Suggested Approach- Bladder

- If not possible to control the uterine arteries before the bladder dissection
- Try posterior approach - be careful of ureters (stents!!)

Excision of posterior wall of bladder

Finger inside bladder
delineating extent of
invasion

