

UROLOGIC ISSUES IN PREGNANCY

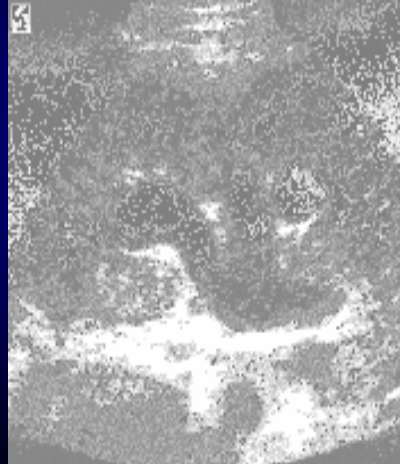
Jennie Mickelson
Grand Rounds
March 2006

OBJECTIVES

- Physiological changes
- Imaging the pregnant patient
- Stones and pregnancy
- Unique case - placenta percreta

CHANGES TO URINARY TRACT - Hydronephrosis

- **PHYSIOLOGICAL HYDRONEPHROSIS** – 90%
- appears 6 – 10 weeks - does not resolve for 4 – 6 weeks post-partum



CHANGES TO URINARY TRACT - Hydronephrosis

- Historically - caused by progesterone
- **compression by uterus** appears to be more significant factor – dilation limited to ureter proximal to pelvic brim
- no significant dilation seen in pts w urinary diversion

Hydronephrosis

- **RIGHT – 86%** more commonly affected than left side
- dextro-rotation of uterus and engorgement of uterine vein
- L ureter is protected from uterine compression by gas-filled sigmoid colon

Physiologic Changes

- **↑ 30 – 50% - in GFR and renal plasma flow**
- normal ranges for serum creatinine and BUN are 25% lower
- Increased renal size

METABOLIC CHANGES

- **↑ Urinary Ca excretion**
 - absorptive hypercalciuria
 - ↑ Serum 1,25 dihydroxyvitamin D
- **↑ Uric acid excretion**
- **↑ Urinary inhibitors**
 - ↑citrate
 - ↑magnesium
 - ↑urine output

UROLITHIASIS IN PREGNANCY

- Incidence 1/1500
- Same as non-pregnant females - despite ↑ Uric acid, Uca
- Most common painful and non-obstetric reason for hospitalization of pregnant pt

DIAGNOSIS

- **1st line - US**
- 47% pts had diagnosis confirmed - Hendricks et al, 1991
- Only 60% US proven diagnosis in 35 women proven to have stones by other modality - Butler et al, 2000
- Sensitivity - 34%
- Specificity - 86% - Stothers et al, 1992

Improving the diagnosis with US: RI, ureteral jets, vag US

- Renovascular resistance increases in acute obstruction (6-48hrs)
- Neither pregnancy nor physiologic hydro alters RI
- In pregnant pt - change in RI had 95% sensitivity, 100% specificity and 99% accuracy in diagnosing acute obstruction

Shokeir et al, 2000

Ureteral Jets

- Doppler U/S may increase the accuracy with showing the level of obstruction compared to iliac vessels -MacNeily and Goldenberg JuroI 1991
- Absence of ureteral jet is suspicious of obstruction- should be confirmed with pt in contralateral decubitus position - Wachsberg, 1998

Vaginal US

- Used for the elusive stone
- Better visualization of distal ureter
- 100% (13/13) of stones visualized in distal ureter with transvaginal ultrasound- Laing et al, 1992.

Radiology Reminder

- 1 cGy = 1 rad 1mGy = 0.1 rad
- fetus absorbs approximately 40% of the dose delivered to the mother's abdomen

Fetal Radiation Exposure

- KUB (plain film) - 0.14 cGy
- Limited-IVP - 0.17 cGy
- Pelvic CT - 2.5 cGy

National Radiological Protection board Biyani et al BJU, 2002

Radiation and the fetus

1st trimester - most susceptible to teratogenic effects

- incidence of congenital anomalies doubles at 25-80 cGy - Swartz and Reichling
- Termination addressed with exposures >5 - 10 cGy
- 10cGy - risk of malformation 5% - Swanson et al. Surg Clinic N A, 1995

Radiation exposure

- "[Fetal] risk is considered to be negligible at **5 rad or less** when compared to the other risks of pregnancy, and the risk of malformations is significantly increased above control levels only at doses above 15 rad."

National Council on Radiation Protection⁵

Radiation Exposure

- For conception age of >15 weeks, there is a small but measurable increase in childhood leukemia and other cancers even for **exposures of 1 cGy (1 rad) in utero**

Fielding et al, Journal of Womens Imaging, 2005.

Radiation exposure to fetus

- **low-dose** exams - expose the fetus to <1 mGy (0.1 rad)-plain films extremities and chest
- **Moderate dose** exams - expose the fetus to 1 cGy (1 rad) or less - plain films of the abdomen and lumbar spine, CT of the chest, and most nuclear medicine exams
- **High-dose** exams expose the fetus to >1 cGy (1 rad) include CT, fluoroscopy, and most interventional procedures.

Fielding et al, Journal of Women's Imaging, 2005

CONTROVERSY

- 5 versus 1 rad?
- BOTTOM LINE - CT STILL EXPOSES FETUS TO >1 RAD - TOO MUCH
- **US IS FIRST LINE**

QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.

SAFE APPROACH

- US
- LIMITED IVP
- CT dosage is too high
- Consider MRI

Fetal Radiation Exposure

- KUB (plain film) - 0.14 cGy
- IVP - 0.17 cGy
- Pelvic CT - 2.5 cGy

National Radiological Protection board Biyani et al BJU, 2002

IVP

- **Gold standard**
- **0.17 cGy or 0.17 rad**
- Limited IVP - visualized stones in 16/17 pts (3 film study - scout, 30 sec, 20 min)
- using an abdo shield on contralateral side with pt prone - Stothers et al. J Urol, 1992

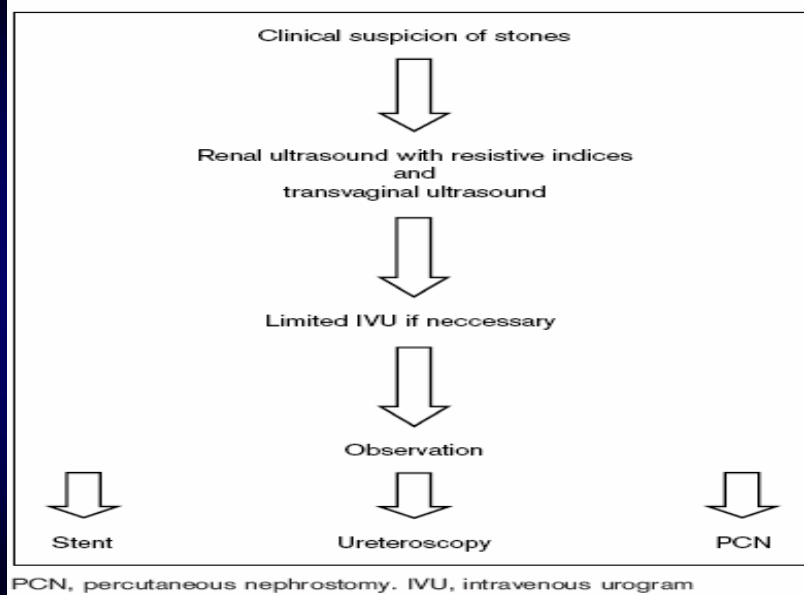
MRI - T2

- Radiation free
- Increasing use
- Drawback - stones are seen as signal voids in high signal urine - makes small stones difficult to see
- Small stones visualized with high-intensity T2 weighted images - Spencer et al, J U 2004

Treatment of Urolithiasis

- CONSERVATIVE - 70-80% of pts will pass stone - Loughlin et al. Urol Clin NA, 2002.
- Treatment options:
 - - percutaneous nephrostomy
 - - stent
 - - ureteroscopy

Figure 1. Suggested schema for stone management during pregnancy



McAleer, Loughlin, Curr Opin Urol, 2004

Percutaneous Nephrostomy

- **PRO:**
 - Useful for pts presenting with fever and pyelo
 - Avoids retrograde instrumentation
- **CON:**
 - Tube dislodgement
 - Bleeding
 - Discomfort
 - Need for external appliance
 - Increased incidence of secondary infection

•Kroovand, J Urol, 1992

INTERNAL STENTS

- **PRO:**
- Can be placed under local anaesthesia under US guidance
- Use of cone tip catheter can aid guidewire passage
- **CON:**
- **Encrustation** - stents need to be changed every 4-8 wks
- Pain
- Hematuria
- Ascending infections

Jarrad, J of Urol, 1993

URETEROSCOPY

- **PRO:**
- Direct visualization of stone
- Definitive treatment
- Avoid stent complications
- Shorter hospital stay than with stent/PCN
- **CON:**
- General anaesthesia risk
- Use of fluoroscopy
- Ureteral injury/perforation
- Induction of labour

Ulvik et al, J Urol, 1995

Table 2. Results of ureteroscopy in pregnant females with ureteral calculi

Study	No.	Reporters	Success rate	Complications
Boyer (18)	1	7-10 (60% success) United Kingdom	100%	None
Yok (19)	2	17 (100% success) United Kingdom	100%	None
Chen (20)	1	10 (100% success) Taiwan	100%	None
Yok (21)	12	14 (100% success) Neurosurgeon, abdominal	100%	None (2) Uterine perforation (2) Premature contractions (2)
Sharma (22)	12	14 (100% success) United Kingdom, obstetric team, G-20 lithotripsy	100%	None
Chakraborty (23)	4	17 (100% success) Taiwan	100%	None
Shah (24)	14	13 (100% success) United Kingdom, obstetric	100%	UTI (2)

UTI, urinary tract infection; none seen in others.

Evans, Wollin, J Endourol, 2002

Ureteroscopy and holmium:YAG laser lithotripsy: an emerging definitive management strategy for symptomatic ureteral calculi in pregnancy

- Abstract
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Watterson et al 2002

- 8 pts / 10 stones
- Avg gestational age - 22 wks
- 6 distal, 1 mid and 3 prox stone - avrg size - 8.1 mm
- Procedure success rate - 90%
- Conclusion: definitive management for failure of conservative treatment

Pt. No.	Presentation	Gestational Age (wk)	Outcome
1	Bilateral ureteral calculi	10	Residual lower pole stone on US POD 2
2a	Distal ureteral calculus	34	Stone free
2b	Encrusted stent + mid/ureteral calculus	30	Stent removed; stone free
3	Distal ureteral calculus	21	Stone free
4	Distal ureteral calculus	23	Stone free
5	Proximal ureteral calculus	22	Stone free
6	Proximal ureteral calculus	25	Stone free
7	Encrusted stent + proximal ureteral calculus	35	Stent removed; stone treated by postpartum SWL
8	Distal ureteral calculus	21	Stone free

Key: Pt. No. = patient number; US = ultrasonography; POD = postoperative day; SWL = shock wave lithotripsy

REASONS TO CONSIDER URETEROSCOPY

- Ureteroscopy can be performed under local and avoid general anaesthetic
- Fluoro not always necessary - capacious ureter makes navigation easier
- Successful treatment of ureteral perforation with stent and term delivery of normal infant has been reported - Ulvik et al, J Urol 1995

CONTRAINDICATIONS TO URETEROSCOPY

- 1) stone burden (>1cm)
- 2) multiple calculi
- 3) transplanted kidney
- 4) sepsis

Biyani, Joyce, Br J Urol, 2002

ESWL and PCNL

- ESWL - associated with IUGR - contraindicated - Smith et al, J Urol, 1992
- PCNL - need for significant fluoro time contraindicates its use

PLACENTA PERCRETA

- 32 y/o G4P2 - 1 prior c-section
- 25 weeks - placenta percreta seen on US
- Cysto - 30 weeks - no invasion into bladder
- MRI - invasion into bladder
- Planned elective section at 36 weeks - hysterectomy

PLACENTA PERCRETA

- PLACENTRA ACCRETA: placenta invades the muscular wall of the uterus
- PLACENTA INCRETA: placental cotyledons become intertwined with the muscular stroma of the uterus
- PLACENTA PERCRETA: trophoblastic tissue penetrates the serosa of the uterus and may extend directly to adjacent structures including the bladder

Placenta Accreta

Definition

- AbN attachment of placenta to uterus

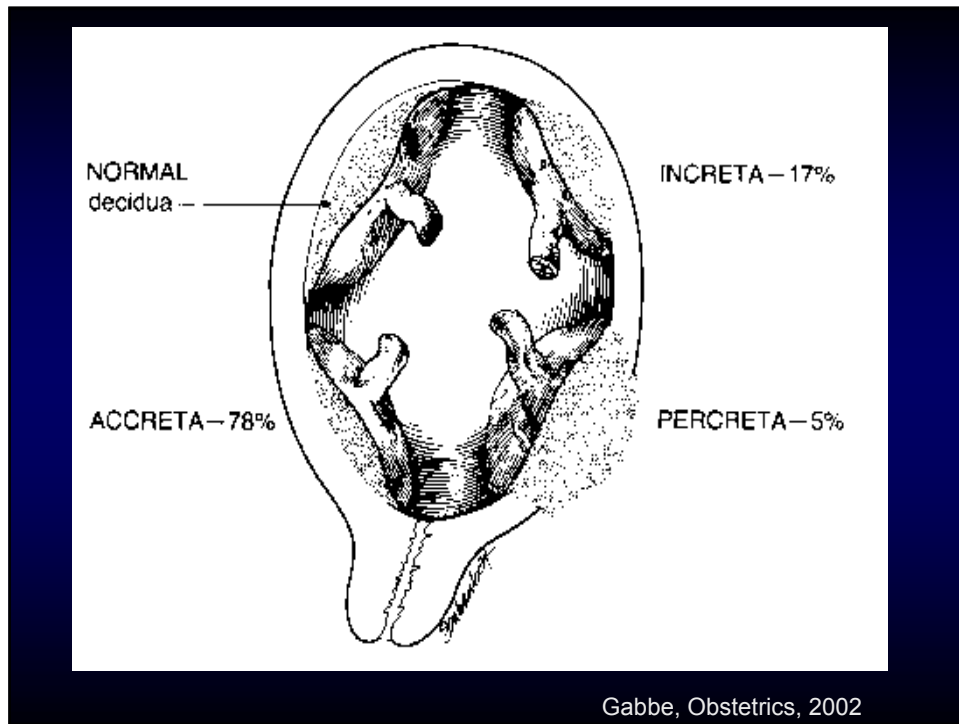
Cause

- Decidua basalis deficiency

Incidence 1/540-1/93,000

Types

- *Accreta* –contact myometrium (80%)
- *Increta* –invade into myometrium (15%)
- *Percreta* – invade into or through serosa (5%)



Placenta Accreta

Associations?

- C/S, previa
 - Multiparity, ↑age, prior D&C
- High risk patients (%risk)

–Previa	10% risk
–Previa + C/S	25% risk
–Previa + 4 C/S	67% risk

RISKS ASSOCIATED WITH PLACENTA PERCRETA

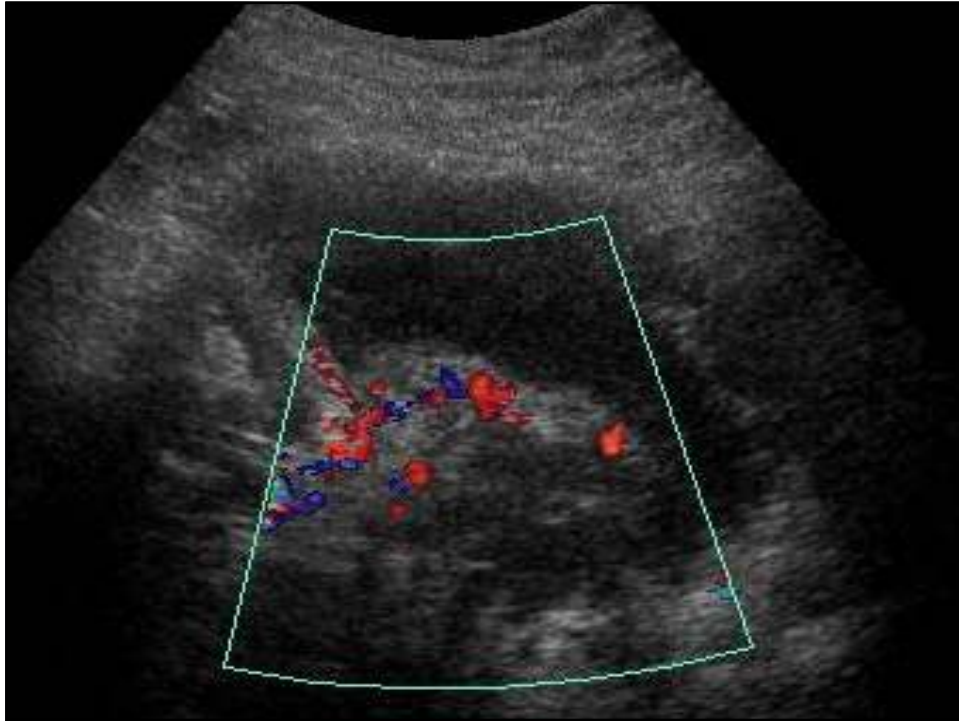
- HEMORRHAGE!
- Despite diagnosis with MRI, US prior to OR -
- intraoperative blood loss remains high
- >20 units

• AUAUS 2005

DIAGNOSIS

- History - any hematuria during pregnancy (with history of c-section) should be presumed percreta
- Pre-delivery US or MRI can show invasion of placenta into bladder
- Cystoscopy: “blackberry under the mucosa” or invading through mucosa

UCNA AUG 2002



Placenta Accreta MRI Findings

ACCRETA

- myometrium focally thinned and indistinct

PERCRETA

- Uterine wall focally obliterated
- Tissue isointense to placenta traverses uterine wall

Placenta Accreta MRI Guidelines

Gadolinium not justified

Indications

Ultrasound nonDx

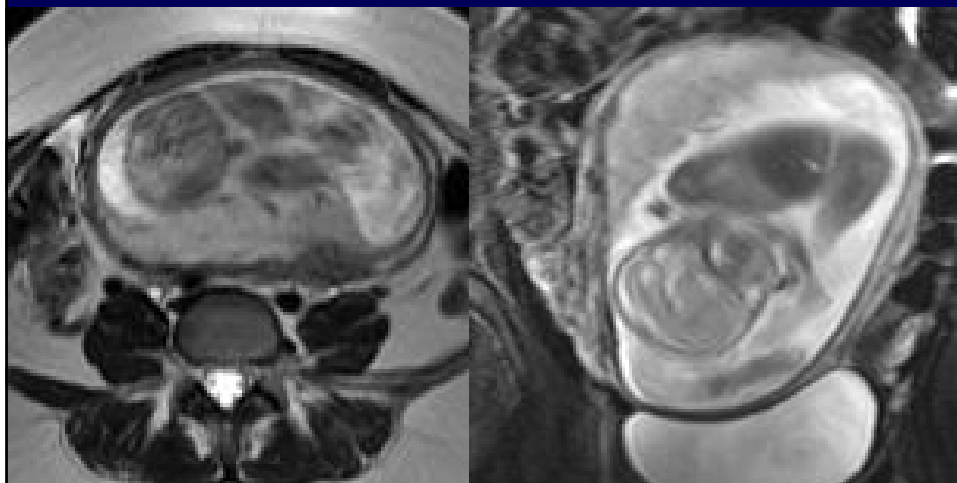
Cases of increta/percreta

topology

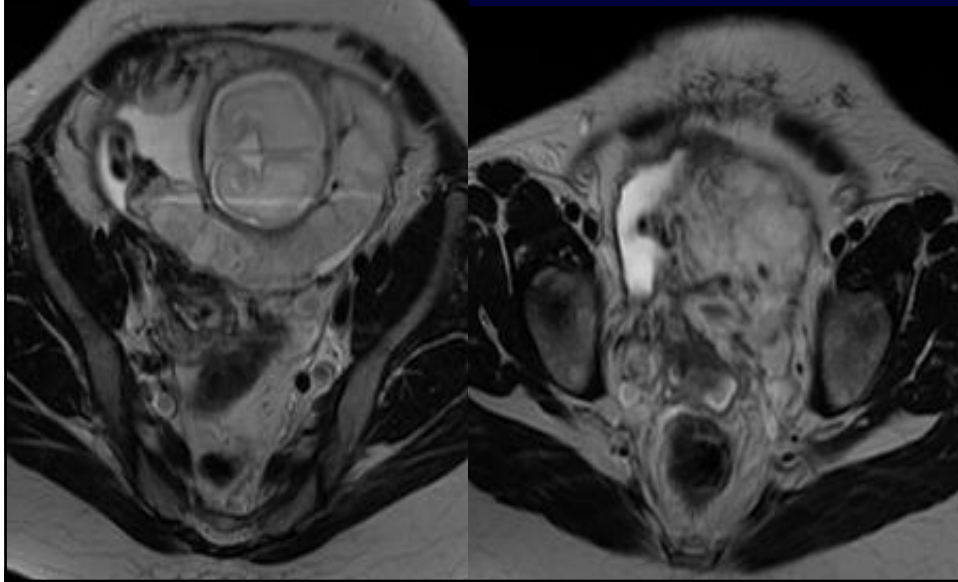
%penetration

↑confidence

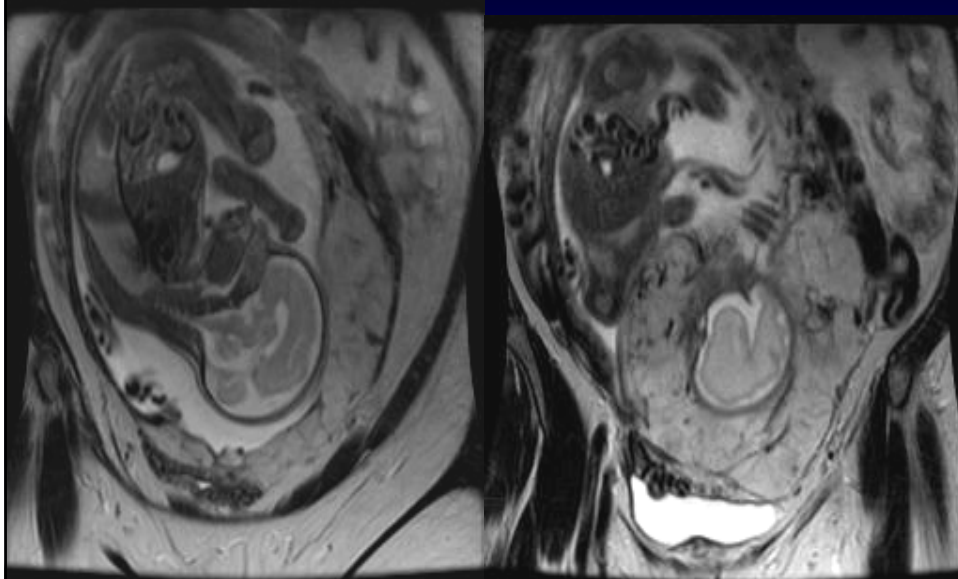
Normal Placenta MRI



Placenta percreta
MRI



Placenta percreta
MRI



Placenta Accreta Interventional Radiology

Pre-op Balloon placement

- Internal iliac arteries
- Anterior divisions

Embolization

- Hemostasis control
- Uterine salvage

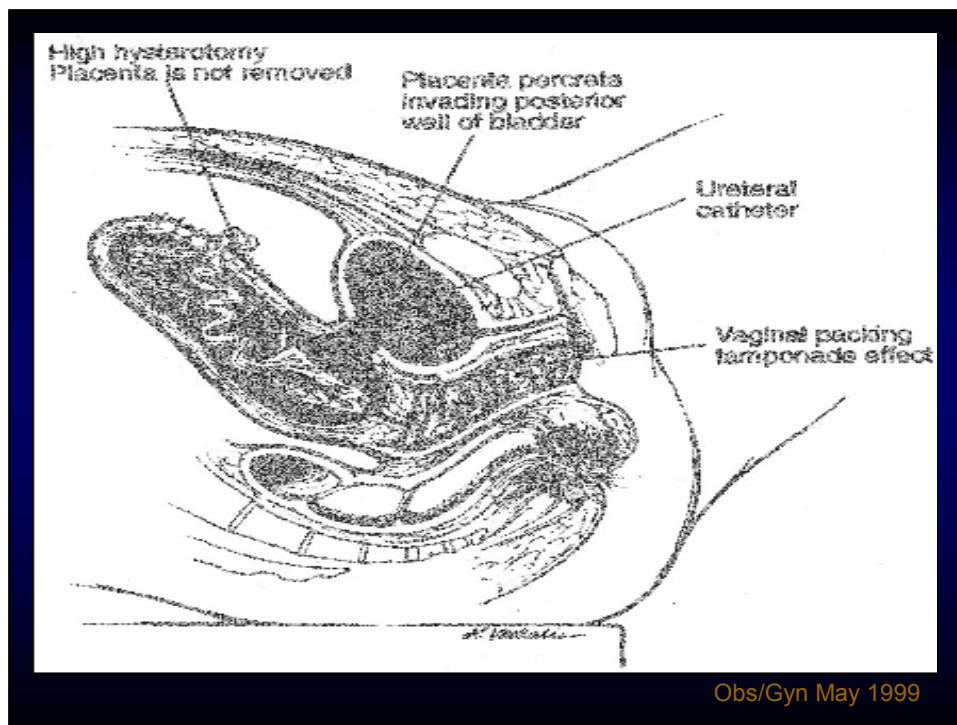
Dubois et al, "Placenta percreta: Balloon occlusion and embolization of the IIAs to reduce intraoperative blood loss", American Journal of Obstetrics and Gynecology, 1997

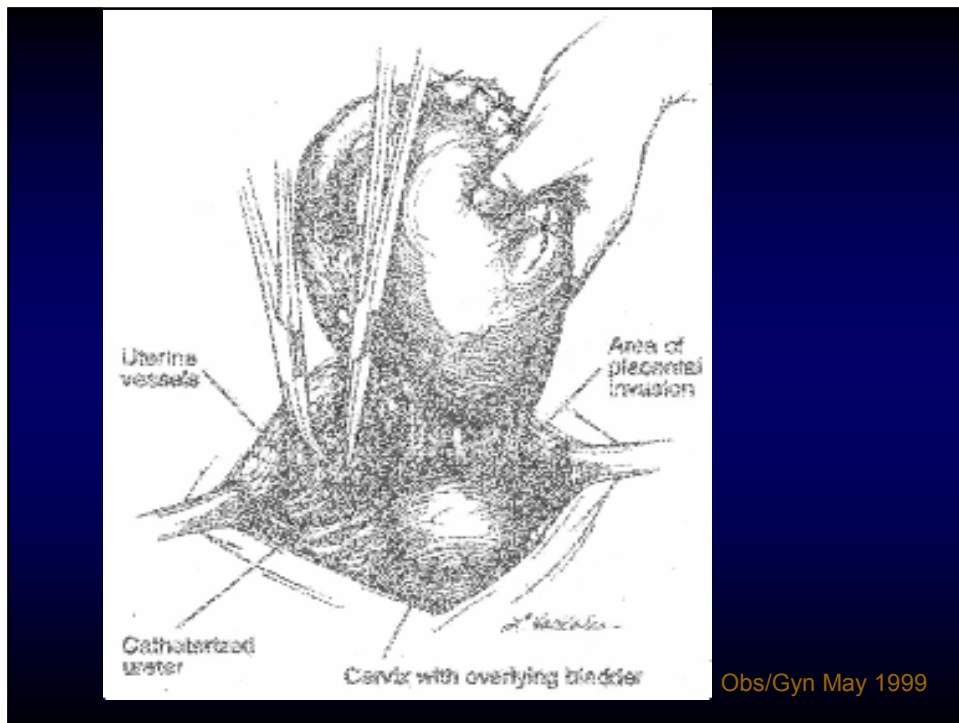
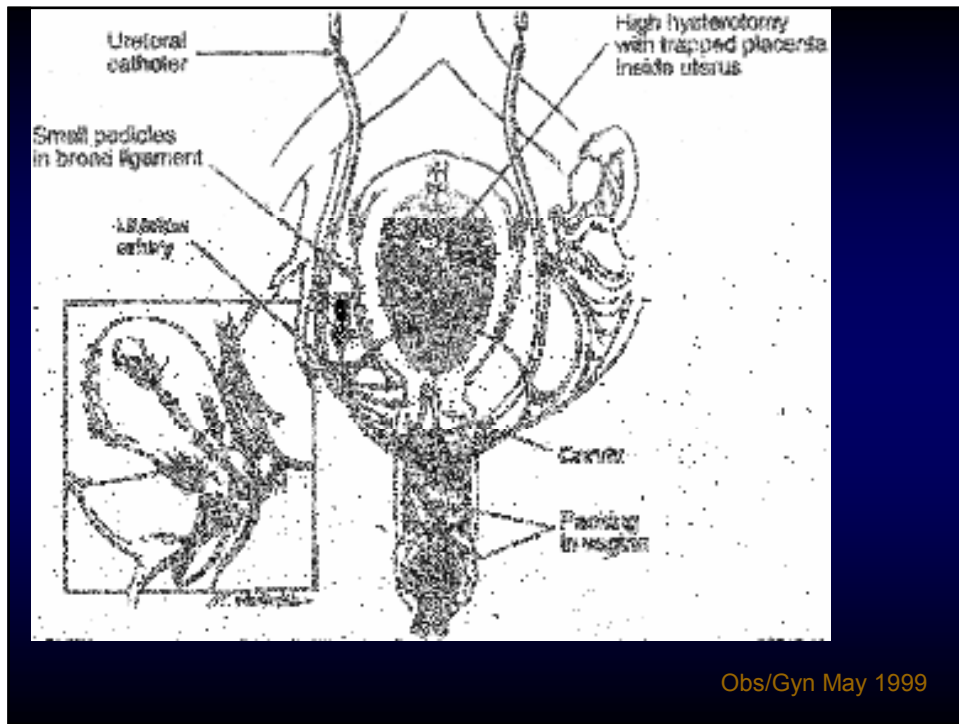
Placenta Accreta Overview

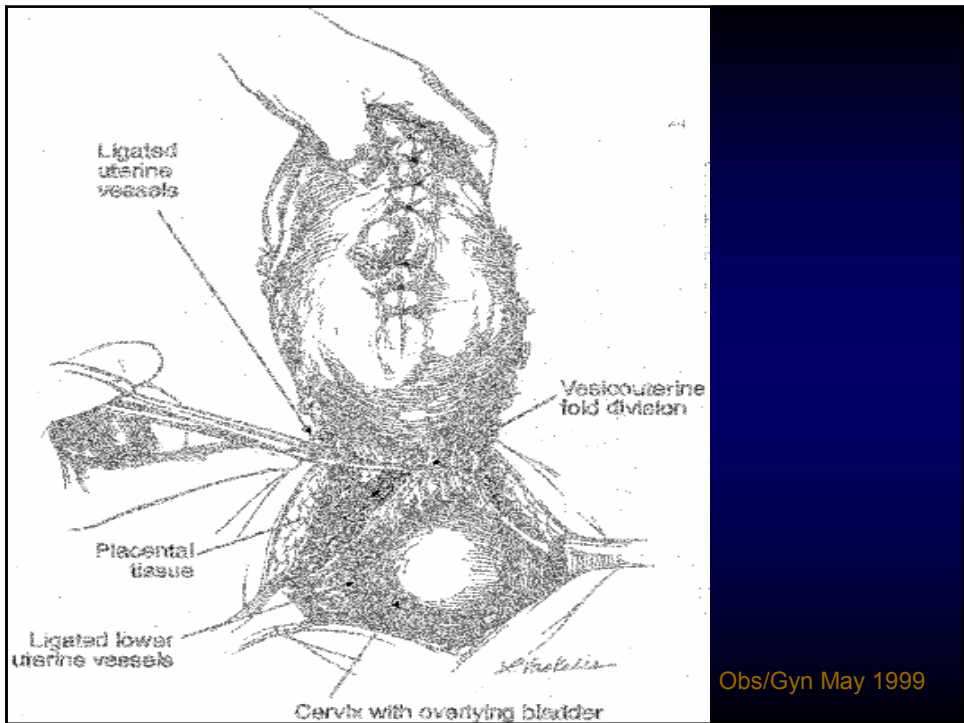
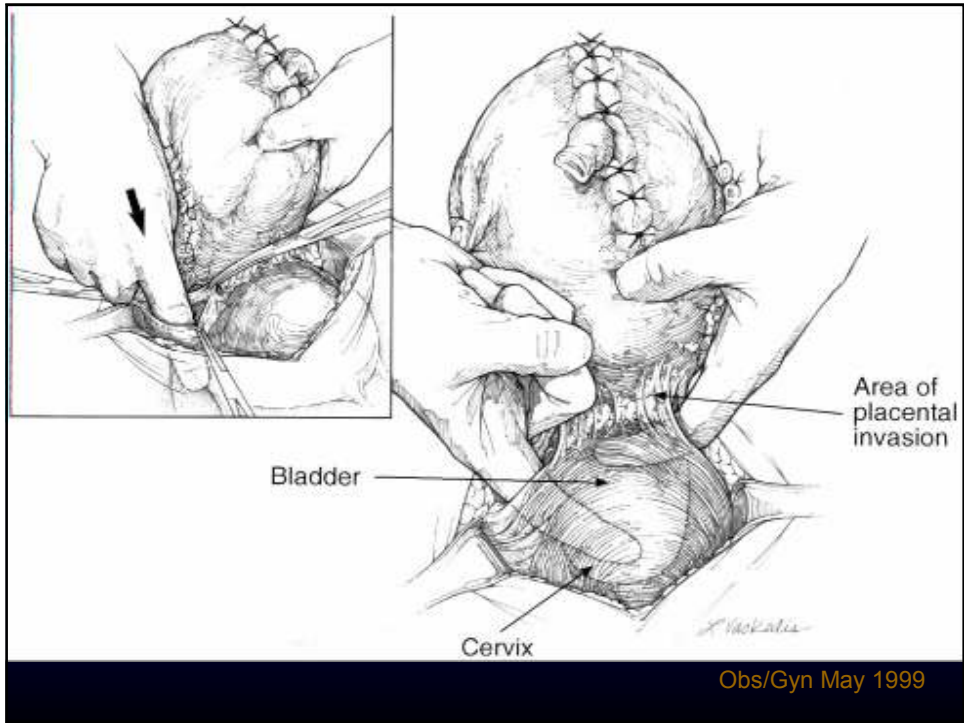
1. High index of suspicion with previa + C/S
2. MRI
 - Problem Cases
 - Further characterization
3. Interventional involvement for percreta

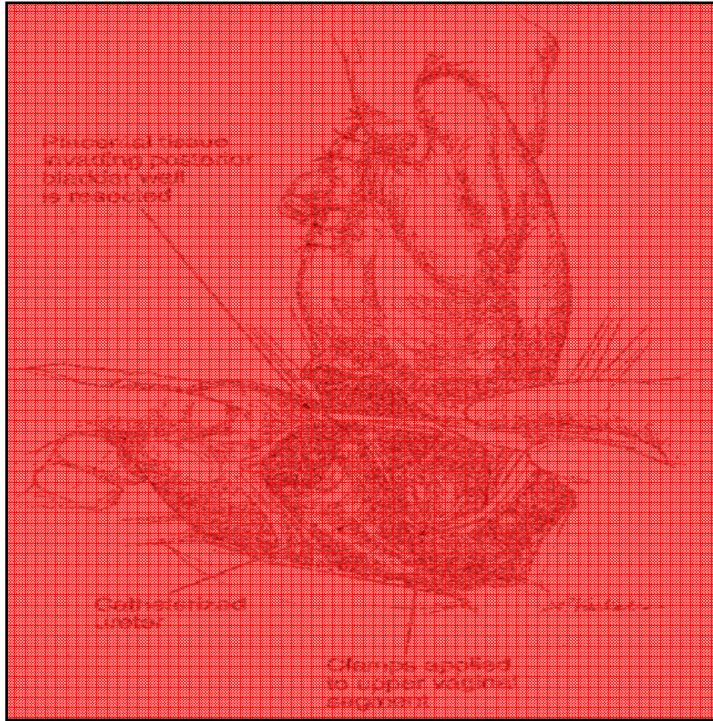
SURGICAL APPROACH

- PREPARATION
- X-match, anaesthesia consult
- Intra-arterial balloon catheters
- Pre-op cysto
- Placement of ureteral stents

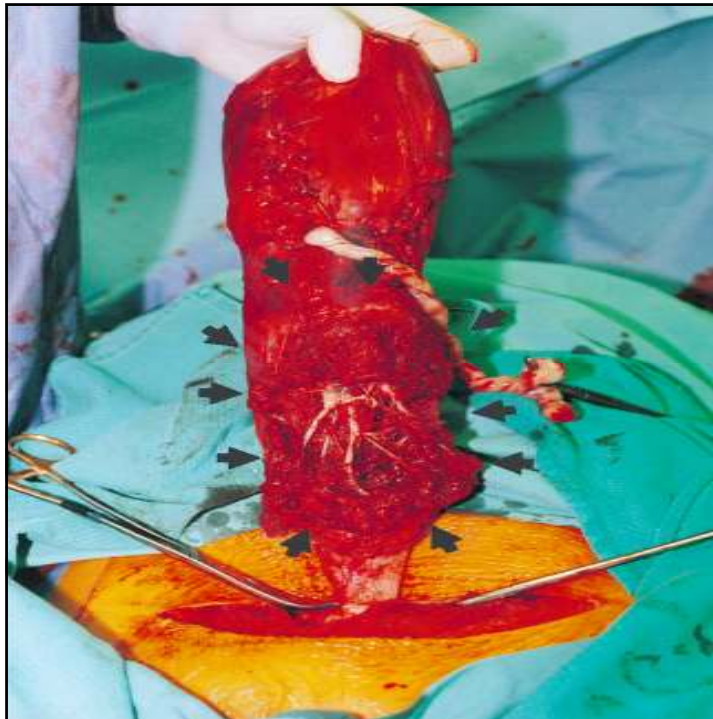








Obs/Gyn May 1999



Obs/Gyn May 1999

SURGICAL APPROACH

- Mobilization of bladder
- identify vesicouterine fold - dissect bladder off
- large veins
- **if too much bleeding or pt unstable - open bladder**
- Hemostatic control - vag packing, uterine packing pre-op intra-arterial balloon (internal iliac artery)

POST-OP MANAGEMENT

- SP TUBE
- HMV
- FOLEY
- URETERAL STENTS
- No documented timing of optimal removal - ensure urology dictates removal!
- should do cystogram before removal of foley and SP

UROLOGIC COMPLICATIONS

- Vesicovaginal fistula
- Ureterovaginal fistula
- Sphinteric damage -
incontinence
- **Maternal/fetal mortality 5-10%**

PREPARATION FOR DELIVERY ROOM

- GU BAG - presume you need everything!
- scope, light source, cysto tubing, lube
- stents (multiple types for difficult intubation), floppy guidewire, angiocath to place in foley
- SP tubes - multiple sizes
- Suture - vicryl/chromic
- drains

SUMMARY

- US still first line for imaging
- Ureterscopy is definitive and safe management
- Preparation is key for management of placenta percreta



PHYSIOLOGIC CHANGES

- Hematologic - ↑blood vol, anemia, hypercoaguable
- CVS - ↑cardiac output, ↓ systemic resistance, ↓venous return

Physiological Changes

- Resp - ↓FRC, ↑O₂ consumption
- GI - ↓gastric motility, relaxation of gastroesophageal sphincter, ↑aspiration risk

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

USA

40



WORLD

90



Placenta Accreta

Critical Dx to make antepartum

- 10% perinatal and maternal mortality
- Risk management
- Multidisciplinary planning
- Reported US accuracy
 - +++ variable (2.5%¹ - 93%²)

1. Gielchinsky, et al "Placenta Accreta – Summary of 10 Years: A Survey of 310 Cases..." in Placenta (2002)
2. Levine, et al "Placenta accreta: Evaluation with Color and Power Doppler Ultrasound and MRI in Radiology (1997)

USA

40

WORLD

90

Placenta Accreta MRI

++ Controversy

?better test

- depends on how good your US is

?gadolinium

- ?added value
- ?safety

Jaraquemada et al, "MRI in 300 cases of placenta accreta: surgical correlation on new findings", Acta Obstet Gynecol Scand., 2004