UROLOGIC ISSUES IN PREGNANCY

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Grand Rounds
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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

- 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 ↑ Uuric 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 Jurol 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 1 mGy = 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 Protection®
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


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
CONTROVERSITY

• 5 versus 1 rad?

• BOTTOM LINE - CT STILL EXPOSES FETUS TO >1 RAD - TOO MUCH

• US IS FIRST LINE

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

- Treatment options:
  - percutaneous nephrostomy
  - stent
  - ureteroscopy
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 then with stent/PCN

**CON:**
- General anaesthesia risk
- Use of fluroscopy
- Ureteral injury/perforation
- Induction of labour

Ulvik et al, J Urol, 1995
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References:
- Evans, Wollin, J Endourol, 2002

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

James D. Wintermeyer, Andrew H. Chew, Darren T. Buikema, Linda Nett, Timothy A. Wollin, Brian Burrows and John D. Bula

Division of Urology, University of Western Ontario, London, Ontario, Canada
Division of Urology, University of Alberta, Edmonton, Alberta, Canada

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
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

- PLACENTA 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 Accreta
Interventional Radiology

Pre-op Balloon placement
- Internal iliac arteries
- Anterior divisions

Embolization
- Hemostasis control
- Uterine salvage


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
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

• Ureteroscopy is definitive and safe management

• Preparation is key for management of placenta percreta
PHYSIOLOGIC CHANGES

• Hematologic - ↑blood vol, anemia, hypercoaguuable

• 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.
Critical Dx to make antepartum
  – 10% perinatal and maternal mortality
  – Risk management
  – Multidisciplinary planning
  – Reported US accuracy
    – +++++ variable (2.5%\(^1\) - 93%\(^2\))


++ Controversy
  ?better test
    - depends on how good your US is
  ?gadolinium
    - ?added value
    - ?safety