

23rd Annual Obstetric Ultrasound
Setting the Standard 2019

POST PARTUM COMPLICATIONS

Imaging Uterus

phyllis.glanc@sunnybrook.ca



University of Toronto
Dept Medical Imaging, Obstetrics & Gynecology

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Disclosures

☐ None

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Objectives

- Normal post partum uterus
- Post-partum hemorrhage
 - ▣ Uterine Atony
 - ▣ Retained products of conception (RPOC)
 - ▣ Sub-involution trophoblastic tissue
- Infection
- Gestational Trophoblast Disease (GTD)
- Unusual Cases

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Definitions

- Post partum period includes after
 - ▣ Spontaneous vaginal delivery or C-section
 - ▣ Termination of pregnancy
 - ▣ Early Pregnancy Loss (EPL)

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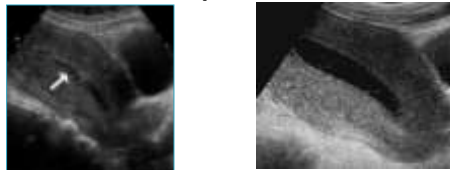
Post-Partum Uterus: Imaging

- Ultrasound 1st line imaging followed by CT or MRI as most appropriate

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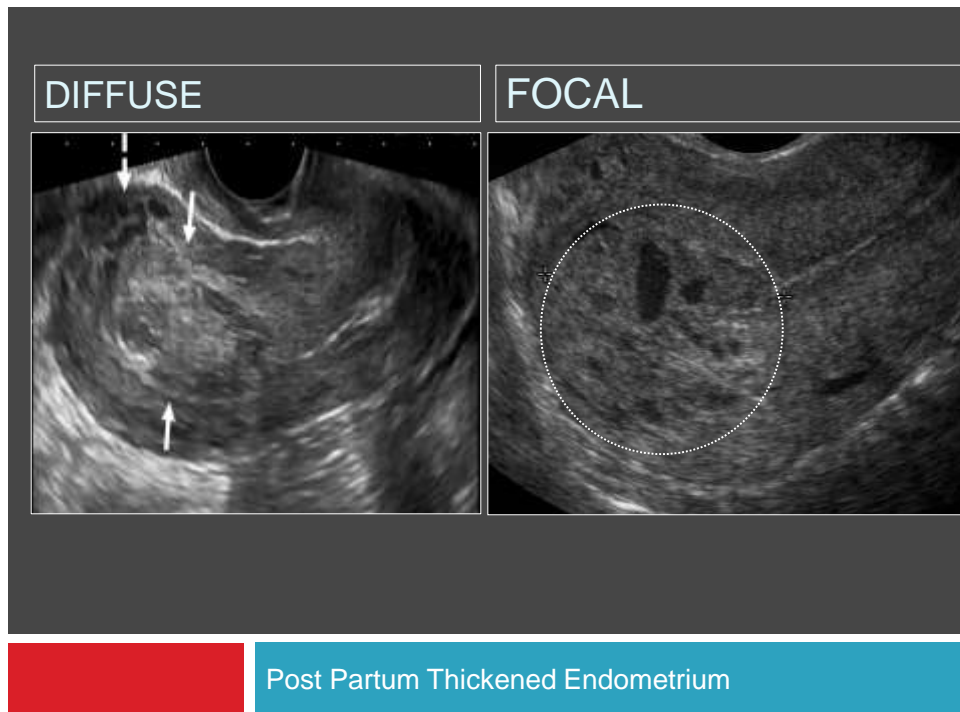
Post-Partum Uterus :Normal

- Endometrial cavity
 - ▣ 2 – 2.5cm sagittal AP (1 week PP)
 - ▣ Heterogeneous containing gas (20%),debris (24%)
- Return to baseline over 6-8 wks
 - ▣ May delayed in setting RPOC or infection
 - ▣ Time < well-defined post TA or EPL



Van Schoubroeck et al. Prospective evaluation of blood flow in the myometrium and uterine arteries in the puerperium. UOG 2004;23(4):378-81

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Differential Diagnosis Thickened Endometrium

Differential diagnosis	
<ul style="list-style-type: none"> □ Normal < 2-2.5cm <ul style="list-style-type: none"> ■ 20% foci gas, 24% debris □ Blood clots □ RPOC □ Subinvolution trophoblastic tissue □ Endometritis – Myometritis □ Gestational trophoblast disease (GTD) 	

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Differential Diagnosis Thickened Endometrium

Differential diagnosis	Stratify by
<ul style="list-style-type: none"> □ Normal < 2-2.5cm <ul style="list-style-type: none"> ▣ 20% foci gas, 24% debris □ Blood clots □ RPOC □ Subinvolution trophoblastic tissue □ Endometritis – (Myometritis) □ Gestational trophoblast disease (GTD) 	<ul style="list-style-type: none"> □ Timing post partum □ Symptoms <ul style="list-style-type: none"> ▣ Bleeding, infection, pain □ bHcg status □ Vascularity <ul style="list-style-type: none"> ▣ Localized to endometrium or extending into myometrium

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Stratify: β hCG Thickened endometrial cavity

βhCG Negative	Consider blood clots, non-viable RPOC
β hCG Low to Negative	Consider RPOC
β hCG High or non-declining	Consider GTD

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Stratify: Bleeding

Thickened endometrial cavity

- Early (< 24 hours) vs Delayed (> 24 hours)
 - ▣ > 500 ml
 - ▣ 1-2% all deliveries
 - ▣ Leading cause maternal mortality

Knight et al. Trends in PPH in high resource countries: a review and recommendations from the International PPH Collaborative Group. BMC Pregnancy Childbirth. 2009;9:55. Rossen J et al. Is there an increase PPH, and is severe hemorrhage associated with more frequent use of obstetric interventions? Acta Obstet Gynecol Scand. 2010;89(10):1248-55. Say L et al. WHO systematic review of maternal morbidity and mortality: the prevalence of severe acute maternal morbidity (near miss). Reprod Health. 2004;1(1):3. Menacker F et al. Recent trends in cesarean delivery in the United States. NCHS Data Brief. 2010(35):1-8. Mulic-Lutvica A et al. US evaluation of the uterus and uterine cavity after normal, vaginal delivery. UOG. 2001;18(5):491-5.

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Stratify: Bleeding (PPH)

Thickened endometrial cavity

- 1) Uterine atony (early PPH)
 - Risk factors include overdistension (multiples, polyh), uterine relaxants (mag sulphate), adherent placenta
 - Treat uterotonic agents (embolization aid control)
- 2) 2nd commonest is RPOC
 - Risk factors include late pregnancy termination/loss, uterine atony, adherent placenta
 - RPOC 17% T1 EPL; 40% T2 PL/TAS; 2.7% T3 delivery

1/3 deliveries via C-section (USA)

- > rate & variety PPH and infections

Knight et al. Trends in PPH in high resource countries: a review and recommendations from the International PPH Collaborative Group. BMC Pregnancy Childbirth. 2009;9:55. Rossen J et al. Is there an increase PPH, and is severe hemorrhage associated with more frequent use of obstetric interventions? Acta Obstet Gynecol Scand. 2010;89(10):1248-55. Say L et al. WHO systematic review of maternal morbidity and mortality: the prevalence of severe acute maternal morbidity (near miss). Reprod Health. 2004;1(1):3. Menacker F et al. Recent trends in cesarean delivery in the United States. NCHS Data Brief. 2010(35):1-8. Mulic-Lutvica A et al. US evaluation of the uterus and uterine cavity after normal, vaginal delivery. UOG. 2001;18(5):491-5.

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Retained Products of Conception (RPOC)

- Diagnosis unequivocal: Fetal parts or placenta
- Suspicious: Endometrial mass +/- vascularity
 - ▣ **Absent CDS not exclude RPOC**
 - Non-viable or necrotic tissue
 - Natural history of non-vascularized RPOC uncertain but believe majority pass spontaneously
 - Calcified foci suggest RPOC
- Specific diagnosis histological proof chorionic villi

*van den Bosch et al Occurrence and outcome of residual trophoblastic tissue JUM. 2008;27(3):357-61.

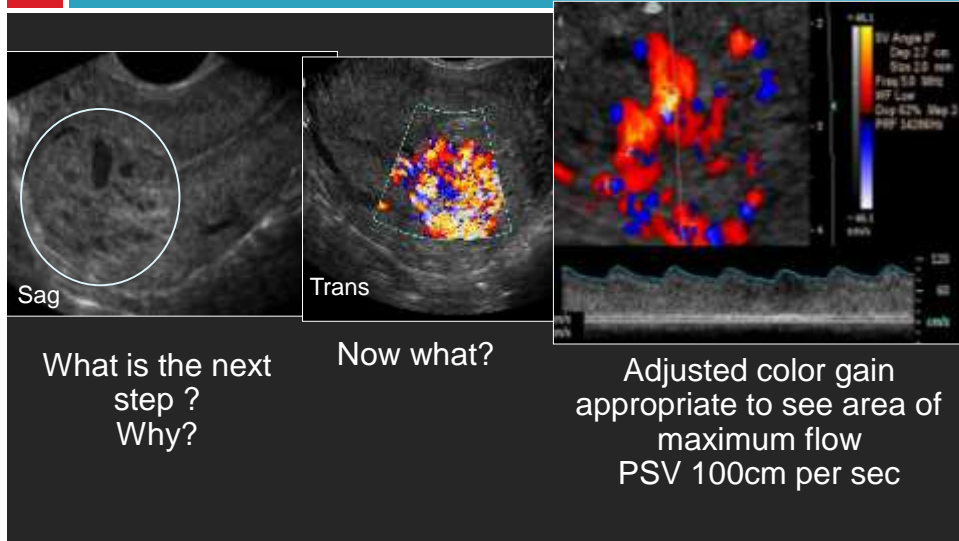
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Management PPH- Delayed

- RPOC D&C or hysteroscopic directed resection
- Pseudoaneurysm and vascular lesions treated with UAE

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Case : What's Your Diagnosis?



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Post-Partum Uterus & Vascularity

Spectrum RPOC to Uterine "non-AVMs"

- Hypervascular turbulent flow inner 1/3 myometrium
- Timmerman:
 - ▣ **PSV > 0.83 cm/sec higher probability significant PPH**
 - ▣ PSV < 0.39 likely safe
- Timor-Tritsch: > 60-70 cm/sec consider UAE
- "Uterine non-AVMs" group with high PSV
 - ▣ No early venous drainage or vascular nidus at angiography but > risk catastrophic hemorrhage PP
 - ▣ *Need appropriate CDS settings to minimize aliasing so ID these high PSV vessels*

Timmerman et al. Color Doppler imaging is a valuable tool for the diagnosis & management of uterine vascular malformations. UOG 2003;21(6):570-7.

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Post-Partum Uterus & Vascularity

Spectrum RPOC to Uterine “non-AVMs”

- Hypervascular turbulent flow inner 1/3 myometrium
 - ▣ **PSV > 0.83 cm/sec higher probability significant PPH**
 - ▣ PSV < 0.39 likely safe
- Timor-Tritsch recommends stratification of uterine vascular lesions by PSV regardless of the presence of RPOC, with UAE considered if the PSV of the lesion is high ($\geq 60\text{--}70\text{ cm/s}$), based on Timmerman's work
 - Timor-Tritsch et al AJOG 2016;214(6):731.e1–731.e10
- Uterine AVM, including patients with concomitant RPOC, suggests that PSV values greater than 76.2 cm/s may indicate a dangerous AVM, and that PSV values less than 35.8 cm/s appear safe
 - Lee TY et al Acta Radiol. 2014;55(9):1145–52.
 - 75 prospective with PPH due “AVM”

Timmerman et al. Color Doppler imaging is a valuable tool for the diagnosis & management of uterine vascular malformations. UOG 2003;21(6):570-7.

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Post-Partum Uterus & Vascularity

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Van den Bosch, Thierry, Dominique Van Schoubroeck, and Dirk Timmerman. "Maximum peak systolic velocity and management of highly vascularized retained products of conception." *Journal of Ultrasound in Medicine* 34.9 (2015): 1577-1582.

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Post partum Uterus & Role CDS

- Role CDS in suspected **RPOC**
 - ▣ Confirm vascularity, location

- ▣ Risk stratification
 - Triage group with higher risk significant PP bleeding

Timmerman et al. Color Doppler imaging is a valuable tool for the diagnosis and management of uterine vascular malformations. UOG 2003;21(6):570-7.

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Management

Spectrum RPOC to Uterine “non-AVMs”

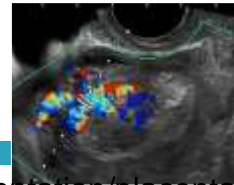
- Conservative or expectant in majority (up to 3-6 months)
- Medical (Misoprostol or methotrexate)
- Surgical Options
 - D&C with US guidance or hysteroscopic resection of focal tissue.
 - Uterine Artery Embolization or Ligation
 - Good option in unstable or unreliable patient with concerning PPH and/or US evidence of “high PSV” with no endometrial mass
 - Unsure risk post UAE infertility, likely low
 - Hysterectomy (unstable-emergent)

Timmerman et al. Color Doppler imaging is a valuable tool for the diagnosis and management of uterine vascular malformations. UOG 2003;21(6):570-7.

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PP: Uterus & Vascularity

Enhanced Myometrial Vascularity (EMV)



- Low resistance, dilated, turbulent BV at implantation/placenta site due subinvolution trophoblast tissue extend into myometrium
 - ~ 8% of routine F/U at 6 weeks (post delivery or TA)
 - ~ 51% day 3 vs 4% wk 6
 - Majority associated with RPOC
- Management:
 - No bleeding – conservative, presumed transient
 - Natural history spontaneous resolution over 6-12 weeks but up to 6 months
 - Bleeding with RPOC – remove RPOC – important remove it quickly as bleeding subside quickly thus hysteroscopic and/or US guidance may be critical

Van den Bosch T, Van Schoubroeck D, Lu C, De Brabanter J, Van Huffel S, Timmerman D. Color Doppler and gray-scale ultrasound evaluation of the postpartum uterus. UOG 2002; 20:586 – 591; Van den Bosch, Thierry, Dominique Van Schoubroeck, and Dirk Timmerman. 2002. 582.



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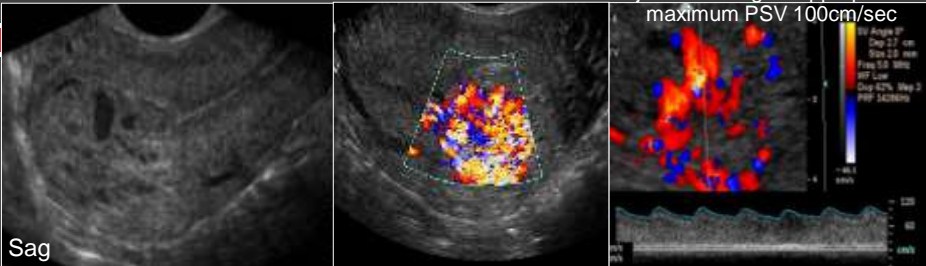
PP: Uterine Vascular Lesions: Non-AVMs/EMVs

- Abnormal connection uterine artery and venous plexus of myometrium
- Theory subinvolution placental bed with failed obliteration vessels in absence RPOC after cessation pregnancy (Timmerman, Van Shoubroeck)

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Case: Persistent bleed require transfusions

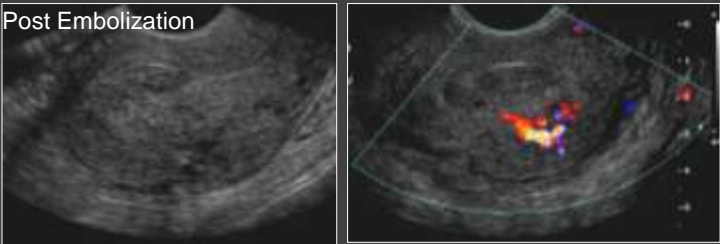
Adjusted color gain appropriate ID
maximum PSV 100cm/sec



Sag

Counsel higher risk population due high PSV in non-AVMs– chose to undergo UAE

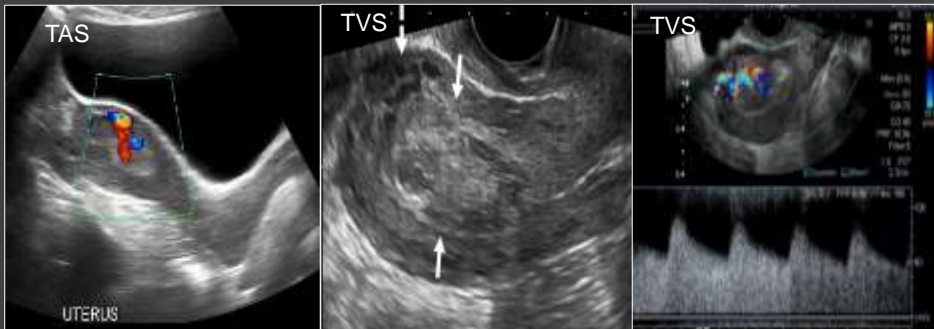
Post Embolization



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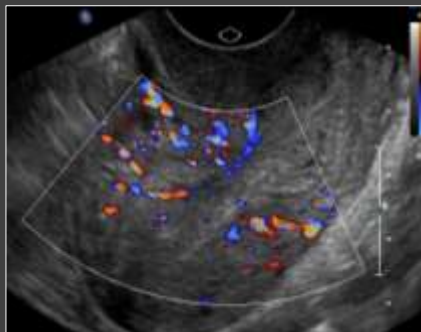
Case: History Rule out RPOC

- Delivered 22 wk triplets due PROM & PTL
- 7 weeks PP with a β hCG 4



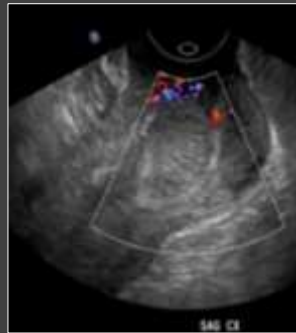
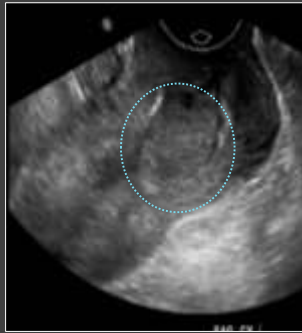
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Repeat US : 9 weeks PP



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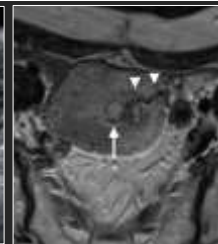
Repeat US at 11 weeks PP



- Still bleeding
- US demonstrates passage of avascular material into lower uterine segment/cervix

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Case: 42yo female severe PPH 2 months post CS Treatment: UAE



US: Endometrial mass with hypervascularity extend into myometrium, PSV 75 cm/sec

T2W

CT- AP

Images courtesy : Iriha, Yuko, et al. "Multimodality imaging in secondary postpartum or postabortion hemorrhage: retained products of conception and related conditions." Japanese journal of radiology 36.1 (2018): 12-22.

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PP: Uterine Vascular Lesion in PP state

Names vary but key is where large vessels of placental bed fail to involute (subinvolution trophoblast tissue), hemorrhage commonest in week 2 PP but occur up to months later

- ▣ Darlow et al found hCG levels resolved as lesions regressed supporting subinvolution placental bed
- ▣ PSV strong differentiating variable to stratify risk
- ▢ In setting secondary/delayed PPH incidence may be up to 13-46%...tend persist in setting RPOC
- ▢ Terminology:
 - ▣ Enhanced myometrial vascularity (EMV)
 - ▣ Uterine vascular malformation (UVM)
 - ▣ Non-arteriovenous vascular malformations (non-AVMs)
 - ▣ Subinvolution placental bed/trophoblast tissue

Darlow KL, Horne AW, Critchley HOD, Walker J, Duncan WC. Management of vascular uterine lesions associated with persistent low-level human chorionic gonadotrophin. J Fam Plan Reprod Health Care. 2008;34(2):118–20.

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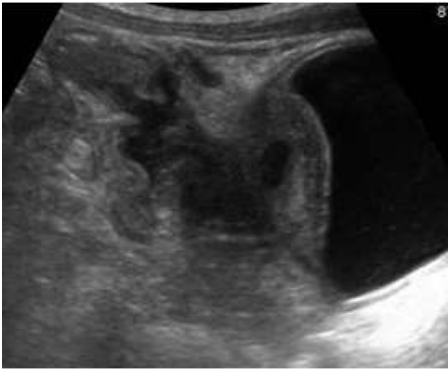
Post C-section: Bleeding

Bladder Flap Hematoma

- ▢ Extraperitoneal perivesical space
 - Confined to space between LUS & bladder
 - Subjacent to peritoneal incision
 - Common occur in 50%
 - ▣ < 2cm generally resolve
 - ▣ > 5 cm increased risk dehiscence
- ▢ Can extend into vesicouterine space (anterior to LUS/bladder) then may track into broad ligament and even extra-peritoneal

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Bladder Flap Hematoma



Bladder Flap Hematoma



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Post C-section: Bleeding

Subfascial Hematoma – next commonest extraperitoneal

- Related to injury epigastric blood vessels/branches
- Track within subfascial rectus musculature potential extending inferiorly to extraperitoneal space of Retzius anterior to bladder
- Large potential space accumulate up to 2.5L
- May co-exist with bladder flap hematoma
- CTA may detect active hemorrhage

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Post C-section: Bleeding

Paravaginal Hematoma

- **Infralevator perivaginal space**
 - ▣ Easy to ID as extend to vulva, perineum, ischiorectal fossa thus may diagnosis on inspection
- **Supralevator** may dissect thru paravaginal fascia and broad ligaments

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Post C-section: Bleeding

- If suspect active bleeding or extravasation then CTA (CT-angiography)
 - ▣ Confirm extravasation, ID BV/site
 - ▣ Define extent
- Angiography useful in hemodynamically unstable or candidates for UAE

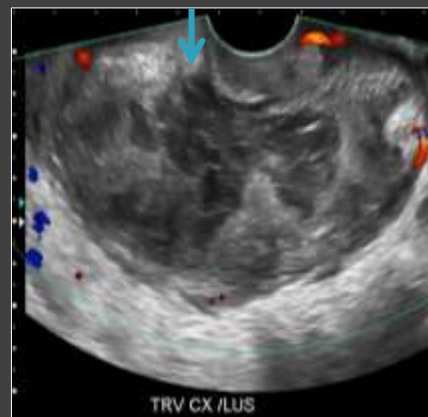
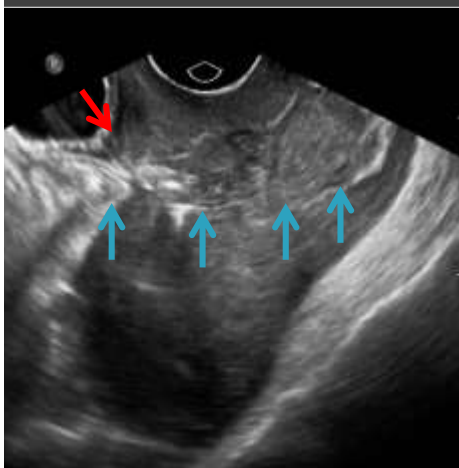
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Case: PPH persistent

- Emergent C-section @ 32 weeks due placental abruption
 - Adherent placenta was removed in bits
 - PPH required 3 units pRBCs
 - Hemoglobin 8.1 at discharge
- Returns 8 weeks PP due persistent bleeding with Hb 8.4
- Ultrasound performed

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Diagnosis: Large bladder flap hematoma with dehiscence gap
Note expansion LUS/cervical canal, bulging uterine contour



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Management Options: 8 weeks PP Bladder Flap Hematoma & Dehiscence

- Avoid D&C due high risk uterine perforation
- Management Plan
 - ▣ Stable, let uterus heal, reassess anatomy with MRI
 - ▣ Unstable UAE or emergency hysterectomy
 - ▣ Concurrent reliable contraception.

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Case: Pain Post Termination Pregnancy

- D&E earlier that day for 16 week pregnancy
 - ▣ 16 weeks post laminaria tent dilation
 - ▣ Experience severe abdominal pain – procedure stopped
- Presented to ER

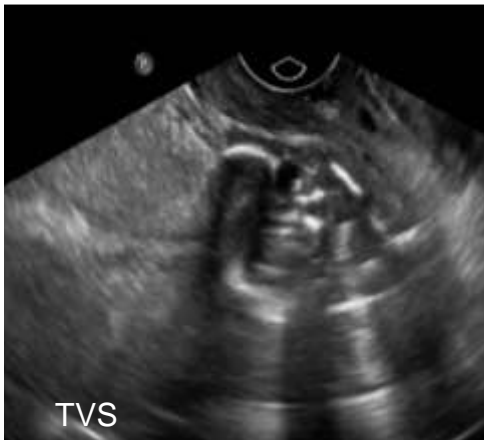
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Case: What's your Diagnosis? Pain post D&E (16 wks)



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Case: What's your Diagnosis? Pain post D&E (16 wks)



Uterine Rupture: Surgical repair 1.5 cm tear lower uterine segment

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Dehiscence & Rupture

□ Risk factors

- ** Prior C-section
- Bladder flap hematoma > 5cm
- Endometritis
- Terminations – late – D&E
- PAD (Placental adherence disorder)
- GTD
- Delayed dehiscence may be related to inadequate treatment PP endometritis or infected RPOC

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PP/Post C-section: Rupture-Dehiscence

- Rare but high morbidity/mortality
 - Partial implies intact serosa vs complete tear extend thru serosa
 - Tends to occur in relatively avascular LUS
- Classic signs include severe pain, PPH, hypovolemic shock
- Treat vary antibiotics to surgical repair
- Concurrent counsel risk future pregnancy and interim use contraceptives

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PP/Post C-section: Rupture-Dehiscence

- Thus careful US evaluation for uterine wall integrity indicated if bladder flap hematoma > 2cm
- US, CT, MR all valuable to assess for discontinuity serosal and/or myometrial layers and blood tracking
 - ▣ US appear normal, subtle thin, frank disruption with extrusion fetal parts beyond endometrium or bowel loops into myometrium
 - ▣ CT defect enhancement myometrium but phlegmon/defect may appear similar unless frank disruption.
 - ▣ MR superior demonstrate transmural defect, non-enhancing myometrium of connection endometrial cavity to serosal surface, lack apposition endometrium & serosa at incision site
 - ▣ Frank rupture usually treated surgically vs conservative dehiscence

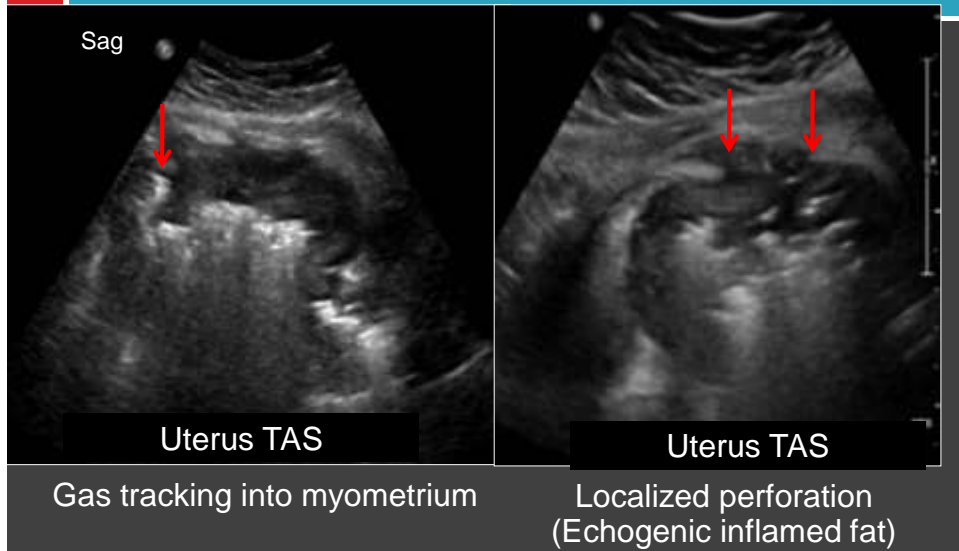
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PP/Post C-section: Puerperal Sepsis

- Occur 1-5% vaginal vs 5-30% C-sections
- Endometritis commonest cause PP fevers
 - ▣ Typically empiric antibiotics without imaging
- Myometritis in small %
 - Risk increased obese, C-section, RPOC
 - Rare infection..necrosis...rupture
- Ultrasound generally non-specific
- MRI helpful distinguish phlegmon vs true dehiscence

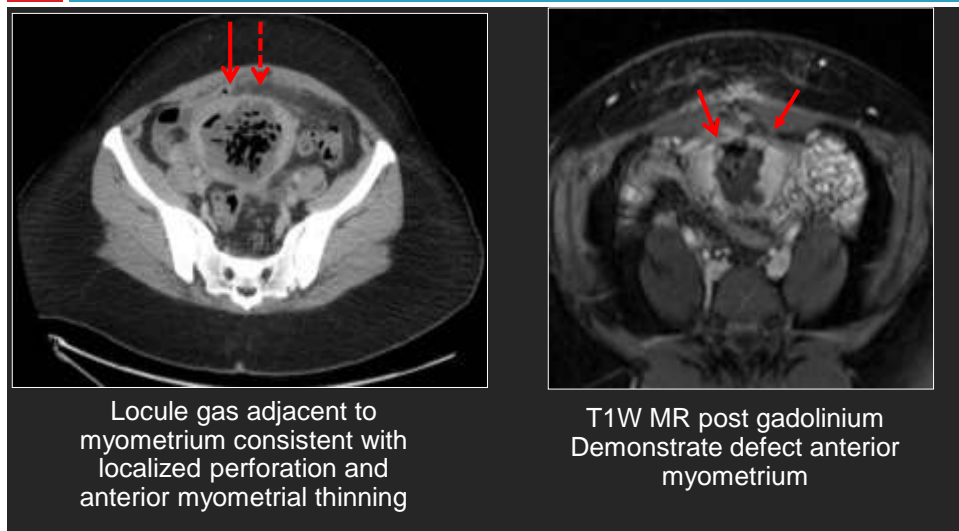
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Case : Emergent C-section, box sutures to stop bleeding
Returns with Fevers and foul smelling discharge



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CT & MRI



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Treatment



- Fulminant endomymometritis with localized perforation
- Treated with simple foley catheter for drainage with retention balloon inflated in vagina & Antibiotics



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Case: 28 yo G1Po @ 20 wks presents with focal pain over known fundal myometrial fibroid

- PMH includes thalassemia minor, otherwise negative
- US enlarging fibroid now 17.5 cm with features internal necrosis + hemorrhage, sent home on analgesics
- Returns 3 days with increasing pain
 - WBC $39.6 \times 10^9/L$ and platelet count $809 \times 10^9/L$, HR 140, anuria despite aggressive hydration, Hb 11.4
 - Normotensive, afebrile
 - Ultrasound – moderate ascites
 - Diagnosis : Acute SIRS (systemic inflammatory response syndrome)
- Day 5 spontaneous PTL with neonatal demise

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Case

- Day 7 improving WBC & platelet counts but dropping Hb 8.4
- Repeat US
 - ▣ Smaller fibroid 11.4 cm associated disruption overlying serosal layer and adjacent complex fluid/hematoma
 - ▣ Diagnosis ruptured fibroid with hemoperitoneum
 - CT, MR confirmed, no active extravasation (CTA)
- Day 8 : Discharge
 - ▣ Plan medical optimization, on Venofer, Exprex
- 6 weeks PP underwent abdominal myometectomy
 - ▣ Confirmed fibroid rupture through uterine wall with spillage of degenerated contents, myometrial/serosal defect closed.
 - ▣ Speculate enlarging fibroid resulted in myometrial necrosis with intraperitoneal rupture fibroid contents resulting in acute SIRS;
 - US usually first line imaging so important aware findings

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Degenerated Uterine Myoma

- First case presentation with acute SIRS likely related to ruptured myomatous elements intraperitoneal
- Hemoperitoneum due to spontaneous hemorrhage of fibroid very rare complication
 - ▣ On rare occasion is limited to intrauterine.

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Painless PPH: Gestational Trophoblast Disease

- ~ 0.5-1/1000 pregnancies (USA)
- Abnormal growth of trophoblast cells.
- **Partial molar** :US multiple cystic placental changes, often segmental, may gestational sac or fetal parts.
- **Complete molar** : > symptomatic with PPH, hyperemesis, occasional hyperthyroidism
 - ▣ Cystic mass enlarging uterus but **no fetal parts**
 - ▣ 50% elevated hCG, with levels rising above 100,000
 - ▣ Theca lutein cysts more common due higher hCG levels



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Partial Mole: Twin 11 weeks

- **Bhcg 113 529**
- Presentation spotting

Finding:

- Mass
- 2 YS
- 1 fetus 5mm no ECA



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Gestational Trophoblast Disease – Complete Mole

- Echogenic mass multiple small cysts filling uterine cavity
- No fetus or gestational sac
- Vascular – high velocity-low impedance



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Painless PHH

Gestational Trophoblast Disease: **Malignant**

- 5-8% of GTD undergo malignant transformation
 - 16-20% complete mole vs 0.5% partial mole
- Choriocarcinoma occurs on background
 - 50% molar pregnancy
 - 25% post TA
 - 25% post normal pregnancy
- Typically within 6 months PP
- Chemosensitive (Mtx), surgical evacuation
- Recurrence risk is 1-2% in subsequent pregnancy



55

Gestational Trophoblast Disease

GTN - Malignant

- FIGO standard diagnosis:
 1. hCG level plateau plus or minus 10% of baseline recorded in 4 measurements over a 3-week duration (days 1, 7, 14, 21)
 2. hCG \geq 10% rise in 3 consecutive measurements recorded over a 2 week duration(days 1,7,14)
 3. Persistence of detectable hCG for more than 6 months after molar evacuation.

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GTN Malignant

Placental SiteTrophoblastic Tumor (PSTT)

- Rarest form GTD (1-2%)
 - Neoplastic proliferation intermediate trophoblast cells
 - role in implantation
- **Thus minimal or no hCG elevation** (delay diagnosis)
- **Increase serum hPL** (human placental lactogen)
 - Histology stain human placental lactogen, b1-glycoprotein
- Follow any type pregnancy
- Slow growing, locally invasive, late metastases
- Primary treatment surgical
 - Relative resistant to chemotherapy



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Summary

- Knowledge of the early and late complications of bleeding and pain in the postpartum period can improve patient care by narrowing or specifying a diagnosis.
- Prompt diagnosis may be life-saving.
- Role of CDS in RPOC can be diagnostic and may potentially stratify patients into low and high risk categories for potential significant PPH.

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Thank you

Phyllis.Glanc @Sunnybrook.ca

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