PLACENTAL CONTRIBUTION TO OBSTETRIC HEMORRHAGE

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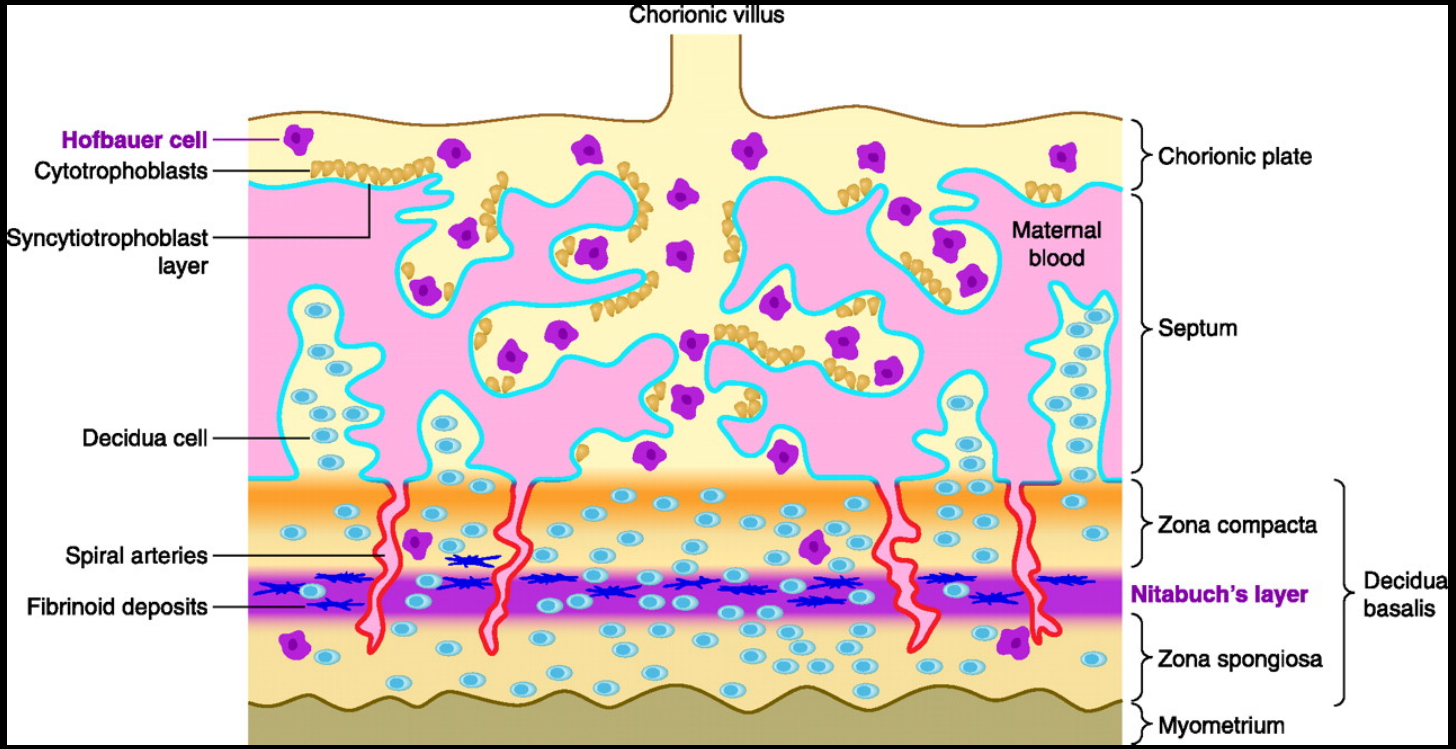
FOUNDATION FOR
Women & Girls
with Blood Disorders


Chorionic villus
Hofbauer cell
Cytotrophoblasts
Syncytiotrophoblast layer
Decidua cell
Spiral arteries
Fibrinoid deposits
Maternal blood
Chorionic plate
Septum
Zona compacta
Nitabuch's layer
Zona spongiosa
Myometrium
Decidua basalis

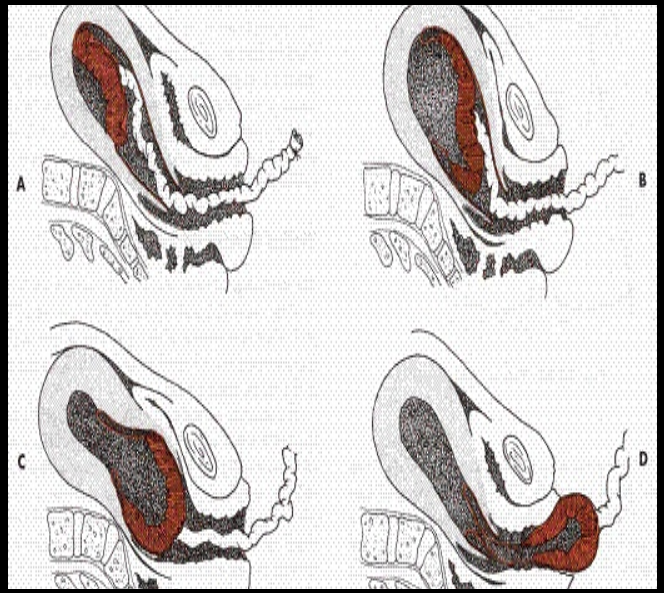
Third Stage of Labor

Sudden decrease in uterine size and area of implantation site

Formation of retroplacental hematoma

Uterine contraction

Secondary clot formation



Placental Contribution to Obstetric Hemorrhage

- Placental abruption
- Placenta previa
- Placenta accreta (spectrum)

Placental Contribution to Obstetric Hemorrhage

- Uterine bleeding after 20 weeks complicates 5-10% of pregnancies; of these:
  - Abruption ~ 15%
  - Previa ~ 10%
  - Accreta ~?
  - Other (local / focal bleeding)

Placental Contribution to Obstetric Hemorrhage

Placental Abruption

- Bleeding at the decidual-placental interface (maternal vessels in decidua basalis) → premature separation
- Occurs in about 0.5-1% of pregnancies
- Adverse outcomes:
  - Fetus/neonate: FGR, LBW, PTB, HIE, perinatal death
  - Mother: DIC, transfusion, hysterectomy, renal failure, death

Placental Contribution to Obstetric Hemorrhage

Placental Abruption

- Estimated to be the cause of ~10% of preterm births and ~10% of perinatal deaths
- Maternal mortality
  - In about about 1% of serious abruption cases
  - Attributable cause of 7 maternal deaths in UK, 2000-2005

Placental Contribution to Obstetric Hemorrhage

Placental Abruption

Risk Factors for Abruption

Demographic or Behavioral

- Maternal age <20 or >34
- Smoking
- Cocaine use

Historical

- *Prior abruption*
- Prior ischemic placental disease
- Prior cesarean

Current Medical

- *Hypertensive disease*
- *Vaginal bleeding in pregnancy*
- *PPROM*
- Trauma
- FGR
- Chorioamnionitis

Placental Contribution to Obstetric Hemorrhage

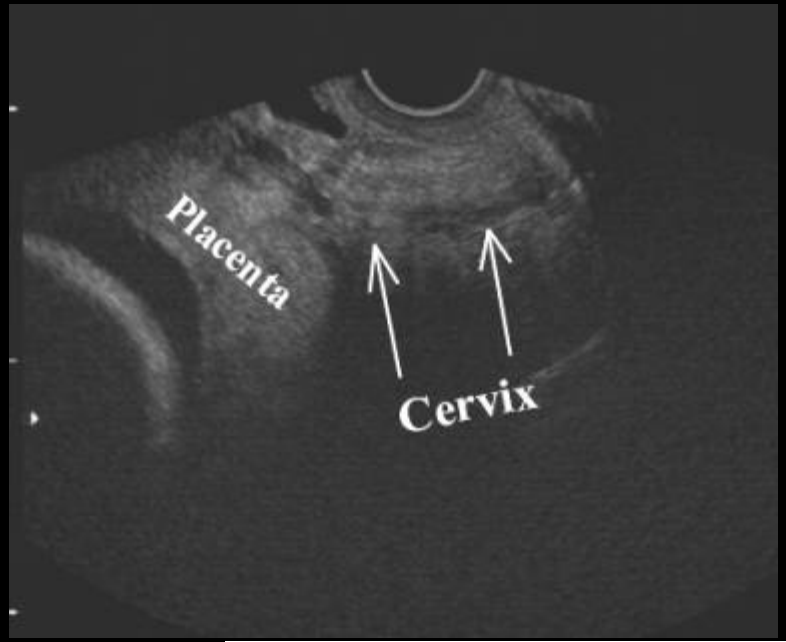
Placental Abruption

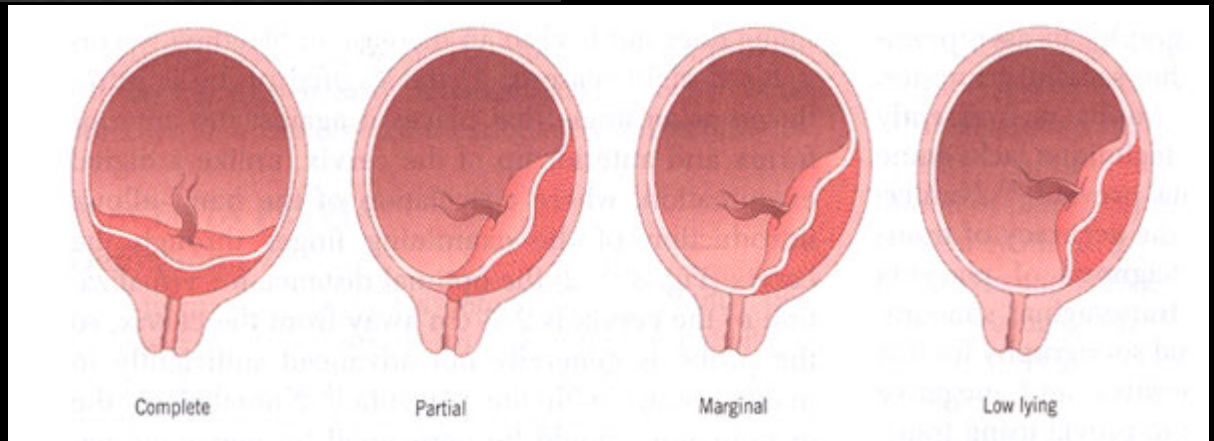
- Etiopathogenesis poorly understood
  - ? Poor utero-placental vascularization – ischemic placental disease
  - ? Defective hemostasis at feto-maternal inferface
    - Genetic factors
  - Vasconstrictive factors

Placental Contribution to Obstetric Hemorrhage

Placental Abruption

- Management
  - Lesser degrees of abruption – hospitalization until resolution or worsening
  - More serious cases – delivery and maternal resuscitation


Placenta
Cervix


Complete
Partial
Marginal
Low lying

Placental Contribution to Obstetric Hemorrhage

Placenta Previa

- Placenta overlying cervical internal os
  - Formerly “complete,” “partial,” and “marginal”
  - Now “previa” and “low lying”
- Complicates ~0.5% of pregnancies
  - More frequent in relation to increased rate of cesareans
  - Also more frequent in relation to prior pregnancy losses and parity

	OR for Placental Previa
Prior Cesareans	
1	4.5 (3.6-5.5)
2	7.4 (7.1-7.7)
3	6.5 (3.6-11.6)
4	44.9 (13.5-149.5)
Prior Pregnancy Losses	
1	1.6 (1.3-1.8)
2	2.3 (1.8-3.0)
3	3.7 (2.7-5.2)
Parity	
1	1.9 (1.5-2.5)
2	2.2 (1.7-3.0)
3	2.6 (1.8-3.8)

Obstet Gynecol Survey. 2012; 667:503

Placental Contribution to Obstetric Hemorrhage

Placenta Previa

- Associated adverse outcomes attributable to maternal bleeding
  - 10-fold increased risk of antepartum bleeding
    - ↑ likelihood of transfusion, hysterectomy, ICU admission, maternal death
  - Adverse fetal-neonatal outcomes
    - Mostly related to prematurity: ~15-20% rate of delivery <34 weeks; 2-4 fold increase PNM rate
    - ? Fetal growth restriction

Placental Contribution to Obstetric Hemorrhage

Placenta Previa

- Mechanism of hemorrhage
  - Antepartum
    - Placental separation from decidua
      - GA-related
      - Contractions, cx changes, alterations in lower uterine segment

Placental Contribution to Obstetric Hemorrhage

Placenta Previa

- Mechanism of hemorrhage
  - Antepartum (occurs in 50% of previa cases)
    - Related to parity
    - May be more frequent with short cx, placental lacunae, other US features

Placental Contribution to Obstetric Hemorrhage

Placenta Previa

- Mechanism of hemorrhage
  - Postpartum
    - Poorly contractile lower uterine segment

Placental Contribution to Obstetric Hemorrhage

Placenta Previa

- Previa is fairly frequent finding on mid-trimester US
  - >85% resolve due to ”placental migration”
    - Concept of *trophotropism*

Placental Contribution to Obstetric Hemorrhage

Placenta Previa

- Antepartum Management
  - Periodic US reassessment of placental location
  - If antepartum hemorrhage:
    - Hospitalization (vs outpatient care)
      - Recurrence in ~50% of cases
      - ? Number of episodes
      - Routine hospitalization at 34 weeks?
    - Antenatal steroids

Placental Contribution to Obstetric Hemorrhage

Placenta Previa

- Antepartum Management
  - Controversial / NEB / not recommended
    - Bed rest / pelvic rest
    - Cx length measurements
    - Tocolytic agents
    - Cerclage

Placental Contribution to Obstetric Hemorrhage

Placenta Previa

- Delivery Management
  - Delivery at 36-37 weeks (*Sem Perinatol.* 2011; 35:249)
  - Cesarean delivery
    - For previa or low-lying placenta within 1-2 cm of cx os

Placental Contribution to Obstetric Hemorrhage

Placenta Previa

- Delivery Management
  - Use of prediction schemes for emergency delivery
    - Prior cesarean
    - Antepartum bleeding (number of episodes)
    - Need for transfusion

Placental Contribution to Obstetric Hemorrhage

Placenta Previa

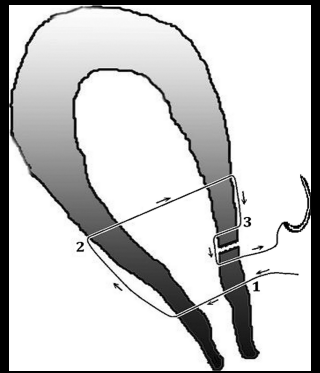
Variable	Delivery When Scheduled (N=121)	Emergency Delivery (N=93)	OR (95% CI)
Cesarean	13 (10.7%)	27 (29%)	4.6 (1.8-11)
1 bleed (vs no bleed)	38 (31.4%)	27 (29.3%)	7.5 (2.5-23)
2 bleeds (vs no bleed)	16 (13.2%)	23 (25%)	14 (4.3-47)
≥ 3 bleeds (vs no bleed)	13 (10.7%)	37 (40.2%)	27 (8.3-90)
Transfusion	3 (2.5%)	22 (23.9%)	6.6 (1.8-24)

Am J Perinatol. 2016; 33:1407–1414

Placental Contribution to Obstetric Hemorrhage

Placenta Previa

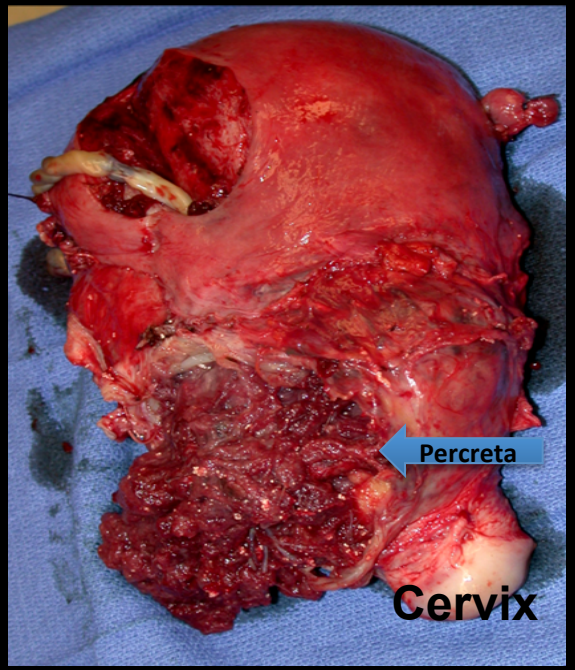
- Intraoperative Management
  - Persistent LUS bleeding
    - Uterotonic agents
    - LUS compression sutures or B-Lynch sutures
    - Intrauterine balloon tamponade
    - Local hemostatic agents



Placenta Accreta

Definitions

- Placenta that is abnormally ("morbidly") adherent to the uterus
  - Increta: Invades the myometrium
  - Percreta: Invades the serosa or adjacent organs (<10%)
- Accreta: All of the above



Oyalese and Smulian. *Obstet Gynecol*. 2006; 102:927

Placenta Accreta

Pathophysiology

- Absence or deficiency of Nitabuch's layer of the decidua
  - Failure to reconstitute the endometrium-decidua basalis after insult
- Histology: trophoblast (usually) invades myometrium without intervening decidua
- Placenta does not separate: bleeding

Placenta Accreta

Incidence

- 1960s: 1 in 30,000 deliveries
- 1985 – 1994: 1 in 2,510 deliveries
- 1982 – 2002: 1 in 533 deliveries
- 2000 – 2010: 1 in 333 deliveries!

Miller, et al. *AJOG*. 1997; 177:210

Wu, et al. *AJOG*. 2005; 192:1458

Pub Committee SFMFM; Belfort, *Am J Obstet Gynecol.* 2010; 430-8

Placenta Accreta

Risk Factors

PREVIA

- Cesarean delivery
- Cesarean delivery
- Cesarean delivery
- Cesarean delivery
- Cesarean delivery
- Cesarean delivery

PARITY

Methods

- Prospective observational cohort
- MFMU
- 19 Academic medical centers
- 4 years (1999 – 2002)
- Daily ascertainment of CD
- Trained study nurses
- 378,168 births / 57,068 CDs
- No labor – 30,132 CDs

Silver, et al. *Ob Gyn.* 2006; 107:1226

Placenta Accreta

Number of Cesareans	N	Accreta
1	6,195	15 (0.2%)
2	15,805	49 (0.3%)
3	6,326	36 (0.6%)
4	1,475	31 (2.1%)
5	260	6 (2.3%)
6 or more	89	6 (6.7%)

Silver, et al. *Ob Gyn.* 2006; 107:1226

Placenta Accreta

Number of Cesareans	Previa	Accreta
1	397	13 (3.3%)
2	212	23 (11%)
3	72	29 (40%)
4	33	20 (61%)
5	6	4 (67%)
6 or more	3	2 (67%)

Silver, et al. *Ob Gyn.* 2006; 107:1226

Placenta Accreta

Clinical Outcomes (76 cases)

- Maternal ICU admission: 18 (26%)
- Blood transfusion: 56 (82%)
- ≥ 4 Unit blood transfusion: 27 (40%)
- Coagulopathy: 20 (29%)
- Ureteral injury: 3 (4%)
- Infections: 18 (26%)
- Reoperation: 6 (9%)

Eller, et al. *Br J Obstet Gynecol.* 2009; 116:648-54

Placenta Accreta

C-Hyst: Morbid Business

Reported outcomes w Accreta Spectrum

Transfusion of 4+ U PRBC	39-79%
Coagulopathy	17-29%
Ureteral injury	1-8%
Bowel Injury	1%
ICU Admission	15-30%
Venous thromboembolism	2-10%
Abdomino-pelvic infection	5-8%
Reoperation	2-13%
Fistula	2-3%
Death	0.5%
Loss of uterus	100%

Composite :

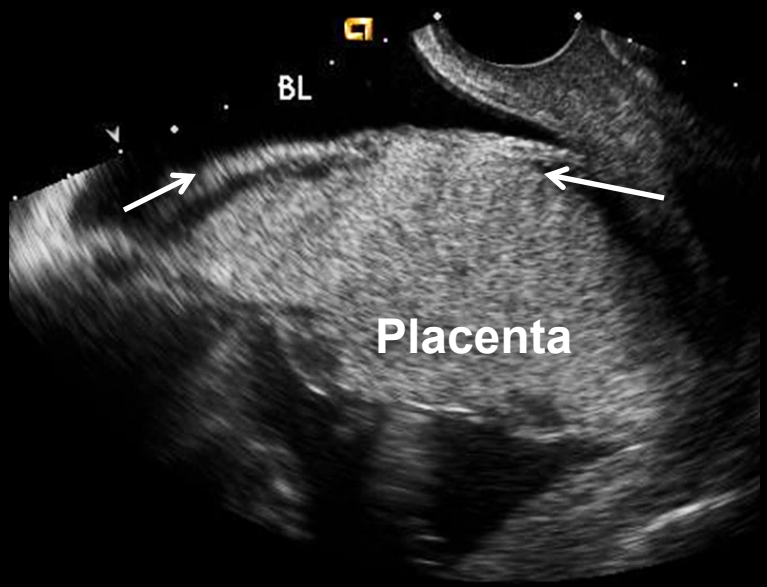
18-51%

Placenta Accreta
Diagnosis

- Antepartum
  - Clinical
  - Ultrasound
  - Magnetic Resonance Imaging
  - Biomarkers
- Postpartum
  - Histology

Placenta Accreta

- Placenta previa
- Multiple placental lacunae
  - 80-93% sensitive
- Loss of retroplacental hypoechoic zone
  - 7-52% sensitive
  - 21% false positive rate
- Decreased retroplacental myometrial thickness
  - <1 mm
- Abnormal bladder interface
- Placenta beyond uterine serosa



Placenta Accreta

Ultrasound Diagnosis

- In patients at risk for accreta and combining multiple criteria:
  - Decent sensitivity and specificity
  - Fair PPV
  - Pretty good NPV
- *But it can't tell me whether or not to attempt placental removal!!*

Placenta Accreta

MRI Diagnosis

- Best MRI signs: T2 hypointense placental bands, a focally interrupted myometrial border, infiltration of the pelvic organs (duh), and tenting of the bladder
- Accuracy probably similar to ultrasound
- May be useful with posterior accreta
- Expensive and less available
- ***But it can't tell me whether or not to attempt placental removal!!***

Placenta Accreta

Management

What to Do Depends Upon the Case

- 4 prior cesareans; major (complete/central) placenta previa; imaging findings c/w accreta
- 3 prior cesareans; major placenta previa; imaging findings show percreta into broad ligament

CURRENT MANAGEMENT:
Appropriate counseling of patient
Scheduled C-hyst with C-hyst team
Type and crossed for major hemorrhage
4-5 hours in OR expected
Planned ICU admission post op

Placenta Accreta

Management

What to Do Depends Upon the Case

- 2 prior cesareans; anterior, low-lying placenta with several imaging findings c/w small area of accreta (but not percreta)
- 1 prior cesarean; major placenta previa; imaging findings c/w accreta (but not percreta)

?

Placenta Accreta

Management Controversies

- Pre-op ureteral stent placement
- Internal iliac / uterine artery ligation
- Internal iliac balloon placement / occlusion
- Lower aorta balloon placement / occlusion

Placenta Accreta

Conservative Management

- Preserve fertility and avoid hysterectomy
- Placenta left *in situ*
- Embolization of internal iliac vessels

Placenta Accreta
Conservative Management

With Placenta Accreta, Including Placenta Percreta

Characteristic	Placenta Accreta, Including Percreta (n=167)
Hysterotomy (n=139)	
Fundal	71 (51.1)
Low transverse	68 (48.9)
Placenta left in situ	167 (100)
Partially	99 (59.3)
Entirely	68 (40.7)
Preoperative ureteric stent placement	6 (3.6)
Uterotonic administration	167 (100)
Primary postpartum hemorrhage	86 (51.5)
No additional uterine devascularization procedure	58 (34.7)
Additional uterine devascularization procedure	109 (65.3)
Pelvic arterial embolization*	62 (37.1)
Vessel ligation*	45 (26.9)
Stepwise uterine devascularization	15 (9.0)
Hypogastric artery ligation	23 (13.8)
Stepwise uterine devascularization and hypogastric artery ligation	7 (4.2)
Uterine compression suture*	16 (9.6)
Balloon catheter occlusion	0
Methotrexate administration	21 (12.6)

Data are n (%).
* The total number of additional uterine devascularization procedures exceeds the number of patients because some patients had more than one such procedure.

Multicenter, retrospective study of conservative management of placenta accreta in 167 women in 25 French university hospitals 1993-2007

Median number of cases 3 (1-46)

Sentilhes, et al. *Obstetrics & Gynecology. 2010;* 115: 526-534.

Placenta Accreta

Conservative Management

Characteristic	Number of Cases (%)
Success of conservative management	131 (78.4%)
Primary hysterectomy	18 (10.8%)
Delayed hysterectomy	18 (10.8%)
Transfusion	70 (41.9%)
More than 5 units	25 (15%)
ICU care	43 (25.7%)
Sepsis	7 (4.2%)
Infection	47 (28.1%)
VTE	3 (1.8%)
Any severe maternal morbidity or death	10 (6.0%)

Sentilhes, et al. *Obstet Gynecol. 2010;* 115: 526-534

Placenta Accreta

Conservative Management with Pelvic Artery Embolization

- Success rates of ~80% reported
  - But at least 20% of cases require hysterectomy
  - Higher rates (40%) in some case series
- Return of menses in ~60% of successful cases
- Postembolization syndrome
  - Nausea, malaise fever for 2-7 days

(1) Suspected Accreta

Randomization

- Planned C-hyst
- In Situ Management

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(2) Suspected Accreta w/ serosal invasion

Randomization

- Planned C-hyst
- Interval C-hyst

Interventions (RCT 1)

In situ Expectant

1. Laparotomy
2. Classical C/S
3. Placenta left in place
4. Postop UAE
5. Postop Abx
6. Inpatient observation
7. Outpatient observation

+/- interval resection

Planned C-Hyst

1.Laparotomy
2.Classical C/S
3.Placenta left in place
4.Hysterectomy

+/- uterotonics
+/- ureteral stents
+/- art. occlusion/ligation
+/- postop UAE

Interventions (RCT 2)

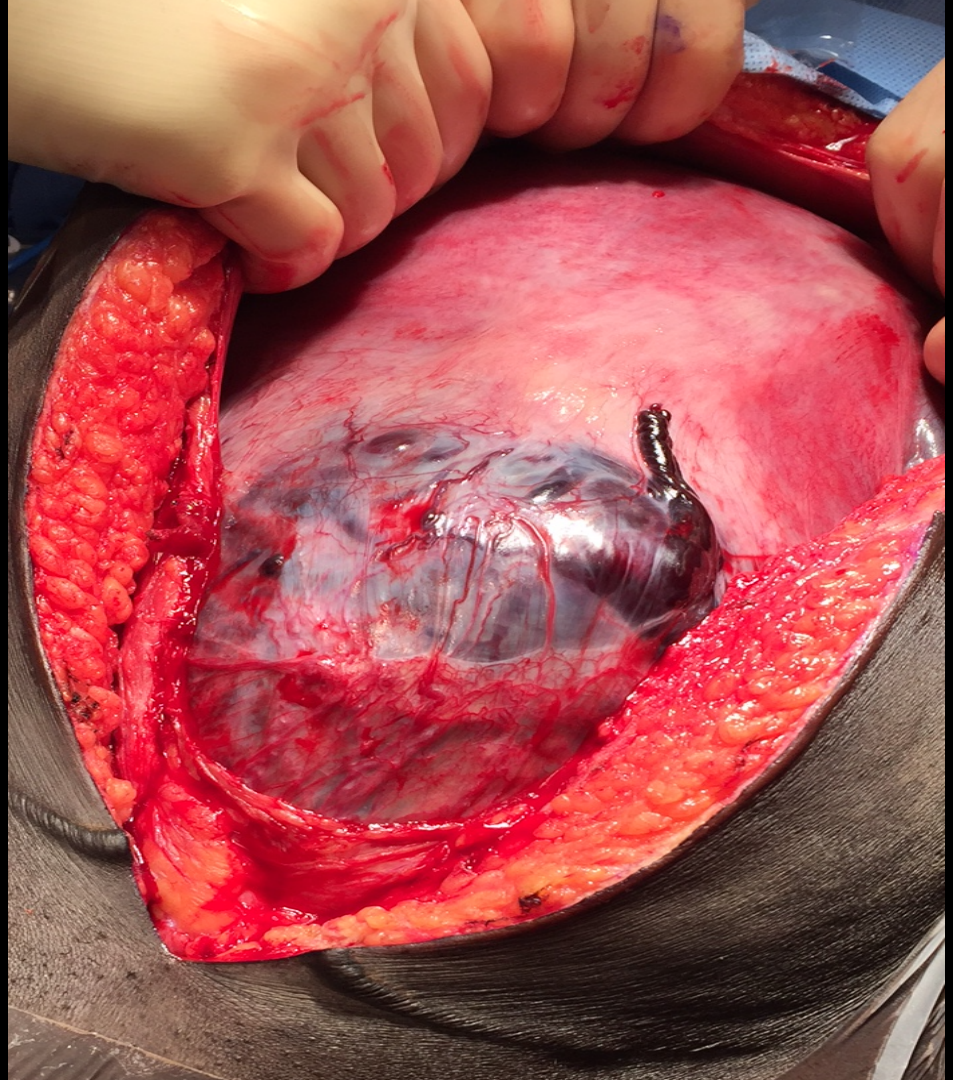
Interval C-Hyst

1. Laparotomy
2. Classical C/S
3. Placenta left in place
4. Postop UAE
5. Postop Abx
6. Inpatient observation
7. Interval hysterectomy, at 2-5 days

Planned C-Hyst

1. Laparotomy
2. Classical C/S
3. Placenta left in place
4. Hysterectomy

+/- uterotonics
+/- ureteral stents
+/- art. occlusion/ligation
+/- postop UAE



Placental Contribution to Obstetric Hemorrhage

- a priori risk stratification → intervention(s) → improved outcomes?
- Is bleeding from abruption qualitatively different?
  - Partial concealment / large surface area
  - Marked increase in local activating factors, e.g., placental TF, VEGF

Placental Contribution to Obstetric Hemorrhage

- Better emergency and intraoperative management?
  - Dedicated obstetric hemorrhage team and resources
  - Massive transfusion protocol
  - Focused intra-crisis laboratory methodology
    - Thromboelastography / -ometry
  - Targeted blood product utilization

Placental Contribution to Obstetric Hemorrhage

- What influences or mediates placental location and invasiveness?