PPH in the Universe of Childbirth

"Cutting-edge advances in the medical management of obstetrical hemorrhage"

R Nussbaum, DO, N Takawira, MD, - Dept of Anesthesia Texas Tech – El Paso, Texas

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PPH in the Universe of Childbirth

"Cutting-edge advances in the medical management of obstetrical hemorrhage"

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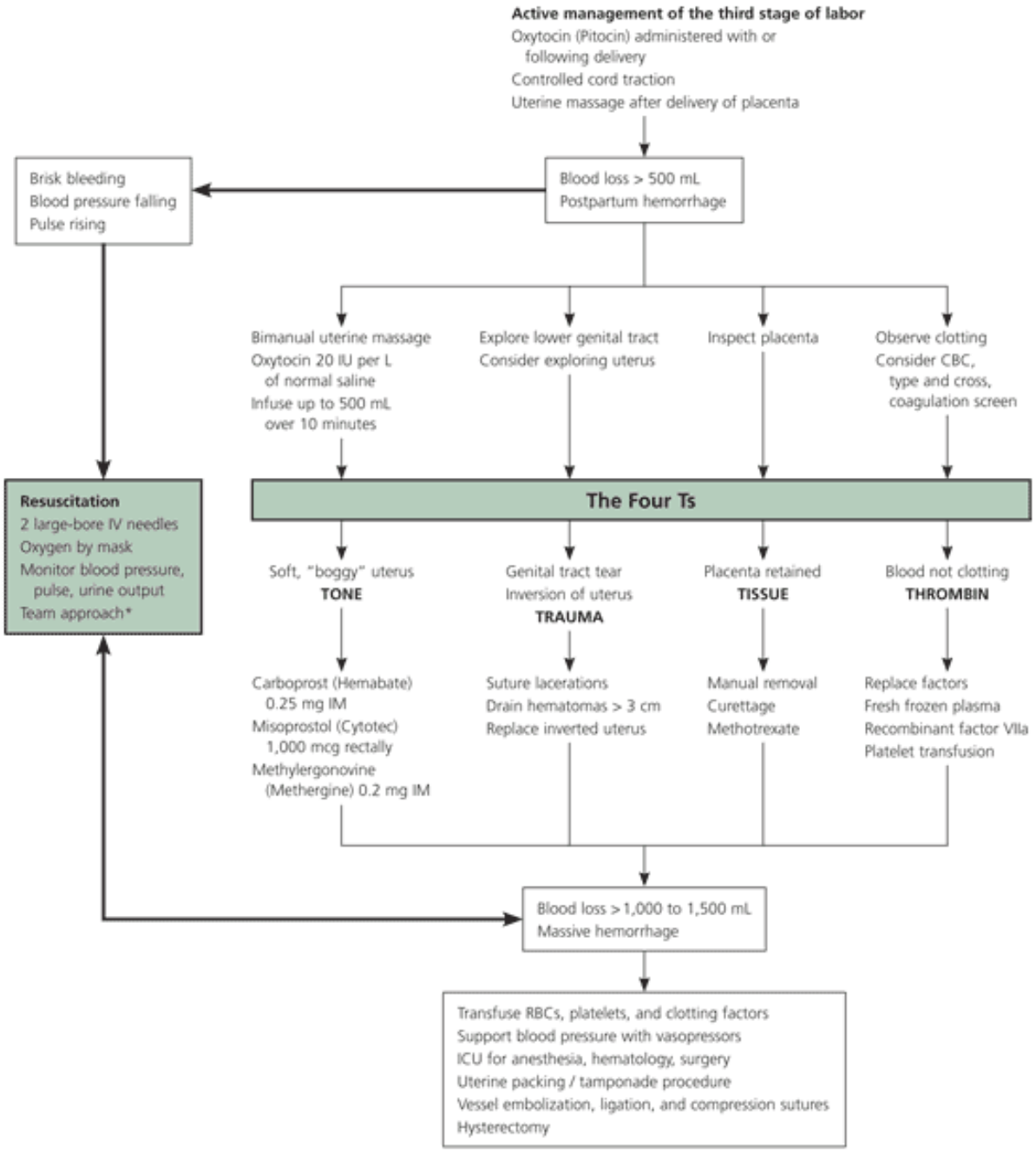
1. Stats
2. Blood Loss
3. Causes
4. Prediction
5. Timing
6. WHO – Normal
7. Referral - OB Hemorrhage Ready Center
    1. Mass Transfusion
    2. Cell Salvage
    3. Vascular Interventions
    4. Critical Care
    5. *Effective Communications*

Priorities in Obstetrical Hemmorhage

- 1 Maternal Salvage
- 2 Fetal Salvage
- 3 Fertility Salvage
- 4 Uterine Salvage

Management of Postpartum Hemorrhage



STATS

TABLE 1

The "Four Ts" Mnemonic Device for Causes of Postpartum Hemorrhage

Four Ts	*Cause*	*Approximate incidence (%)*
Tone	Atonic uterus	70
Trauma	Lacerations, hematomas, inversion, rupture	20
Tissue	Retained tissue, invasive placenta	10
Thrombin	Coagulopathies	1

WHO
WORLD HEALTH ORGANIZATION

WHO

- Diagnosis
- Management Atonic PPH
- Management Retained Placenta
- Choice of Fluid for replacement or resuscitation
- Health Systems and Organizational interventions
- PPH care pathways

Care pathways for Postpartum haemorrhage and retained placenta

World Health Organization

Make initial assessment and start basic treatment

- ✓ Call for help
- ✓ Assess airway, breathing, and circulation (ABC)
- ✓ Provide supplementary oxygen
- ✓ Obtain an intravenous line
- ✓ Start fluid replacement with intravenous crystalloid fluid
- ✓ Monitor blood pressure, pulse and respiration
- ✓ Catheterize bladder and monitor urinary output
- ✓ Assess need for blood transfusion
- ✓ Order laboratory tests:
  - complete blood count
  - coagulation screen
  - blood grouping and cross

Temporizing and transfer interventions

Be ready at all times to transfer to a higher-level facility if the patient is not responding to the treatment or a treatment cannot be administered at your facility.

Start intravenous oxytocin infusion and consider:
- uterine massage;
- bimanual uterine compression;
- external aortic compression; and
- balloon or condom tamponade.

Transfer with ongoing intravenous uterotonic infusion. Accompanying attendant should rub the woman's abdomen continuously and, if necessary, apply mechanical compression.

Observe factors related to bleeding and determine cause

Uterine atony: uterus soft and relaxed

Treat for uterine atony
- Uterine massage
- Uterotonic drugs:
  - Oxytocin
  - Ergometrine
  - Prostaglandins
    - Misoprostol
    - Prostaglandin F2α

If bleeding continues
- Nonsurgical uterine compression:
  - Bimanual uterine compression
  - Balloon or condom tamponade
- Tranexamic acid

If bleeding continues
- Compression sutures
- Artery ligation (uterine, hypogastric)
- Uterine artery embolization

If bleeding continues
- Hysterectomy
- If intra-abdominal bleeding occurs after hysterectomy, consider abdominal packing

Placenta not delivered

Treat for whole retained placenta
- Oxytocin
- Controlled cord traction
- Intraumbilical vein injection (if no bleeding)

If whole placenta still retained
- Manual removal with prophylactic antibiotics

Placenta delivered incomplete

Treat for retained placenta fragments
- Oxytocin
- Manual exploration to remove fragments
- Gentle curettage or aspiration

If bleeding continues
- Manage as uterine atony

Lower genital tract trauma: excessive bleeding or shock contracted uterus

Treat for lower genital tract trauma
- Repair of tears
- Evacuation and repair of haematoma

If bleeding continues
- Tranexamic acid

Uterine rupture or dehiscence: excessive bleeding or shock

Treat for uterine rupture or dehiscence
- Laparotomy for primary repair of uterus
- Hysterectomy if repair fails

If bleeding continues
- Tranexamic acid

Uterine inversion: uterine fundus not felt abdominally or visible in vagina

Treat for uterine inversion
- Immediate manual replacement
- Hydrostatic correction
- Manual reverse inversion (use general anaesthesia or wait for effect of any uterotonic to wear off)

If treatment not successful
- Laparotomy to correct inversion

If laparotomy correction not successful
- Hysterectomy

Clotting disorder: bleeding in the absence of above conditions

Treat for clotting disorder
- Treat as necessary with blood products

Drugs and dosages

Oxytocin – treatment of choice
- 20–40 IU in 1 litre of intravenous fluid at 60 drops per minute, and 10 IU intramuscularly
- **Continue** oxytocin infusion (20 IU in 1 litre of intravenous fluid at 40 drops per minute) until haemorrhage stops

Ergometrine – if oxytocin is unavailable or bleeding continues despite oxytocin
- 0.2 mg intramuscularly or intravenously (slowly), or Syntometrine® 1 ml
- **After** 15 minutes, repeat ergometrine 0.2 mg intramuscularly
- **If required**, administer 0.2 mg intramuscularly or intravenously (slowly) every 4 hours
- **Do not exceed** 1 mg (or five 0.2 mg doses)

Prostaglandins – if oxytocin or ergometrine are unavailable or bleeding continues despite oxytocin and ergometrine

Misoprostol:
- 200–800 µg sublingually
- **Do not exceed** 800 µg

Prostaglandin F2α:
- 0.25 mg intramuscularly
- Repeat as needed every 15 minutes 0.25 mg intramuscularly
- **Do not exceed** 2 mg (or eight 0.25 mg doses)

Tranexamic acid
- 1 g intravenously (taking 1 minute to administer)
- **If bleeding continues**, repeat 1 g after 30 minutes

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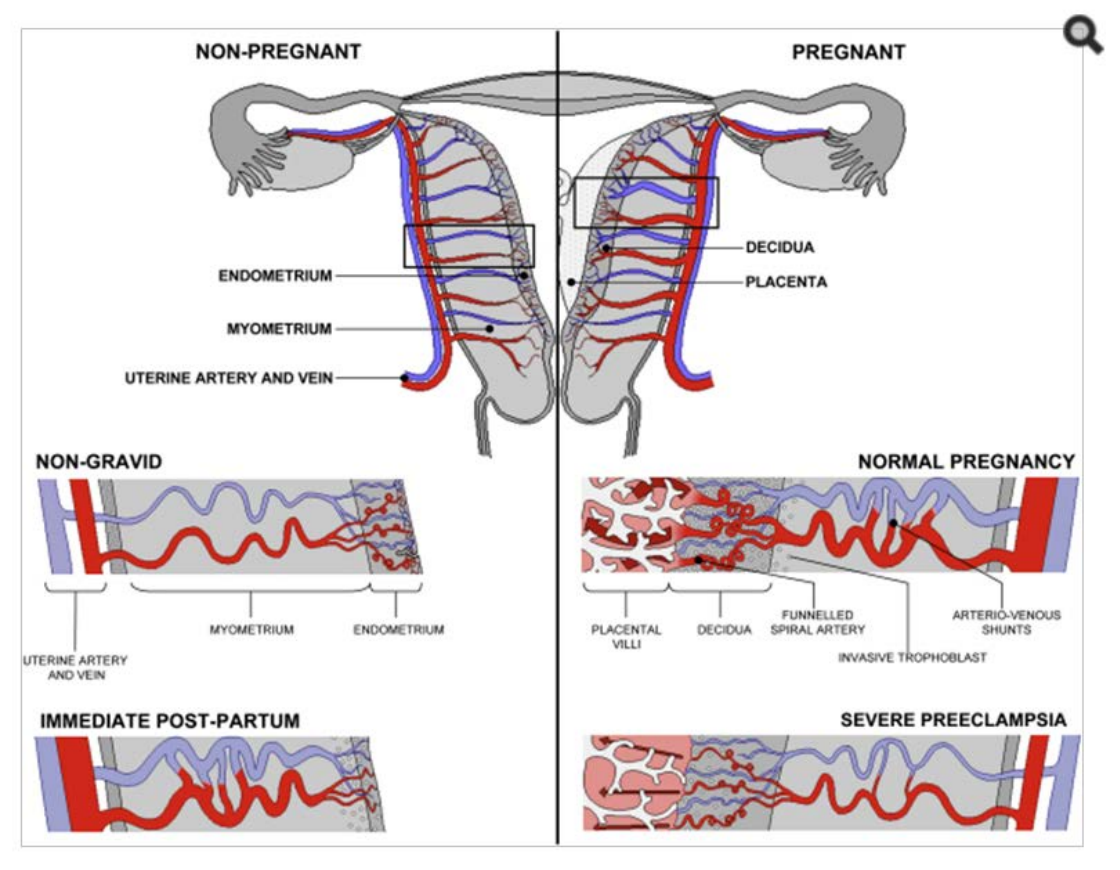
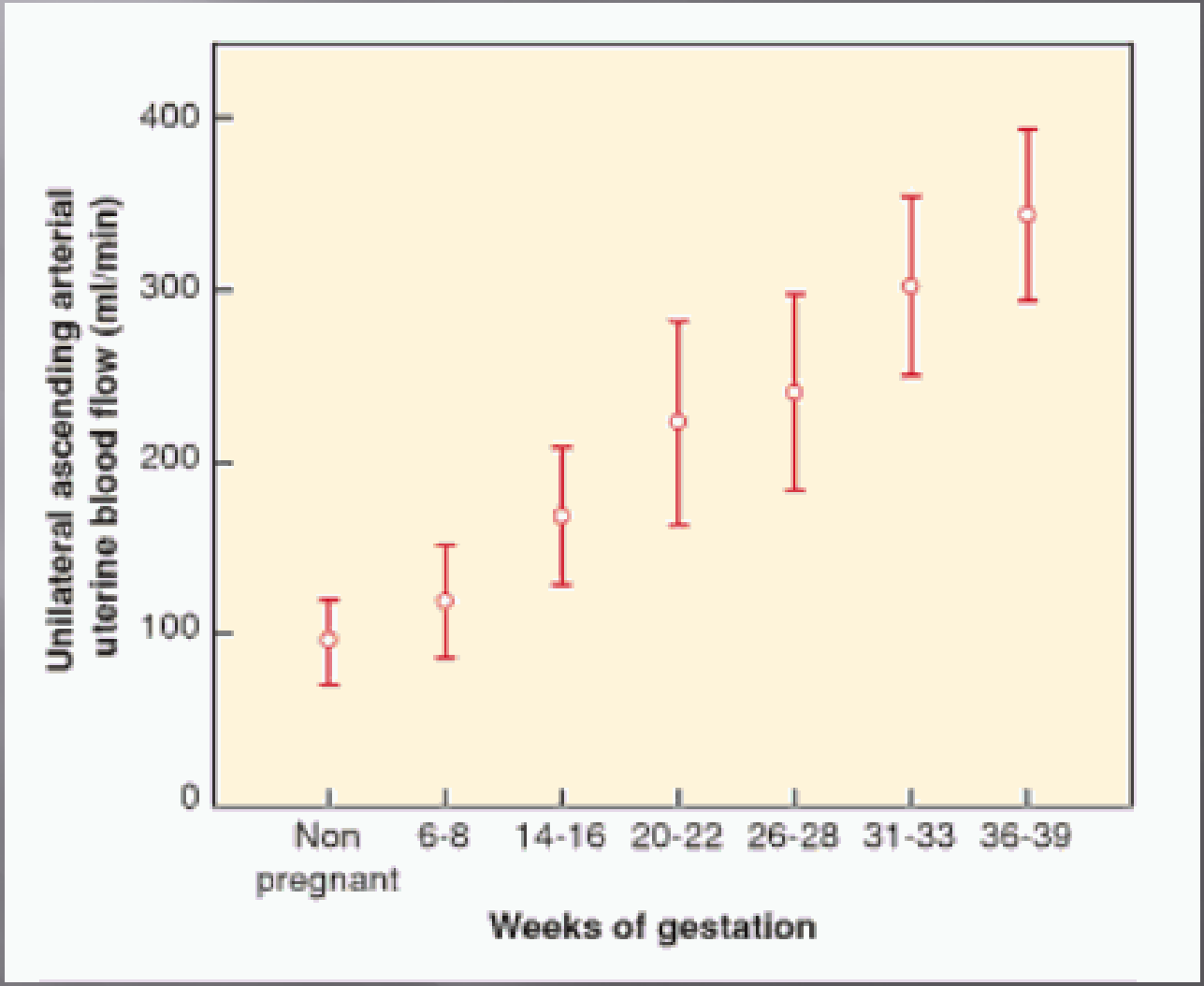
Blood Flow and Cardiac Output



700-1000 ml/min blood flow



Tone

Uterine Atony

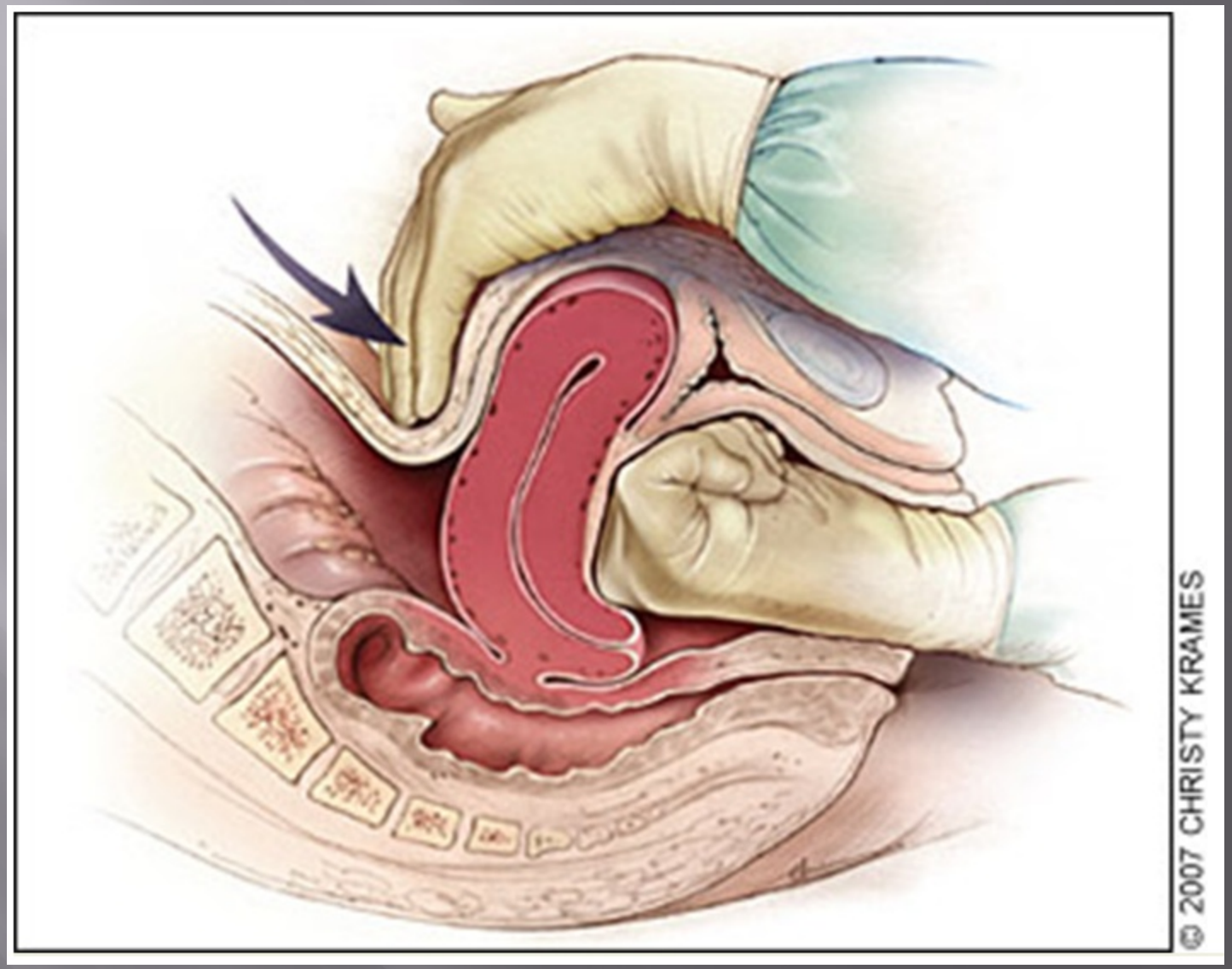
- No 1 cause 80% PPH
- Bladder distension> 80%
- Over distension of Uterus

  multiple gestations, polyhydraminos

  macrosomia

Chorioamonits

Drugs –Gen Anesthesia, Ephedrine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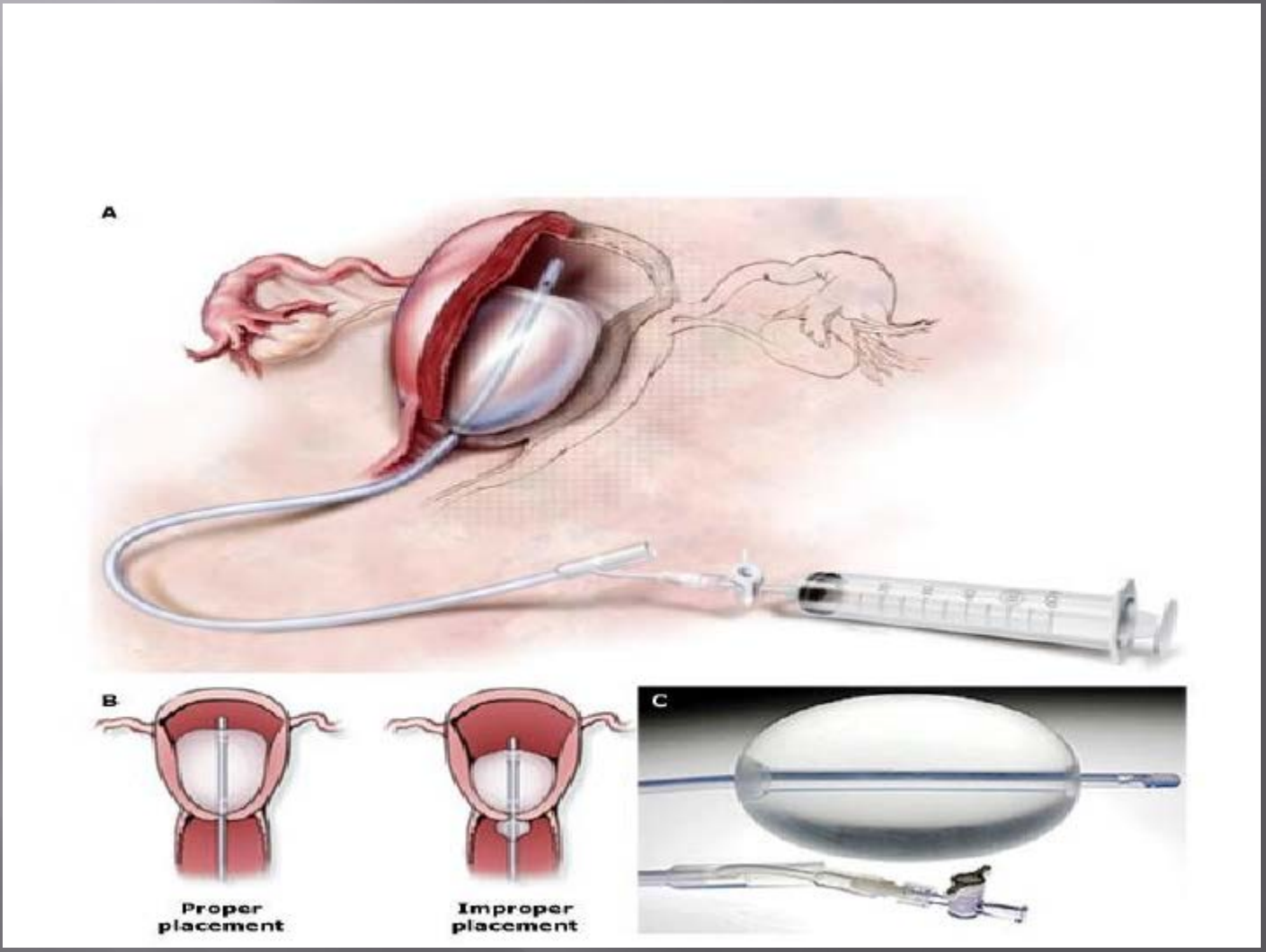
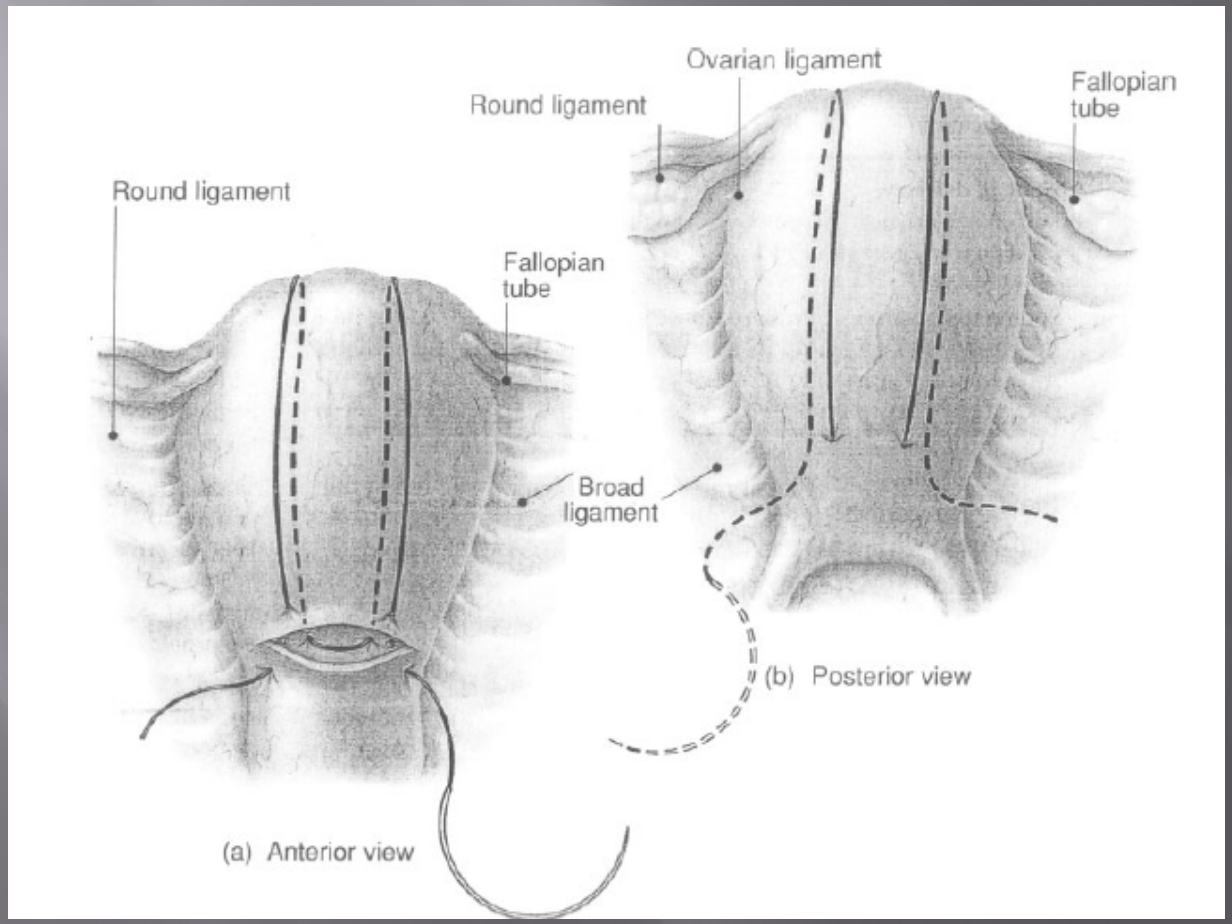
Invasive Treatments

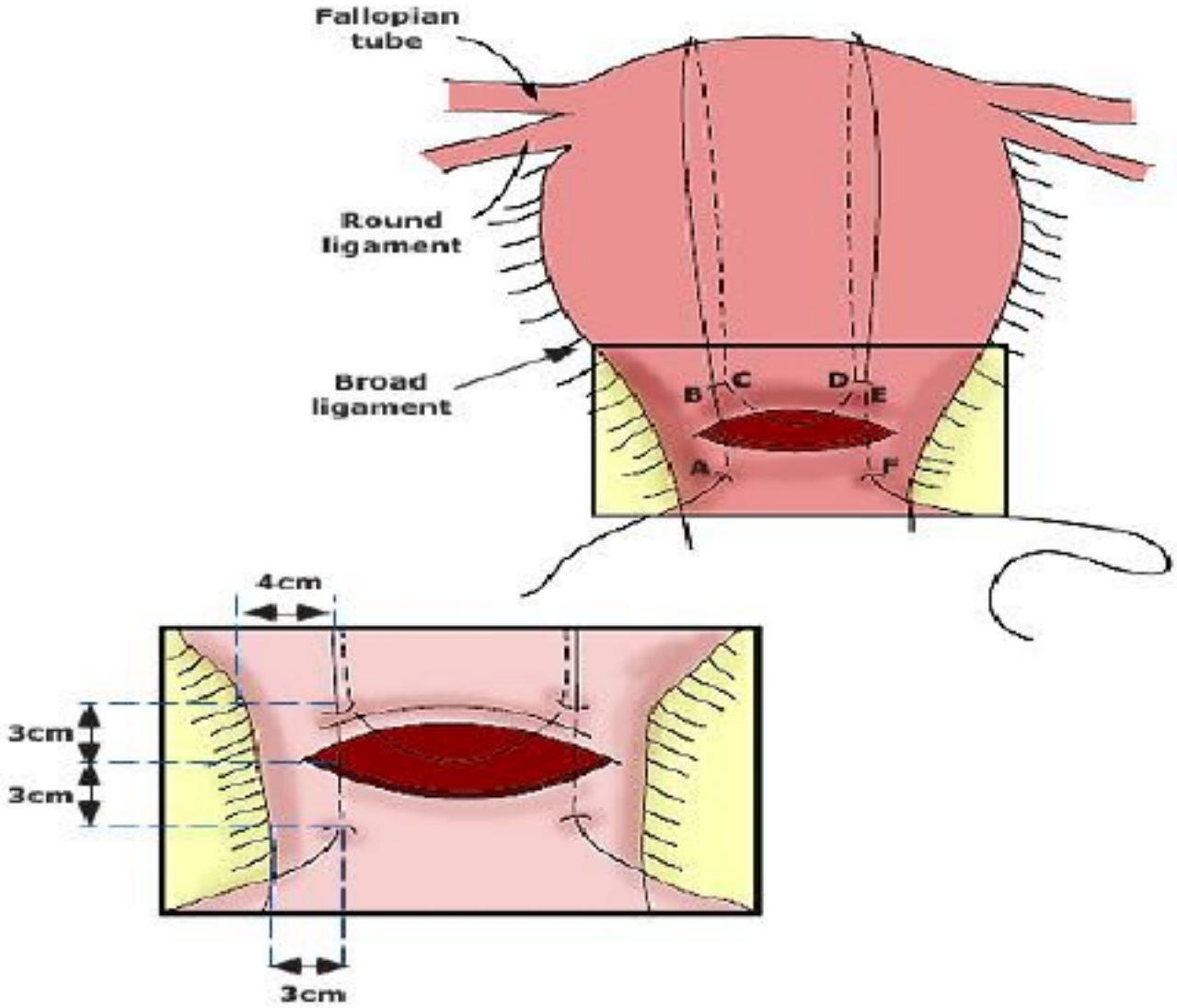
- Intrauterine Balloon
- Uterine Artery Ligation
- B-Lynch Suturing
- Uterine Artery Embolization
- Hysterectomy

Backri Balloon

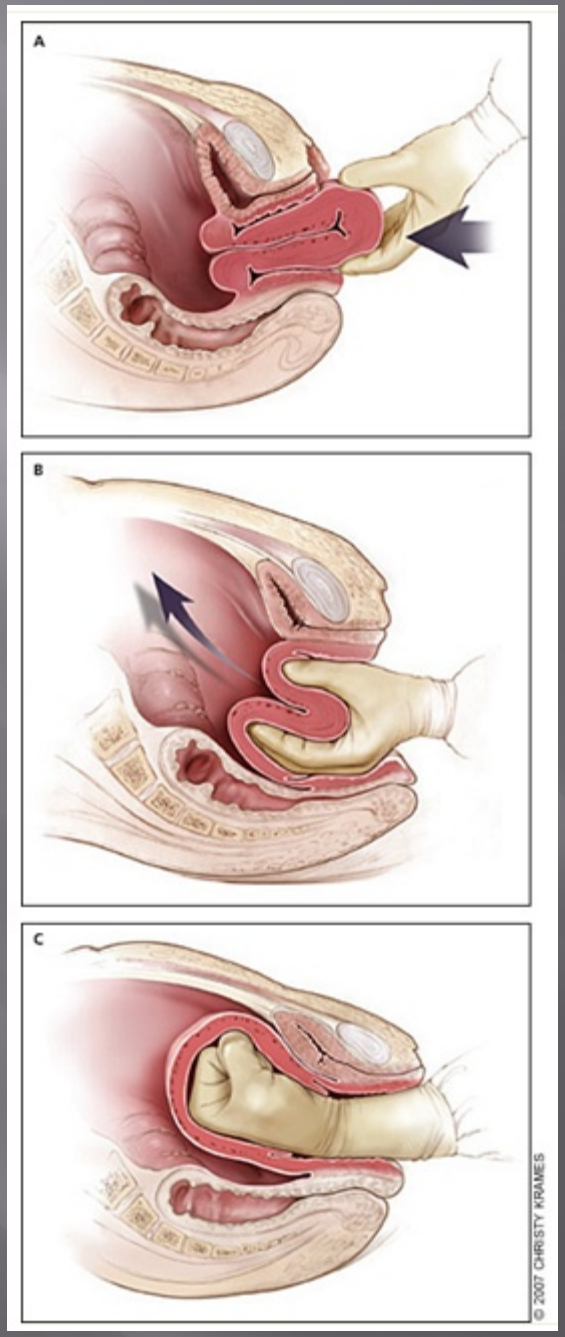


B-Lynch For Atony

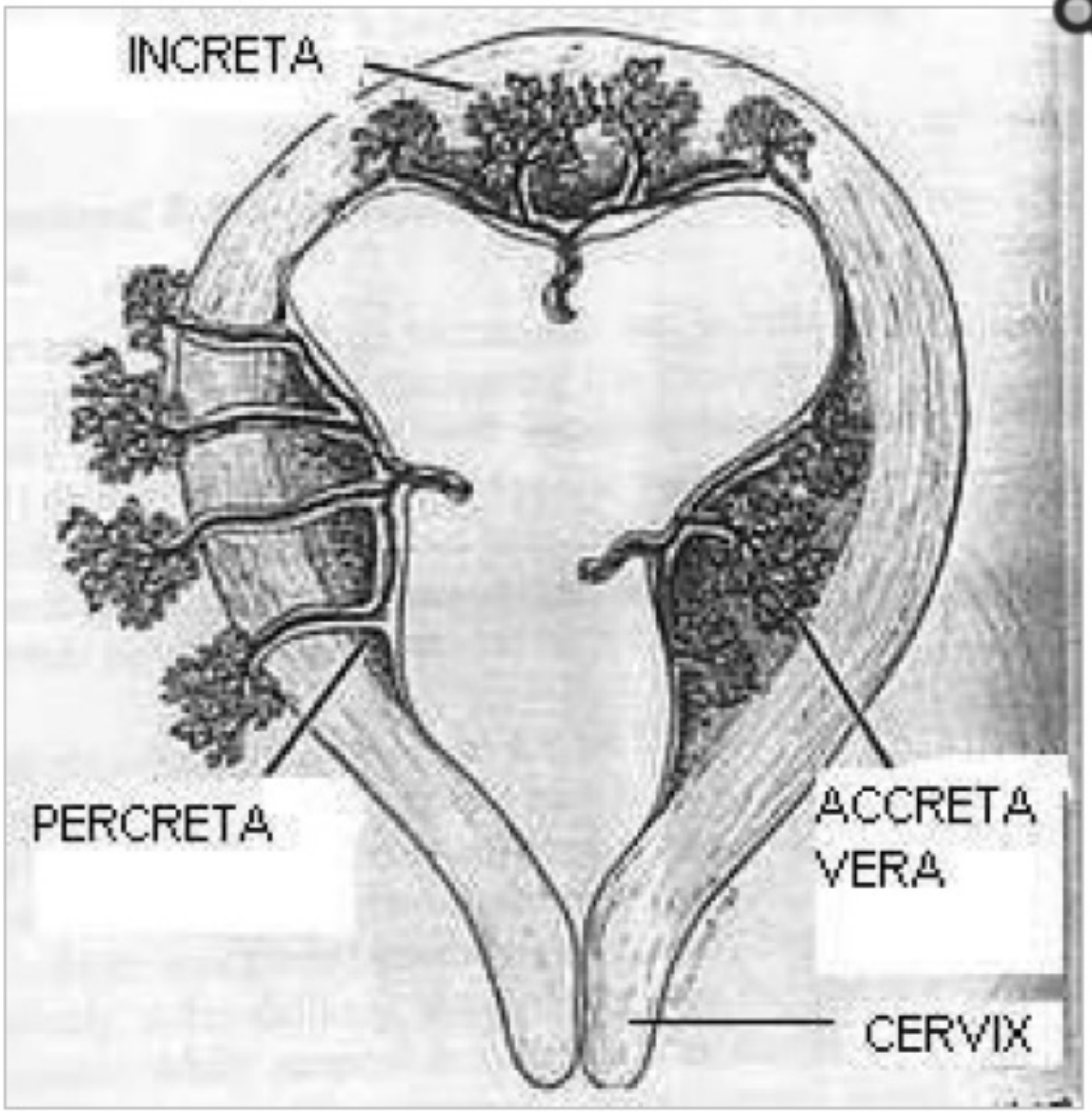



Fallopian tube
Round ligament
Broad ligament
A
B
C
D
E
F
4cm
3cm
3cm
3cm

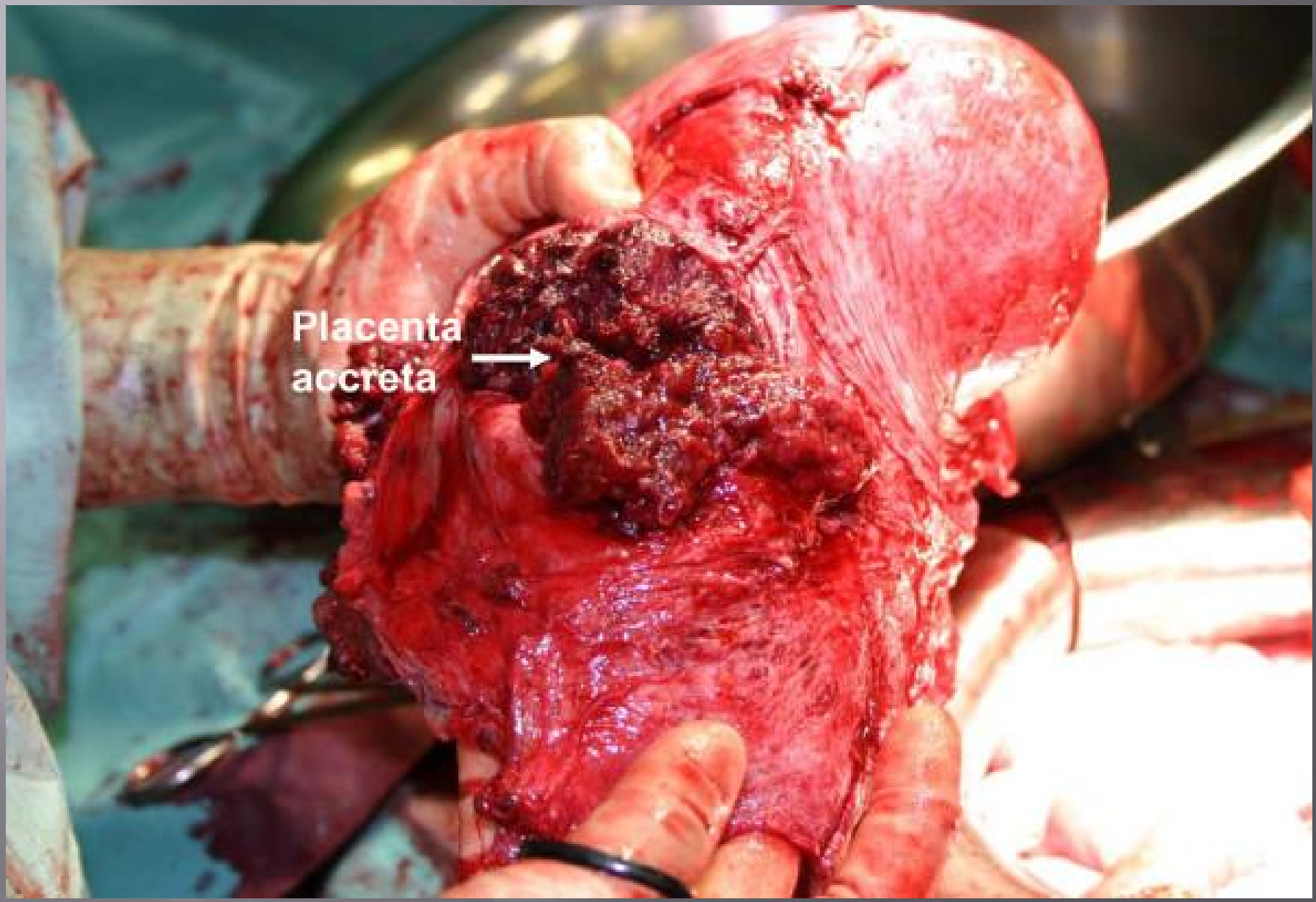
Trauma


A
B
C
© 2007 CHRISTY KRAMES

Tissue



Placenta accreta is classified according to the degree of invasion into the myometrium.


Placenta
accreta

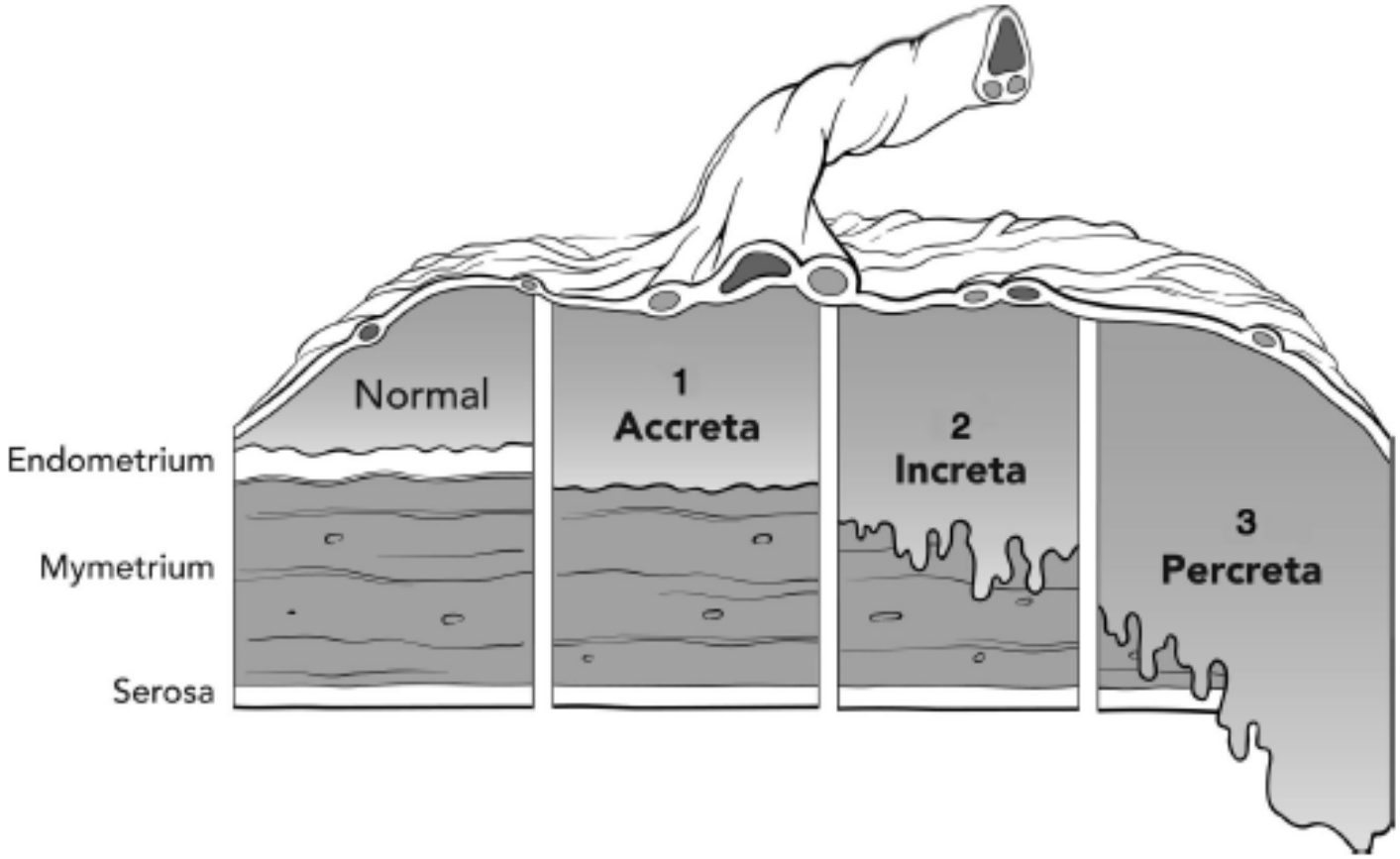
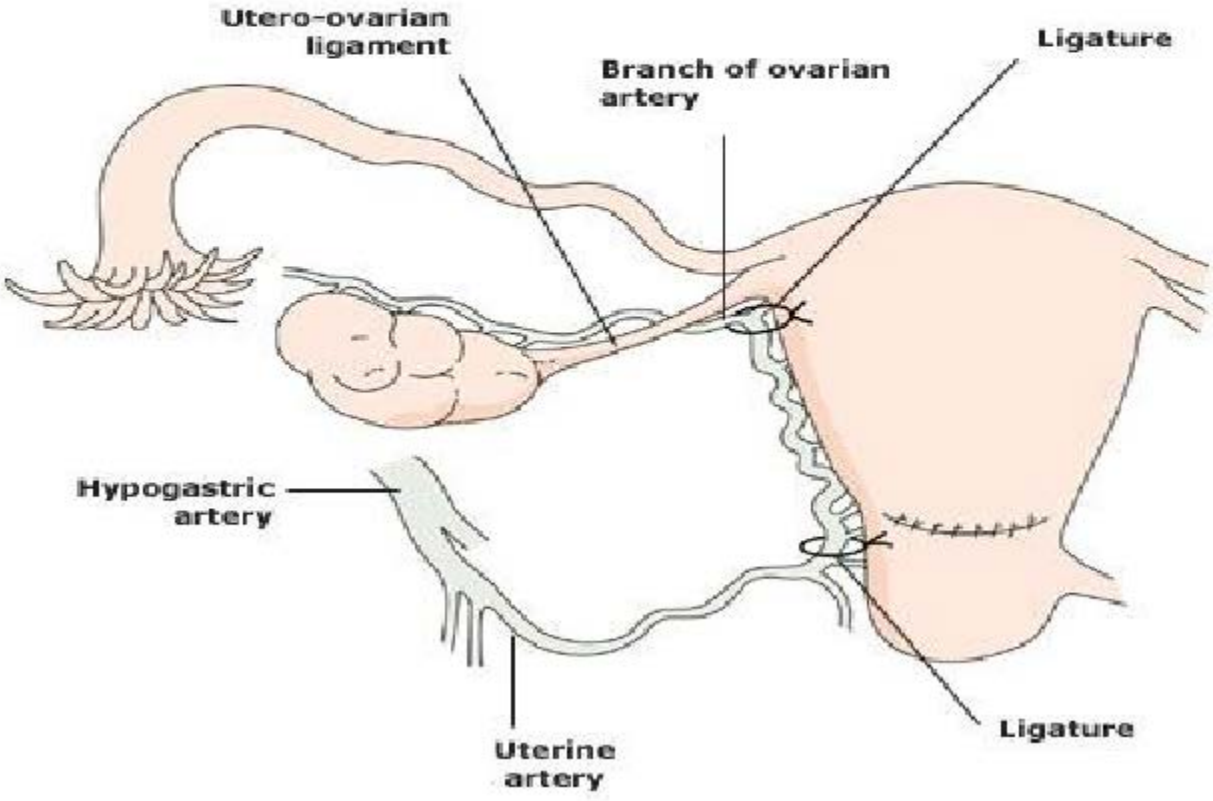


Fig. 3. Diagram of degrees of abnormal placental infiltration. (1) Placenta accreta is adherent to the myometrium. (2) Placenta increta invades the myometrium. (3) Placenta percreta extends beyond the uterine serosa and may invade any other organ.

Uterine Artery Ligation


Utero-ovarian ligament
Branch of ovarian artery
Ligature
Hypogastric artery
Uterine artery
Ligature

PREDICTION

Antepartum care

- Diagnosis
- Sonographic
- Magnetic resonance imaging

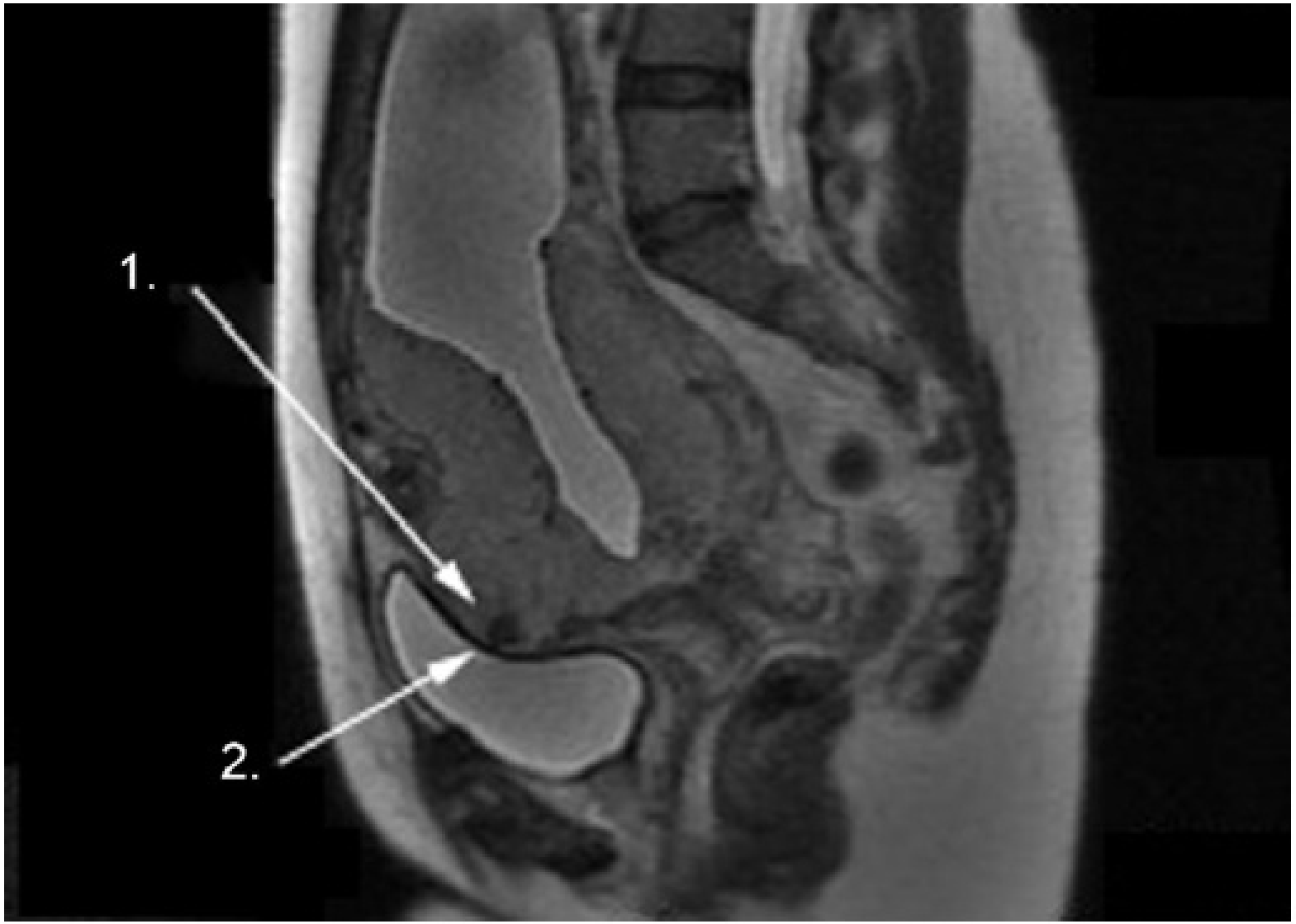


Fig. 2. MRI view of pregnant uterus with placenta accreta. Note heterogeneous placenta with lacunae (*1*). Placenta bulges into upper bladder surface (*2*).

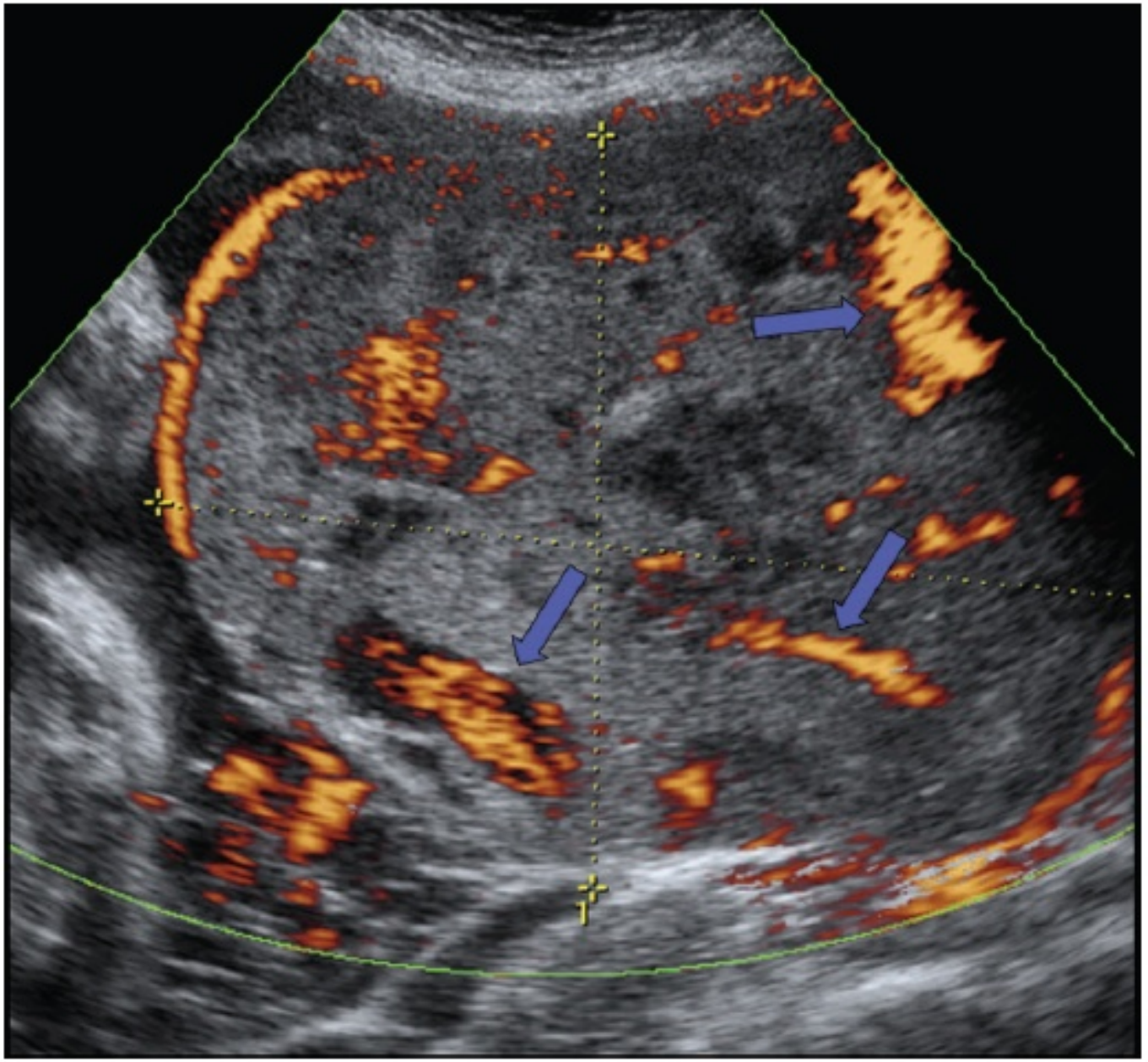
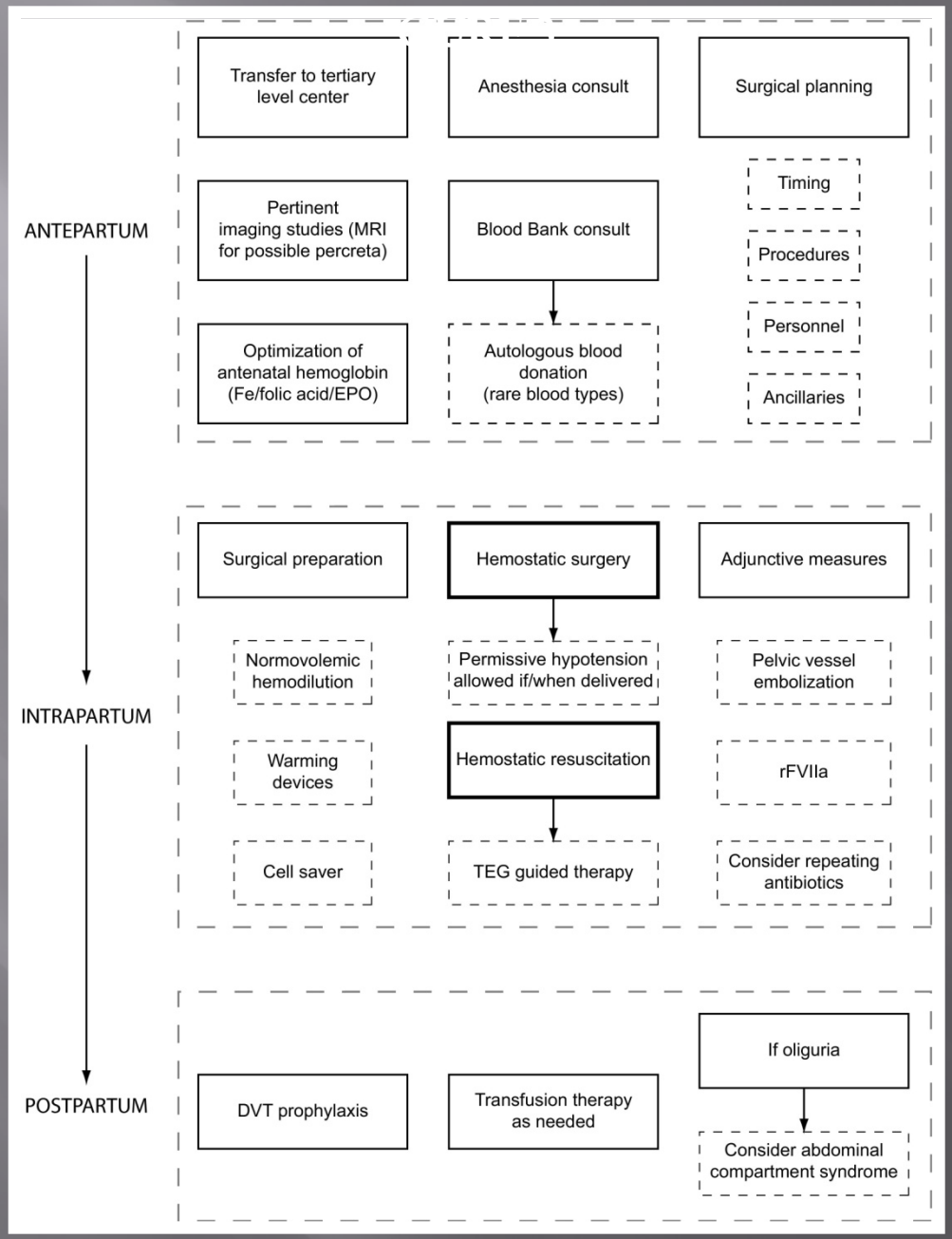


Fig. 1. Ultrasound view of placenta. Highly vascular placenta with prevalent placental lacunae is shown (*blue arrows*).

TIMING

Components of Care

- Early Diagnosis → Anticipation
  - Erythropoietin, Autologous Transfusion, ANH
- Mass Transfusion Protocol
  - Factor VIIa
- Coagulopathy
  - TEG, Rotem
- Interventional Radiology
  - Uterine Artery
    - Embolization vs. Balloon


ANTEPARTUM
Transfer to tertiary level center
Anesthesia consult
Surgical planning
Pertinent imaging studies (MRI for possible percreta)
Blood Bank consult
Timing
Procedures
Personnel
Ancillaries
Optimization of antenatal hemoglobin (Fe/folic acid/EPO)
Autologous blood donation (rare blood types)
INTRAPARTUM
Surgical preparation
Hemostatic surgery
Adjunctive measures
Normovolemic hemodilution
Permissive hypotension allowed if/when delivered
Pelvic vessel embolization
Warming devices
Hemostatic resuscitation
rFVIIa
Cell saver
TEG guided therapy
Consider repeating antibiotics
POSTPARTUM
DVT prophylaxis
Transfusion therapy as needed
If oliguria
Consider abdominal compartment syndrome

Antepartum care

Preoperative autologous blood donation

Timing of delivery

between 34 and 37 weeks

Advanced planning and interdisciplinary collaboration are fundamental

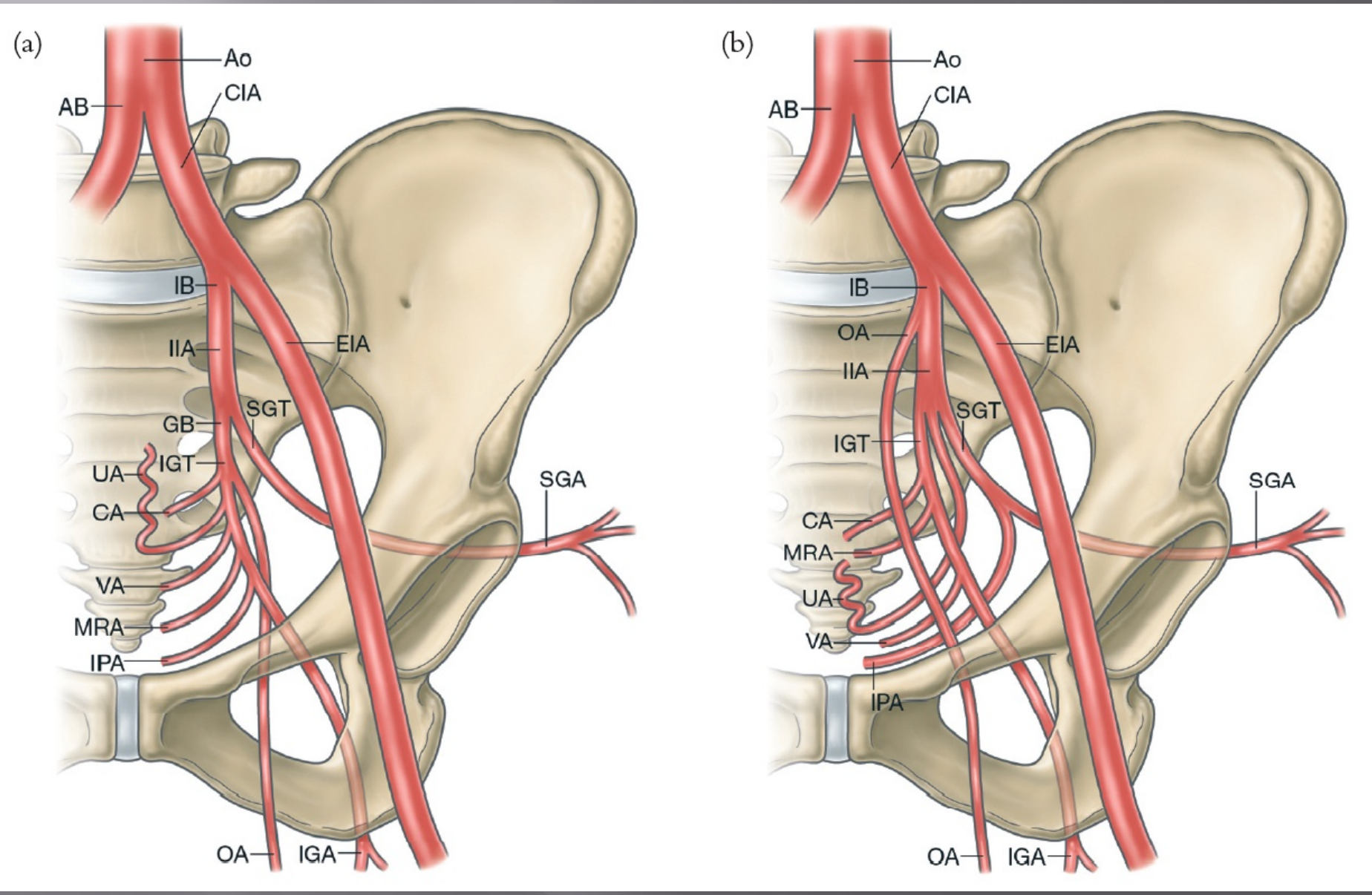
REFERRAL OB HEMORRHAGE READY CENTER

VASCULAR INTERVENTIONS

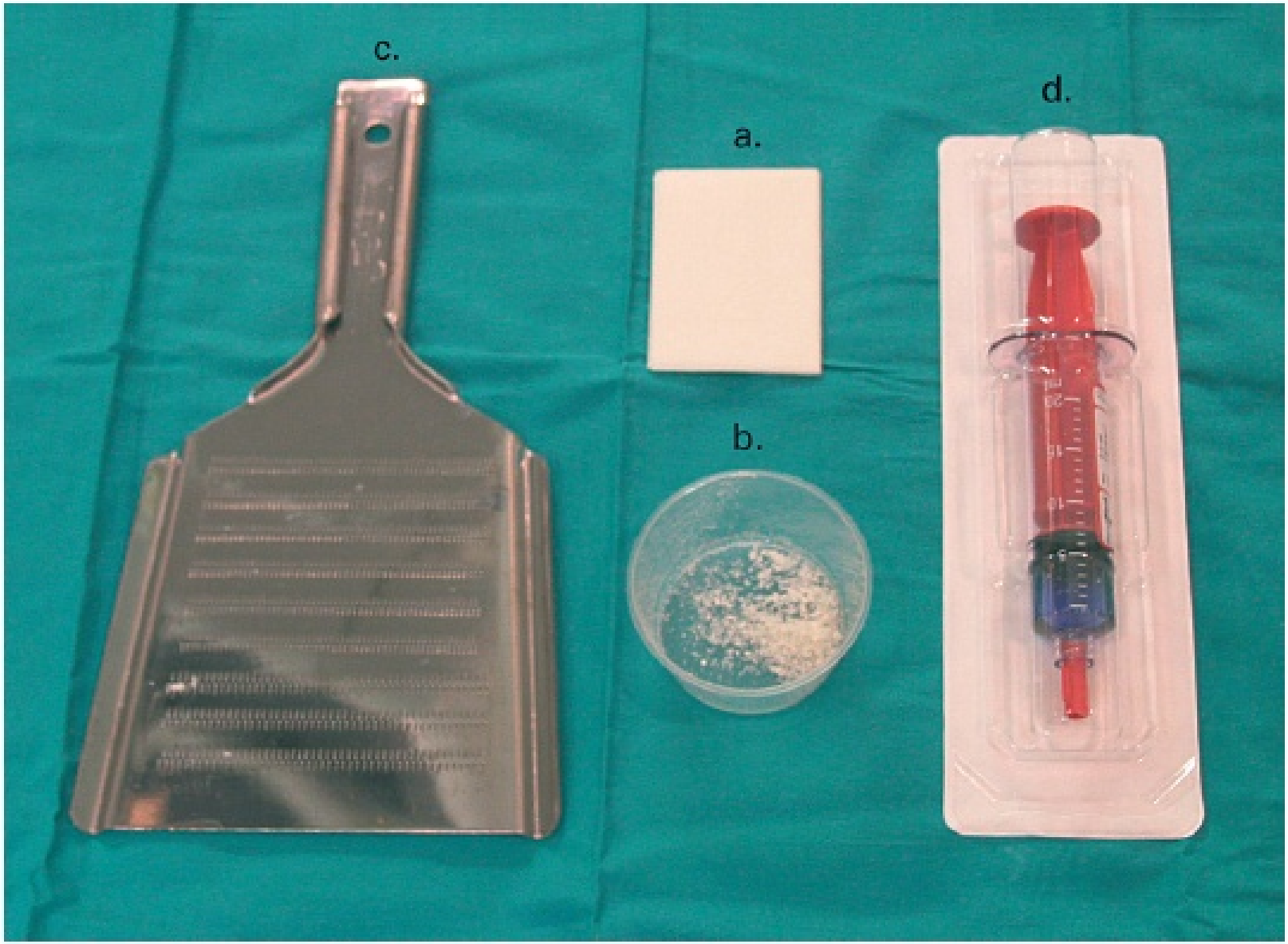
Preoperative bilateral common iliac artery balloon catheter

- Theoretically, balloon inflation leads to bilateral vessel occlusion, limiting blood loss
- Preoperative placement of femoral access by interventional radiology with selective embolization of uterine vessels at the time of delivery using polyvinyl alcohol, gel foam, or coils

Digital Subtraction Angiography


(a)
Ao
CIA
AB
IB
IIA
EIA
SGT
GB
IGT
UA
CA
SGA
VA
MRA
IPA
OA
IGA
(b)
Ao
CIA
AB
IB
OA
EIA
IIA
SGT
IGT
SGA
CA
MRA
UA
VA
IPA
OA
IGA

Embolization



BLOOD LOSS

- Immediate Death vs. **Early Death** during first 6 hours due to hemorrhage.
  - Damage Control Surgery for "Rapid Control of Bleeding"
  - Coagulopathy Risk Factors
    - ISS >25
    - Systolic Pressure < 75mm Hg
    - pH < 7.2
    - Core Temp < 34 degrees C

Transfusion Therapy

Classically

Crystalloids, PRBC.

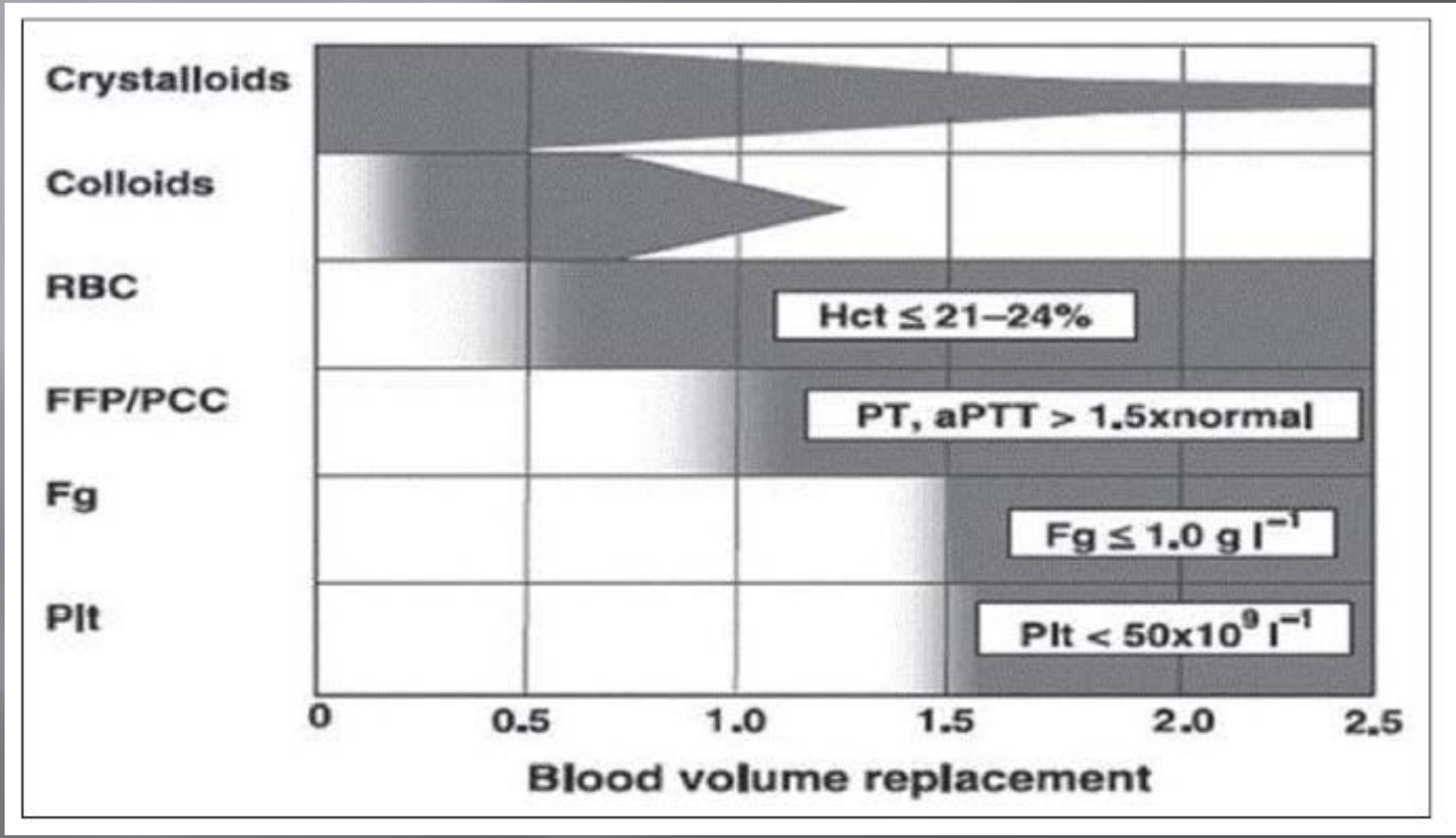
Use of other blood products FFP, cryoprecipitates, and platelets is indicated if hematologic parameters are abnormal (eg, platelet count <50,000/mm3, fibrinogen <100 mg/dL, prothrombin time [PT], or activated partial thromboplastin time [aPTT] >1.5 × normal).

Transfusion Therapy

Fails to prevent coagulopathy in massive bleedings

Frequently leads to dilution of clotting factors and platelets, leading to the so called “dilutional coagulopathy.”

Blood Volume Loss Transfusion Guide



Transfusion therapy

- *Hemostatic resuscitation*
- Limiting early aggressive crystalloid use and considering permissive hypotension
- Early administration of FFP and platelets ratio of 1:1:1
- Early use of rFVIIa?

Acute normovolemic hemodilution (ANH)

Patients should have a hemoglobin level above 10 g/dL and no history of cardiovascular disease. On average, 500-1000 mL whole blood may be collected and concurrently replaced with either colloid (1:1 ratio) or crystalloid (3:1 ratio) to maintain hemodynamic stability

MASS TRANSFUSION

Immediate Death vs. **Early Death** during first 6 hours due to hemorrhage.

- Damage Control Surgery for "Rapid Control of Bleeding"
- Coagulopathy Risk Factors
  - ISS >25 Body/Region Anatomical Scoring System
  - Systolic Pressure < 75mm Hg
  - pH < 7.2
  - Core Temp < 34 degrees C

Sequence for transfusing and approximate time needed for availability

Group O RBCs, AB plasma (O negative RBCs in women of child bearing potential)	Immediate (sometimes limited) availability
	No testing required
Type-specific products (e.g. B negative RBCs and FFP to B negative recipient)	5–10 min required
Cross-matched products	40 min or more

Predetermined blood product administration in massive transfusion in trauma victims. A sample protocol

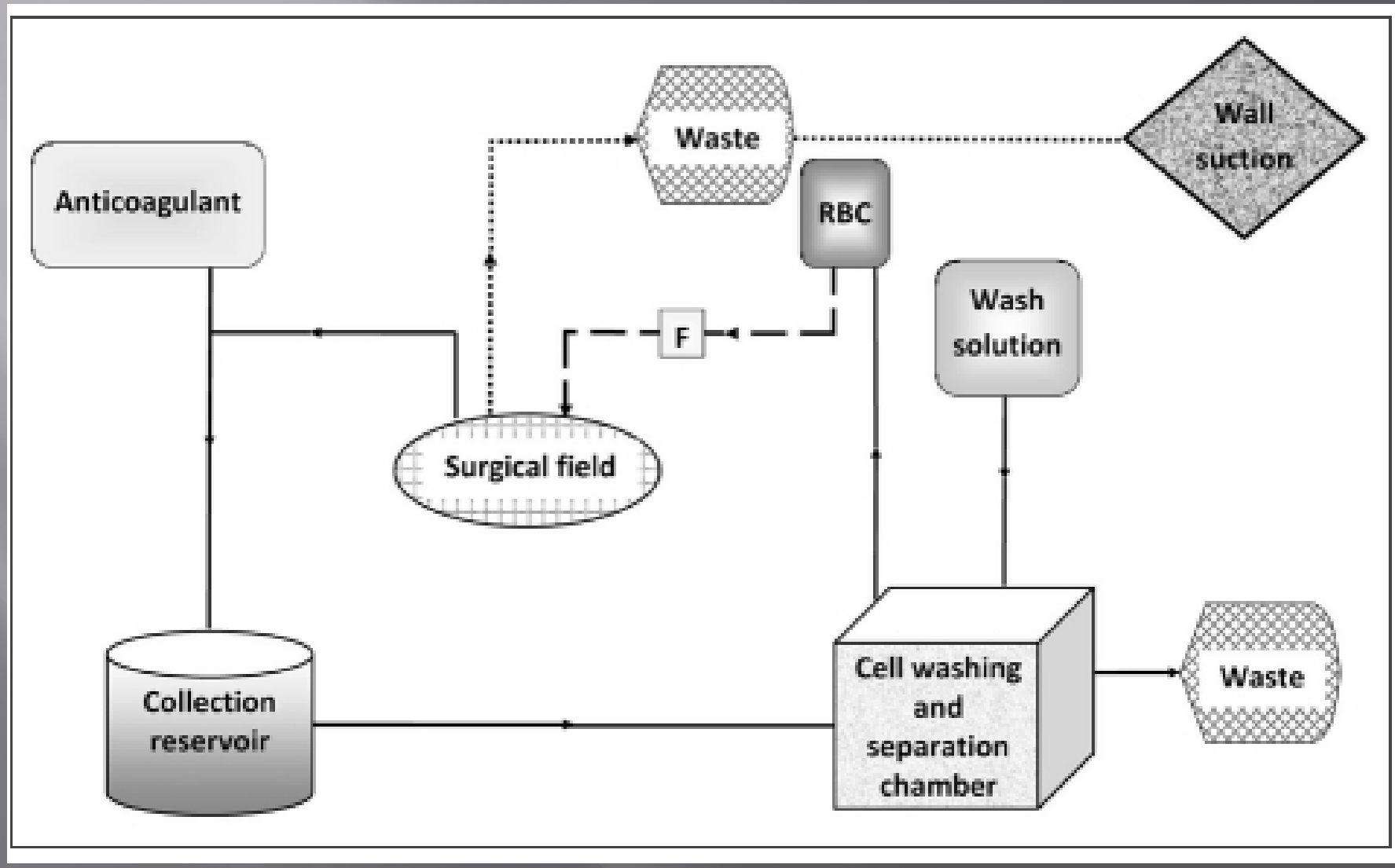
Package no.	RBC units	FFP units	Platelets	Cryoprecipitate
1	6	6		
2	6	6	1	
3	6	6		20 units
4	6	6	1	
5	6	6		10 units
6	6	6	1	
7	6	6		10 units

CELL SAVER

Intraoperative Cell Salvage

- Blood is aspirated from the surgical field and filtered into a collecting reservoir
- After filtration, packed red cells concentrated to a hematocrit of 55-80% are obtained and can be readministered to the patient

Double Suction set up Cell Salvage



Recombinant factor VIIa (rFVIIa)

- **Not currently FDA approved for PPH however multiple case reports and reviews exist**
- Inability to control bleeding with surgery or embolization and strongly suspected coagulopathy despite FFP/Plts
- Last Resort

Recombinant factor VIIa (rFVIIa)

- licensed for use in patients with hemophilia and inhibitory alloantibodies
- off-label indications including trauma, heart surgery after cardiopulmonary bypass, vascular surgery, warfarin reversal, and obstetric hemorrhage

Recombinant factor VIIa (rFVIIa)

- Ob/Gyn dose 60-120Ug/kg
- Effective in 30 min or less in 80%
- Thrombotic complications in 2-10%

Postpartum considerations

- High risk of developing thromboembolic complications after delivery
- Mechanical prophylaxis devices should be used. As soon as considered safe, pharmacologic prophylaxis should be instituted

Tan

- Immediate Death vs. **Early Death** during first 6 hours due to hemorrhage.
  - Damage Control Surgery for "Rapid Control of Bleeding"
  - Coagulopathy Risk Factors
    - ISS >25
    - Systolic Pressure < 75mm Hg
    - pH < 7.2
    - Core Temp < 34 degrees C

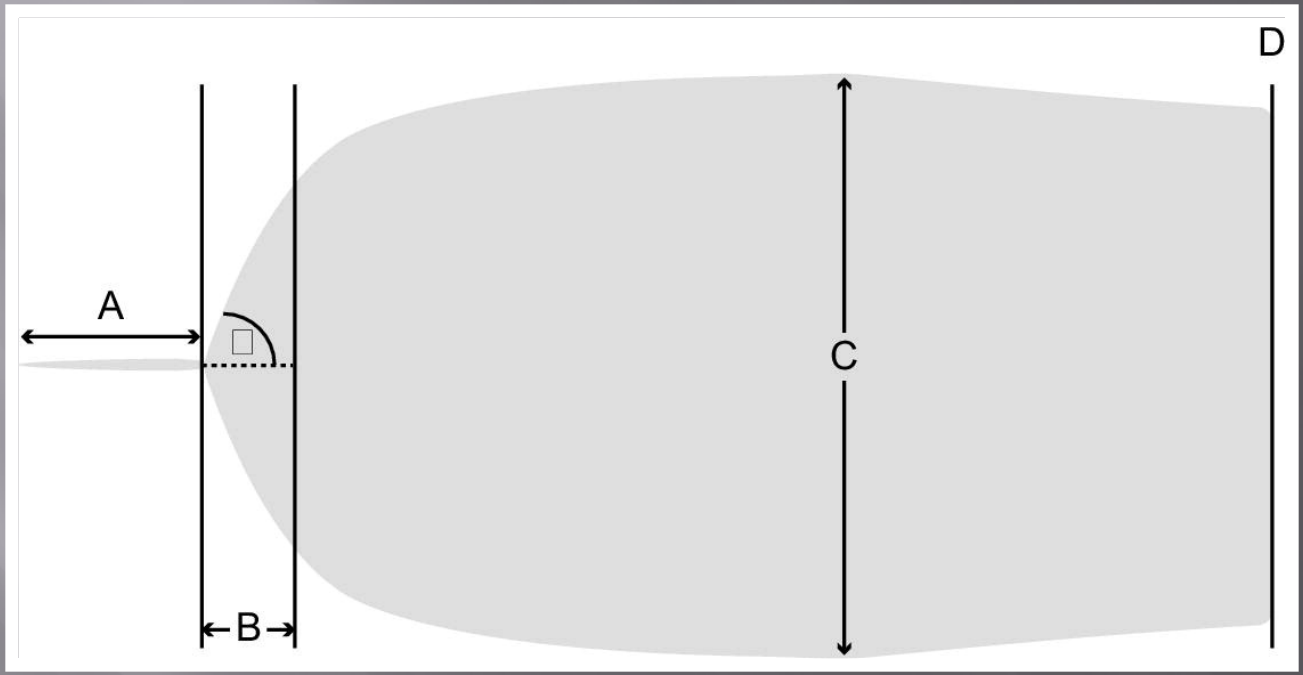
Tan

- Factor VII vs. Ratio of Transfusion
  - 20 patients 1:1 – 1:2, Mortality of 18%, ISS 26
  - 12 patients 1:2 – 1:4, Mortality of 92%, ISS 41
  - Retroactive 1:1 – 1:2 mortality 41% ISS 34

Hemostasis monitoring

- PT, aPTT, INR are *poor predictors* for transfusion requirements and *do not identify specific coagulation* anomalies
- **Thromboelastograph** (TEG) provides information regarding the specific component of the coagulation process that may be affected

FIGURE 2



Source: American Journal of Obstetrics & Gynecology 2011; 205:526-532 (DOI:10.1016/j.ajog.2011.06.009)
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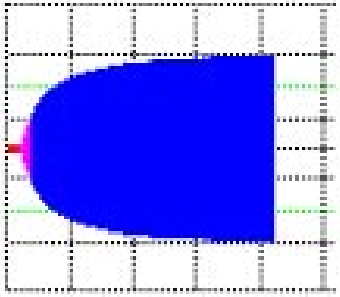
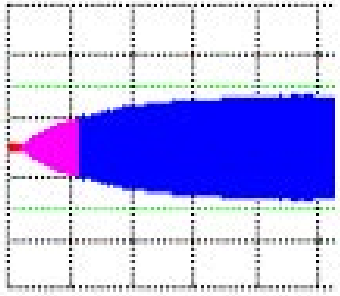
Thromboelastogram

- **A** corresponds to the reaction time. **B** indicates clotting time. **A**, **B**, and the **α angle** reflect the function of clotting factors. In cases of clotting factor deficiency, both times will be prolonged. **C** is the maximum amplitude of the clot, and it correlates with platelet function. The amplitude is proportional to platelet function. **D** indicates fibrinolysis. Cases of hyperfibrinolysis will show a rapid resolution of the clot, giving a "tear drop" appearance.

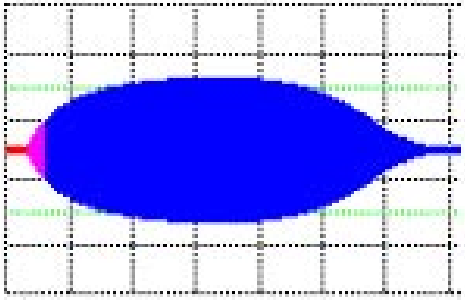
Qualitative interpretation (InTEG)



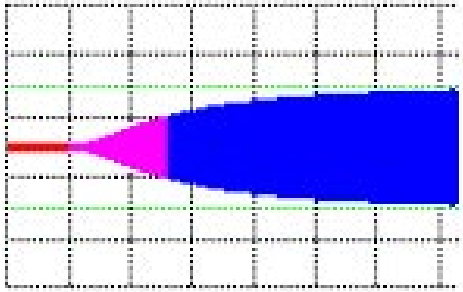
Normal



thrombocytopenia
or
low fibrinogen



lysis



heparin
or
factor deficiency

CRITICAL CARE

EFFECTIVE COMMUNICATIONS

Team STEPPS

Simulation

Team STEPPS provides higher quality, safer patient care by:

- Producing highly effective medical teams that optimize the use of information, people, and resources to achieve the best clinical outcomes for patients.
- Increasing team awareness and clarifying team roles and responsibilities.
- Resolving conflicts and improving information sharing.
- Eliminating barriers to quality and safety.

Labor and Delivery: Team STEPPS

- **Problem communication**
- http://www.ahrq.gov/professionals/education/curriculum-tools/teamstepps/instructor/videos/ts_vig004a/vig004a.html
- **Successful communication**
- http://www.ahrq.gov/professionals/education/curriculum-tools/teamstepps/instructor/videos/ts_vig004b/vig004b.html
- **Briefing L and D**
- http://www.ahrq.gov/professionals/education/curriculum-tools/teamstepps/instructor/videos/ts_BriefLandD/brief2.html
- **Call Out**
- http://www.ahrq.gov/professionals/education/curriculum-tools/teamstepps/instructor/videos/ts_ldcallout/callout2.html
- **Cross Monitor**
- http://www.ahrq.gov/professionals/education/curriculum-tools/teamstepps/instructor/videos/ts_ldcrossmon/crossMonitorIntern.html
- **CUS**
- http://www.ahrq.gov/professionals/education/curriculum-tools/teamstepps/instructor/videos/ts_debrief_LandD/debrief_LandD.html
- **Debrief**
- http://www.ahrq.gov/professionals/education/curriculum-tools/teamstepps/instructor/videos/ts_CUS_LandD/CUS_LandD.html

Recent Case

Illustration case of many of the important

concepts we have covered in the discussion

26 yr/old G3P2, 2 prior C-section without prenatal care

3 cm dilation in active labor

Screening sonogram

Ant low lying placenta

13.7 Hb / 37 Hct, 134 plt, BS 134, BP 154/92

On insulin, Juarez, Mexico

Formal sonogram

PLACENTA PERCRETA

No previa

Evolution of Our case

Nonreactive fetal tracing.
Thick meconium

→ NO interventional radiology

Team STEPPS

http://teamstepps.ahrq.gov/

Huddle → Situational Awareness

Stand by Trauma Surgery, ICU

Consult Neonatalogy

Cross-match 4u PRBC's, 4u FFP

Standby - Mass Transfusion

Second qualified Obstetrical Surgeon

Warm Room – 80 Degrees Fahrenheit

Two large bore IV's, 16's, Level One Blood Warmer

Cell Saver - set up

Counseled patient, Cleared the Deck

Additional Anesthesia Team members

Anesthesia?

Which anesthetic technique ?

Regional anesthesia

vs

General anesthesia

Anesthesia Plan

CSE

Speed of onset and reliability SAB

Post op analgesia

Duration and flexibility Epidural

A-Line in reserve

Cordis in reserve

GA in reserve

Blood Bank to prepare for Mass Transfusion

High Risk Referral Center Patient with No Prenatal Care

Urgent presentation to OR ~ 2hrs from arrival with no prenatal care to completion of surgery. Accurate DX Placenta percreta.

Opening abdomen

Frank active bleeding

600 blood loss prior to opening uterus*.

Evolution of Anesthesia Plan

Left radial arterial line (without local)

70/45

Single dose 5mg ephedrine

Full initiation Mass Transfusion Protocol

Second Level One Infuser

Case Continuation

Placenta accreta with abruptio placenta thru uterine window.

Subsequent dissection thru placenta.

Estimated blood loss by time delivery of infant 2000cc.

Apgar 8, 8, New born nursery

Mother-father-infant bonding allowed

Level One Rapid Infusers

First unit initiated at 11:00

Fourth unit administered by 11:11

Total estimated blood loss 5000cc

Total transfusion

8u PRBC's

4u FFP

3 x 10-pack platelets

1200 Cell Saver Blood returned > 2400cc washed*

Case Continued

Hypertensive Spike

125/76 rate 70s → **<u>180/90s rate 60</u>**

<u>IV's to KVO</u>

NTG 50ucg!!!!!!!!!!

NTG gtt not

Hydralazine 10, 10

Labetalol 5, 5

125/70s rate 90-100s

Lasix 10mg

Versed 4mg

Case Continued

Patient had uncomplicated post op course and made full recovery

Post op Hb 12 Plts 235

No further blood products required

Baby to normal newborn nursery doing fine

Team Work: Members

C Hyst performed

2 OB Attendings

Multiple Residents OB/Gyn, Pedi

1 Anesthesia Attending

1Anesthesia Resident

1 CRNA

1 Anesthesia Tech

Multiple Neonatal Providers

Multiple Nursing Service Providers

20+

Post Event Huddle

How do we measure up to WHO Standards ?

What could we have done differently ?

Were blood products appropriate ?

Possible use of TEG, Novo 7

Was patient compromised in any way?

?

?

?

?