Postpartum Haemorrhage

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Bahman 1396

Background

- Leading cause of maternal mortality.
- Maternal mortality ↓ in the developed world, PPH cause of maternal mortality elsewhere.
- Maternal mortality rate in the U.S, 17.3 per 100,000 live births.(11.% PPH national statistics)

Background

- In the developing world, 1000 / 100,000 live births, and W.H.O statistics 60% of maternal deaths in developing countries is due to PPH. more than 100,000 per year.
- ACOG ,Practice Bulletin : 140,000 / year or 1 woman every 4 minutes.
- The rate of PPH from 1.5%-4.1% (1999 - 2009, atonic PPH rose from 1%- 3.4%in 1999 - 2009. (adherent placenta)

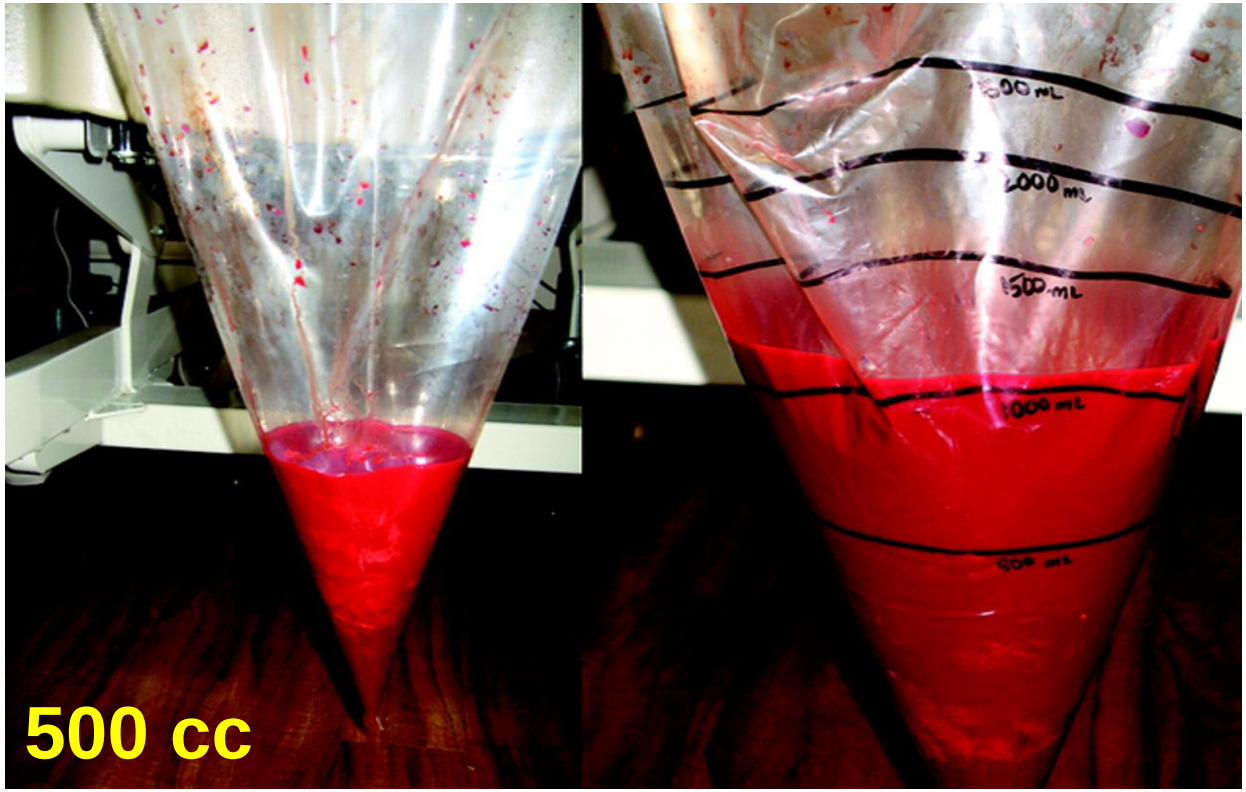
Hemorrhage
has probably killed more women than any other complication of pregnancy in the history of mankind.

90% of deaths from Postpartum hemorrhage are preventable.

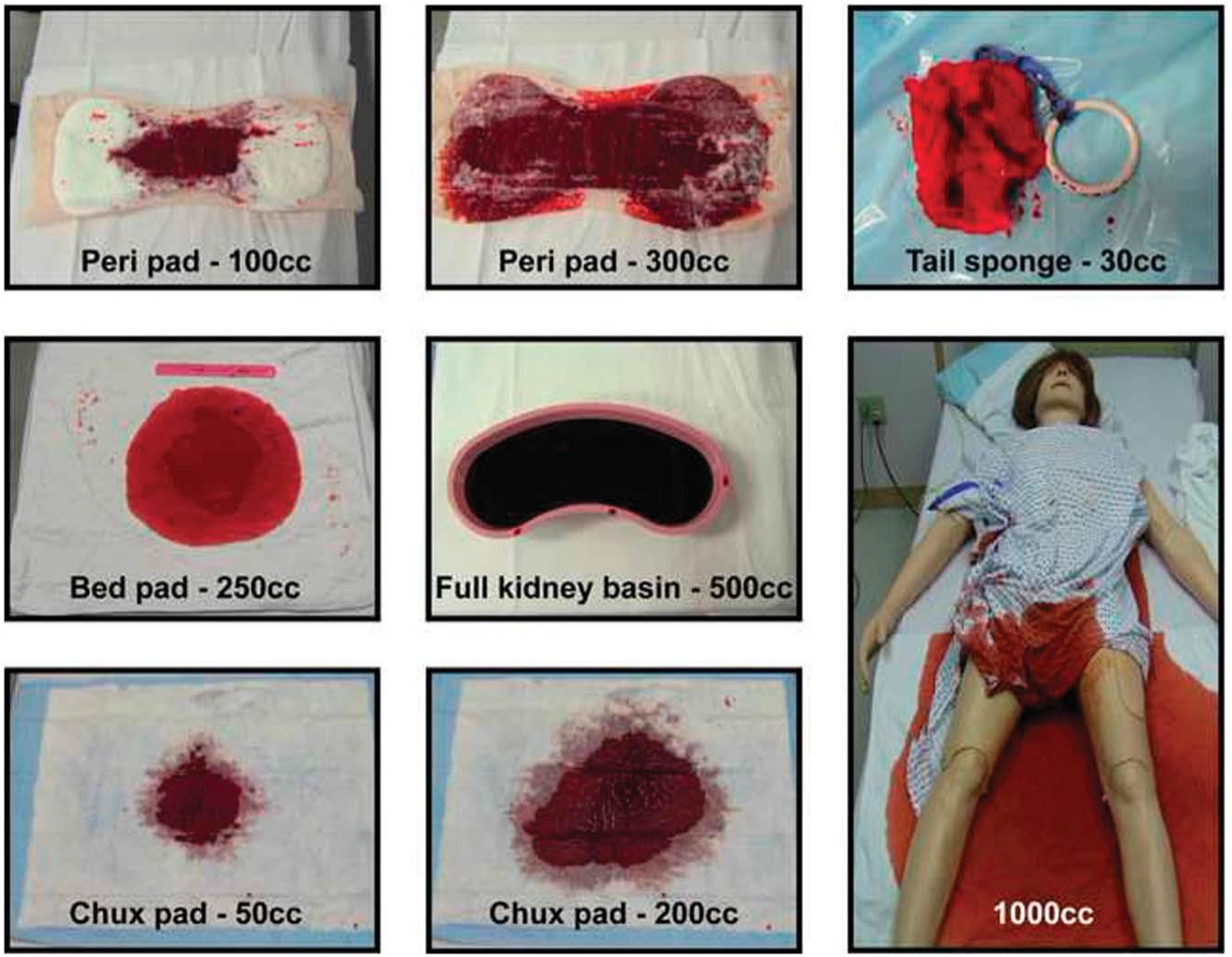
What is Postpartum Hemorrhage (PPH)?

- Varied definitions
  - Blood loss greater than the "normal" estimates
    - Vaginal delivery > 500cc
    - c/s > 1,000 cc
    - C-hyst > 1,500cc
  - 10% change in hematocrit(timing of the test and the amount of fluid resuscitation)
  - Need for blood transfusion

How much blood is in the drape on the left?



Visual Pocket Card



Zuckerwise et al. OBG 2014;123(5)

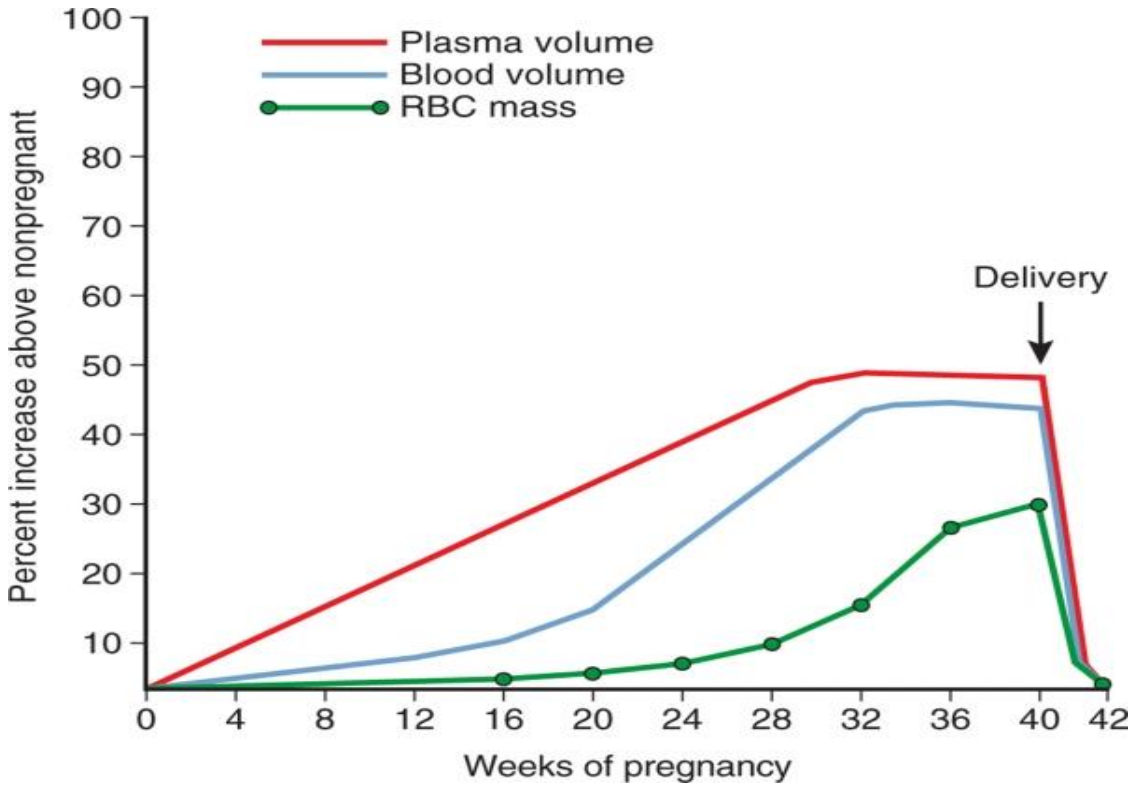
- Estimates of blood loss are subjective and **inaccurate**.
- The diagnosis would be **retrospective,** useful for research , not so in the clinical setting.
- Mostly > 20 W of gestation.
- Primary first 24 hr, secondary after 24 hr.

Differing capacities

- Different capacities of patients to cope with blood loss.
- A healthy woman has a 30-50% In blood volume.

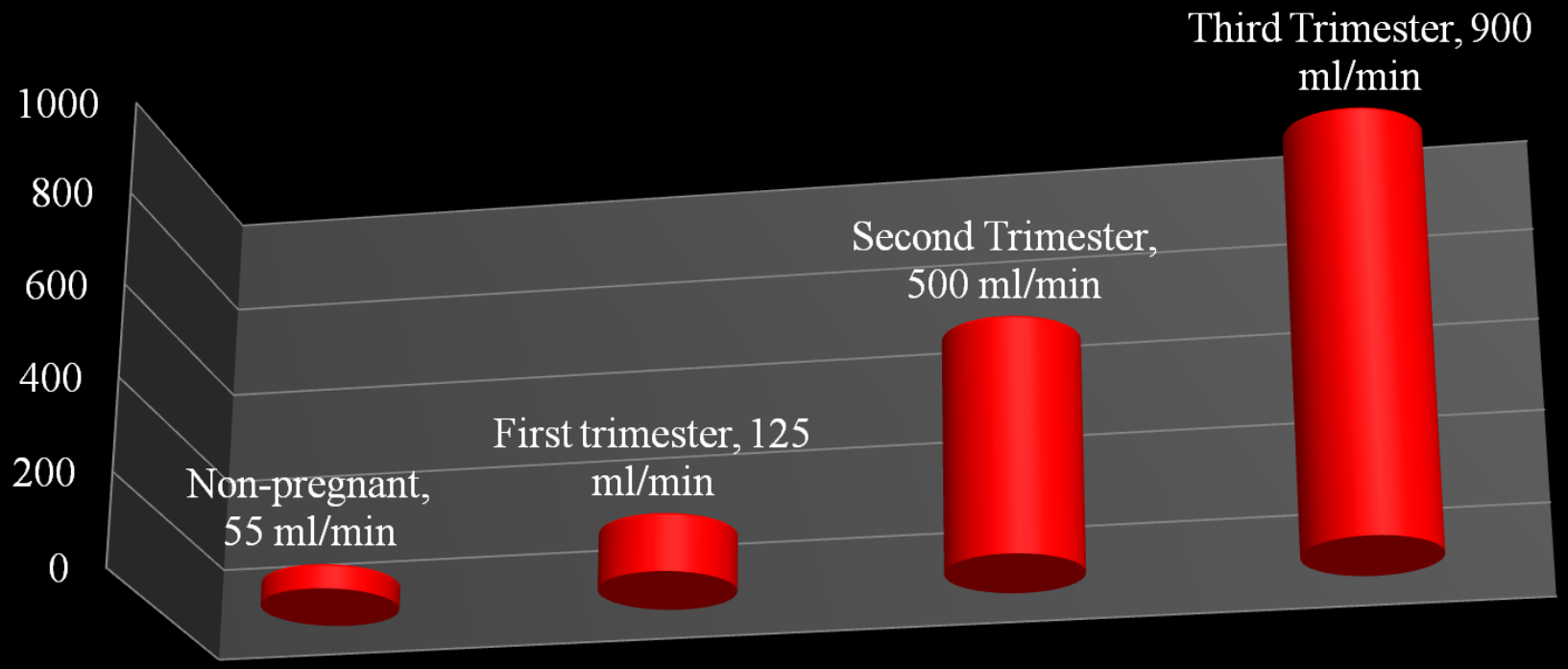
- pre existing anemia, cardiac condition, volume-contracted , dehydration or preeclampsia.
- Then PPH should be diagnosed with any amount of blood loss that threatens the hemodynamic stability of a woman.

Blood Volume in Pregnancy ~100 cc/kg



The average pregnant woman increases blood volume by ~1200cc

Uterine Blood Flow



Threatens the hemodynamic stability of the woman

Epidemiology

- The **frequency** of PPH is related to the **management of the third stage of labor**.

- The prevalence of >500ml bleeding is 5% in active management / 13% expectant management.

- The prevalence of >1000ml bleeding is 1% active management 3% when expectant management.

Epidemiology

- **Developing countries increased frequency is due:**

- lack of availability of **medications**.
- Same drugs used in active management of the third stage are use in treatment of PPH.

- The lack of **experienced** caregivers.

- Lack of **blood transfusion** services, **anesthetic** services, and **operating** capabilities .

Presentation

- **Slower bleeding** ultimately result shock.
- **Retained placenta** , significant blood behind a partially separated placenta, the membranes.
- fourth stage, gently palpating the **uterine fundus**.
- Bleeding from trauma concealed in the form of **hematomas** of the retroperitoneum, broad ligament or lower genital tract.

- MCMC admission for OB. Haemorrhage:648 from 94- 96 Bahman.(Abortion laceration,PPH)

- Maternal mortality in93: 11 , 1 due to PPH.
- Maternal mortality in94: 11 , 5 due to PPH.
- Maternal mortality in95: 6 , 1 due to PPH.
- Maternal mortality in 96: 6 , 2 due to PPH.

(first half)

THE STEPS TO PPH:
POSTPARTUM HEMORRHAGE:

PREDICT

↓

Identify patients at risk

PREPARE

↓

Use a multi-disciplinary Approach

HANDLE

↓

Optimize clinical management

Etiologies of PPH
Remember –PPH is not the diagnosis

- Early (< 24hrs)
  - Uterine atony
  - Lower genital tract lacerations
  - Retained placenta
  - Placental invasion
  - Uterine rupture
  - Uterine inversion
  - Coagulopathy
- Late (>24hrs-6wks)
  - Infection
  - Retained placenta
  - Placental site subinvolution
  - Coagulopathy

Obesity

- PPH is also associated with **obesity**. In a study by Blomberg, the risk of atonic uterine ,hemorrhage BMI.
- ↑ BMI over 40, the risk was 5.2% -13.6%with normal delivery and with instrumental delivery.

- PPH usually has a **single cause**, more than one cause is possible: prolonged labor ,operative vaginal birth.

Clinically Important Risk Factors for Postpartum Hemorrhage

- Prior postpartum hemorrhage
- Abnormal placentation
- Operative delivery

Risk Factors for Postpartum Hemorrhage under Clinical Control

Prolonged labor

Instrumental delivery

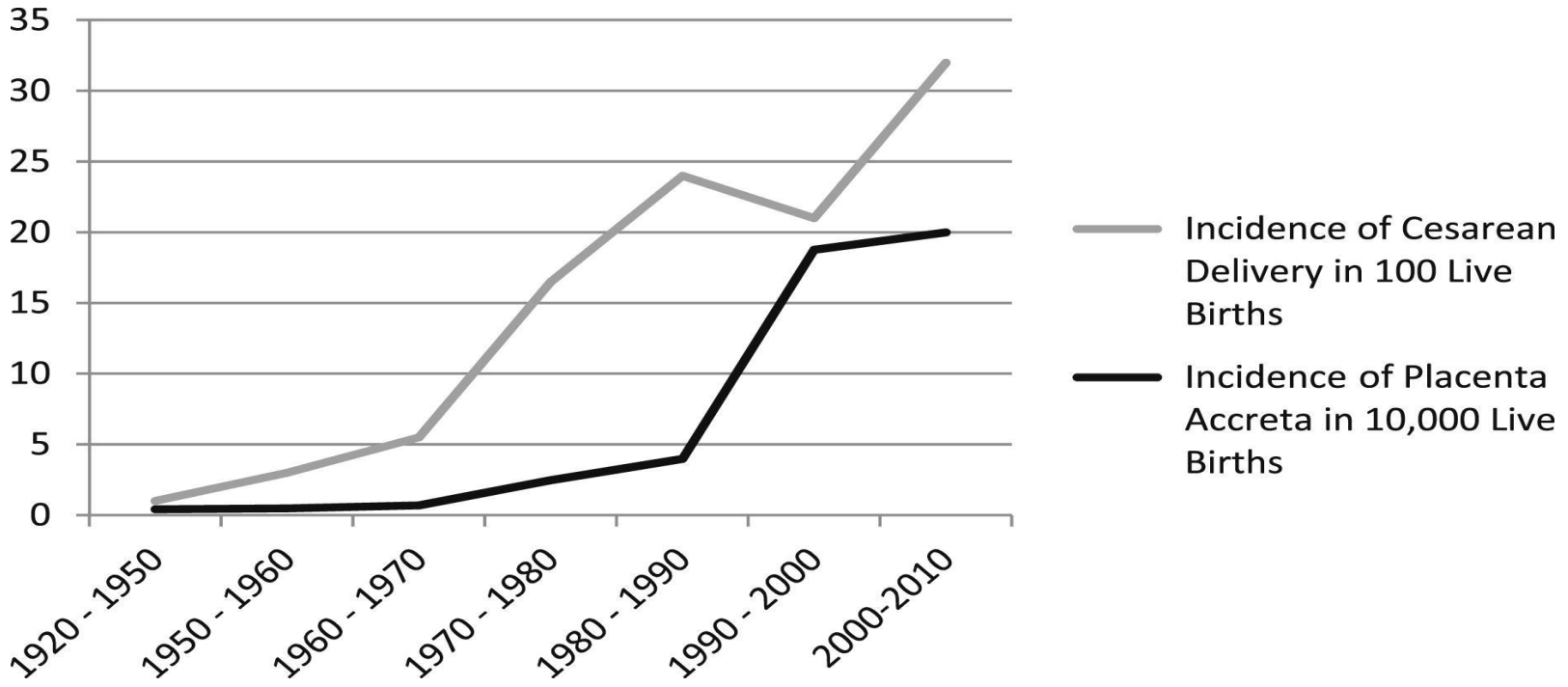
Anticoagulation therapy

Prolonged use of oxytocin

Cesarean delivery

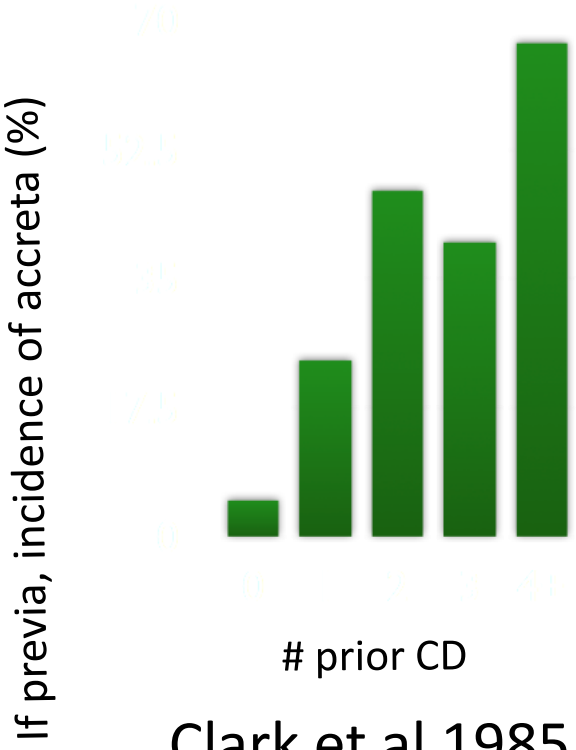
General anesthesia

More Cesarean = More Invasion

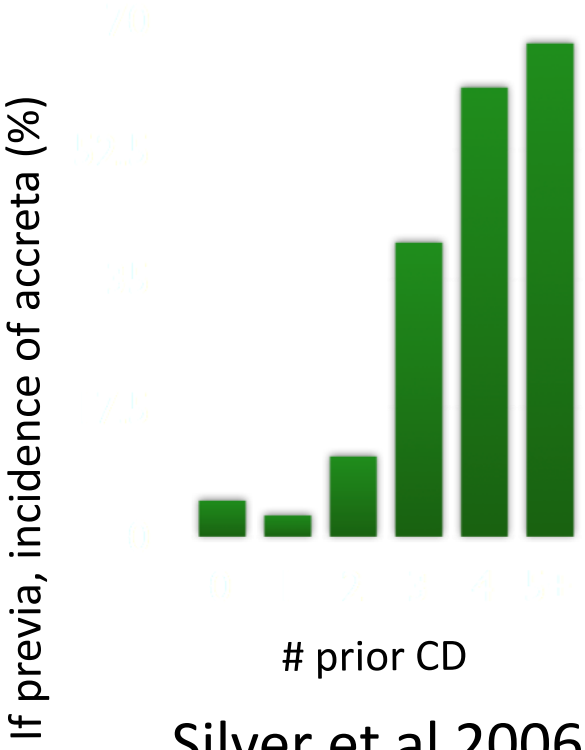


Alison. Placenta Accreta, Increta, and Percreta Obstet Gynecol Clinics of North America 2013; 40(1):137

CD and Placenta Previa



Clark et al 1985

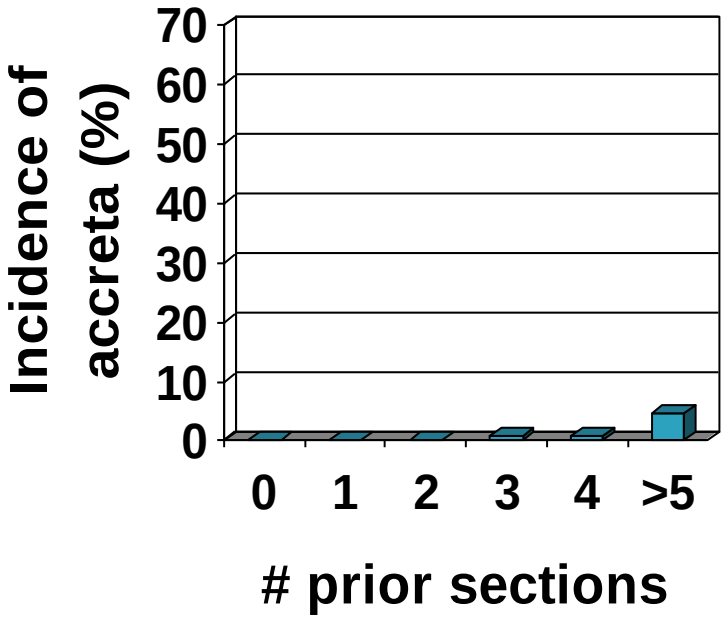


Silver et al 2006

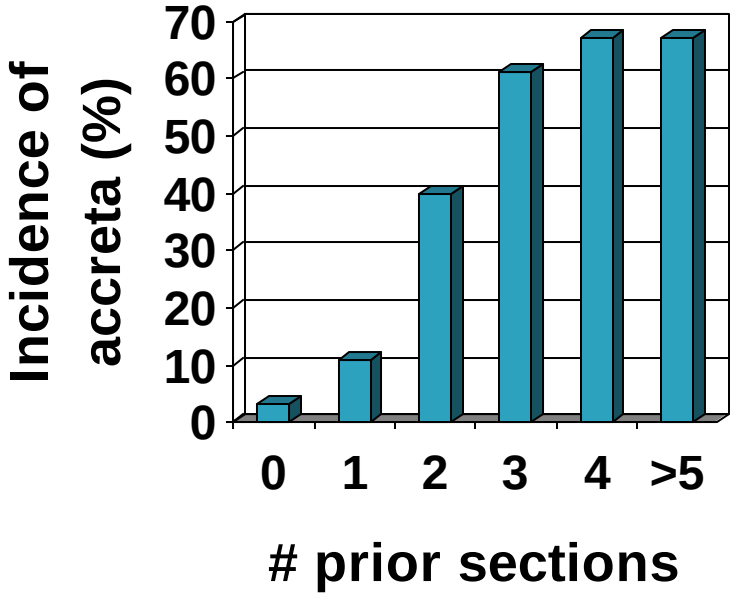
The majority of patients with accreta have a history of prior cesarean delivery and previa

Placenta previa, prior cesarean and accreta risk

No previa



Previa



A placenta previa with no prior sections is associated with a 3-4% risk of accreta.

Accreta risk is low without a previa until section # 4.

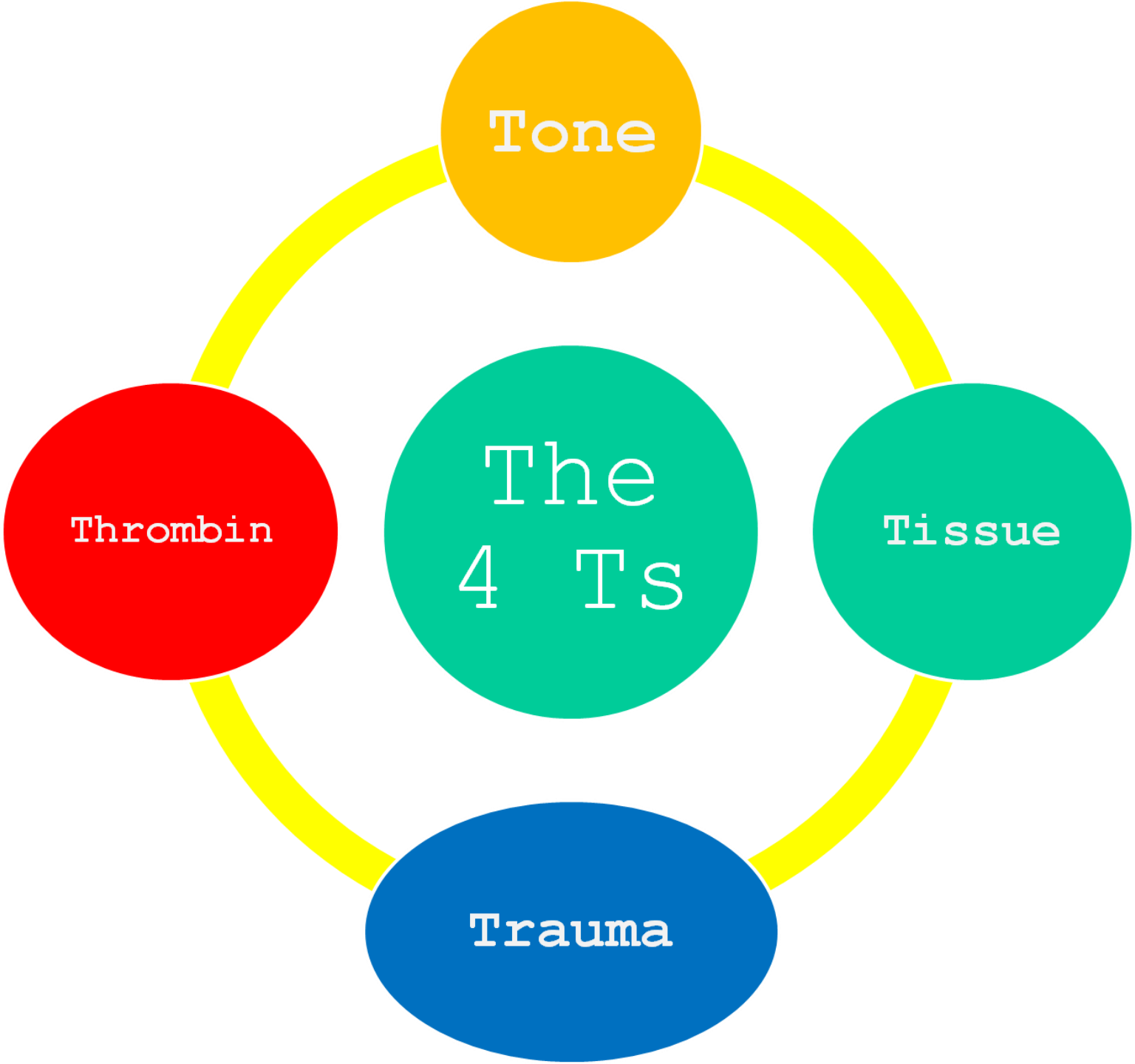
Uterine contraction is more important than clot formation or platelet aggregation as a mechanism of hemostasis

Complications

- **Death**
- Hypovolemic shock and organ failure: renal failure, stroke, myocardial infarction, postpartum hypopituitarism (Sheehan syndrome)
- Fluid overload .
- Abdominal compartment syndrome
- Anemia
- Transfusion-related complications
- Acute respiratory distress syndrome
- Anesthesia-related complications
- Sepsis, wound infection, pneumonia
- Venous thrombosis or embolism
- Unplanned sterilization due to need for hysterectomy

Management

- Has the **placenta** been delivered and is it complete?
- Is the uterus **well-contracted**?
- Is the bleeding due to **trauma**?


Tone
Thrombin
The
4 Ts
Tissue
Trauma

80% OF CASES OF POSTPARTUM HEMORRHAGE ARE DUE TO UTERINE ATONY

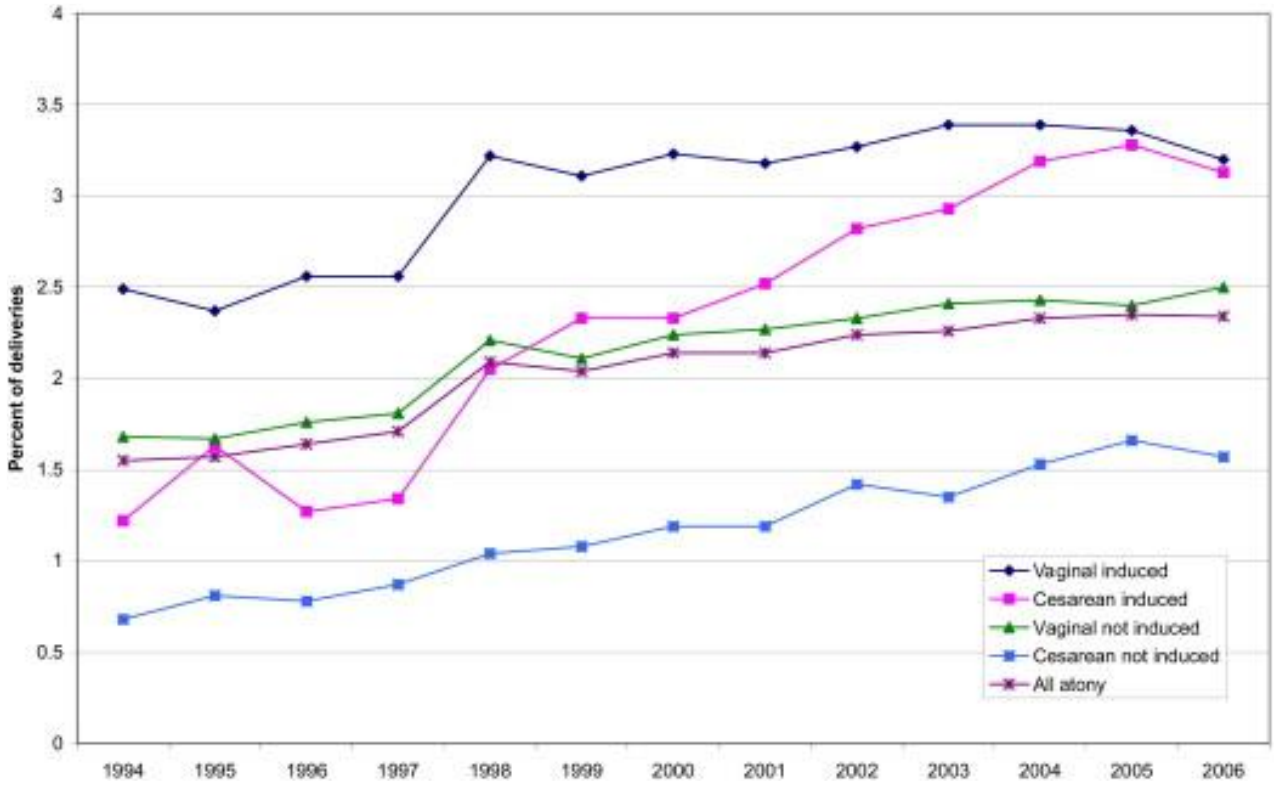
Causes of Uterine Atony

Overdistension of the uterus

Myometrial laxity

Tone

- 1- Overdistension of the uterus :
- absolute or relative,
- multifetal gestation,
- fetal macrosomia,
- polyhydramnios,
- fetal abnormality (sever hydrocephalus)
- fibroid,
- retained blood clot.



Volume 202, Issue 4, Pages 353.e1-35

American Journal of Obstetrics & Gynecology 2010; 202:353.e1-353.

Tone

- Poor myometrial contraction , fatigue :
- Prolonged labor
- Rapid forceful labor, especially if stimulated.
- halogenated anesthetic agents, nitrates,nifedipine
- magnesium sulfate, beta-sympathomimetics,
- Placenta previa, abruptio placenta
- bacterial toxins (chorioamnionitis, endomyometritis),
- Multiparity ?

Tissue

- Succenturiate or accessory lobe.
- Preterm gestations (especially < 24 wk), .
- The use of misoprostol ↓ retained placenta / intrauterine prostaglandin or hypertonic saline.(D&C of 3.4% -22.4%).

Trauma

- **Cesarean delivery**
- **Uterine rupture** :previous cesarean . fibroidectomy; uteroplasty ; cornual resection (Routine transvaginal palpation of such scars is no longer recommended).
- Very prolonged or **vigorous labour**, c.p.d, .
- The highest risk is probably associated with internal version and extraction .
- Remove a **retained placenta** manually or with instrumentation.

Thrombosis

- Fibrin deposition over the placental site and clots within supplying vessels , and abnormalities in these areas can lead to **late PPH** or exacerbate bleeding from other causes, trauma.

- **Preexistent** or **acquired**. Thrombocytopenia, idiopathic thrombocytopenic purpura, or acquired HELLP syndrome , abruptio placentae, (DIC), or sepsis.

Thrombosis

- **Preexisting abnormalities of the clotting system**, familial hypofibrinogenemia and von Willebrand disease.

- **Finally, dilutional coagulopathy may occur following massive PPH and resuscitation with crystalloid and packed red blood cells (PRBCs).**

Congenital coagulation disorders

Uncommon, are present more frequently than commonly thought

Examples:

- **VonWillebrand's disease**
- **Specific factor deficiencies (factors II, VII, VIII, IX, X, and XI)**

Thrombosis

- Women with von Willebrand disease are prone to post abortal bleeding, but no PPH at term.

- **PPH alone is not a strong indication for screening for these defects**.

Thrombosis

- No response to **general measures**, possibility of a bleeding disorder , especially with a history of menorrhagia,+ F.HX. excessive bleeding after minor trauma.

- Only 1/50 PPH, identified a bleeding disorders

Prevention

- **Active management** is the combination of:
- (1**) Uterotonic** administration (preferably oxytocin) immediately upon delivery of the baby.

- (2) Early **cord clamping** and cutting.

- (3) Gentle **cord traction** with uterine counter traction when the uterus is well contracted.

Prevention

- 60% ↓PPH . 80% ↓therapeutic uterotonic agents .

- Every 12 active management,/one **PPH** would be prevented. every 67 /one patient would avoid **transfusion** with blood products.

- Oxytocin immediately after delivery of baby or placenta.(retained placenta)?

Active management

- **Uterotonic agent** is the most important component of this package .

- when uterotonic agents are not available, **breast feeding** might reduce the incidence of postpartum haemorrhage.(**nipple massage**)

W.H.O clinical guidance

- W.H.O recommends use of Misoprostol in settings where it is not possible to use injectable uterotonic agents

  (Oxytocin, Ergometrine)

600mcg orally , immediately after birth.

Prevention

- **Underestimation** blood loss : 50%,clot =1/2 .
- Most women are **healthy** and compensate for blood loss very well.
- Birthing **position** is semi recumbent with the legs elevated.

Get Help!

Management

The goal is to:

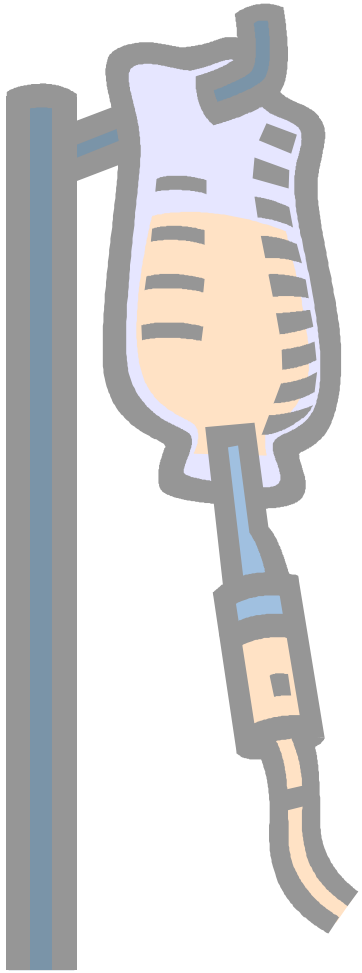
- Restore or maintain adequate circulatory volume to prevent **hypoperfusion** of vital organs.
- Restore or maintain adequate **tissue oxygenation**.
- Reverse or prevent **coagulopathy**.
- Eliminate the **obstetric cause** of PPH.

Postpartum hemorrhage is not the diagnosis

Fluid Management

- Crystalloid solution
  - Warmed NS and(10L)/or LR
  - 3:1 replacement of fluid to EBL(4-5)
  - Dextrose , no role
- Colloid solutions
  - Albumin, Dextran

  (Produce greater increase in plasma volume)



Fluid Management

- PPH of up to 1500 mL in a healthy pregnant woman can usually be managed by crystalloid infusion alone **if the cause of bleeding is arrested**.

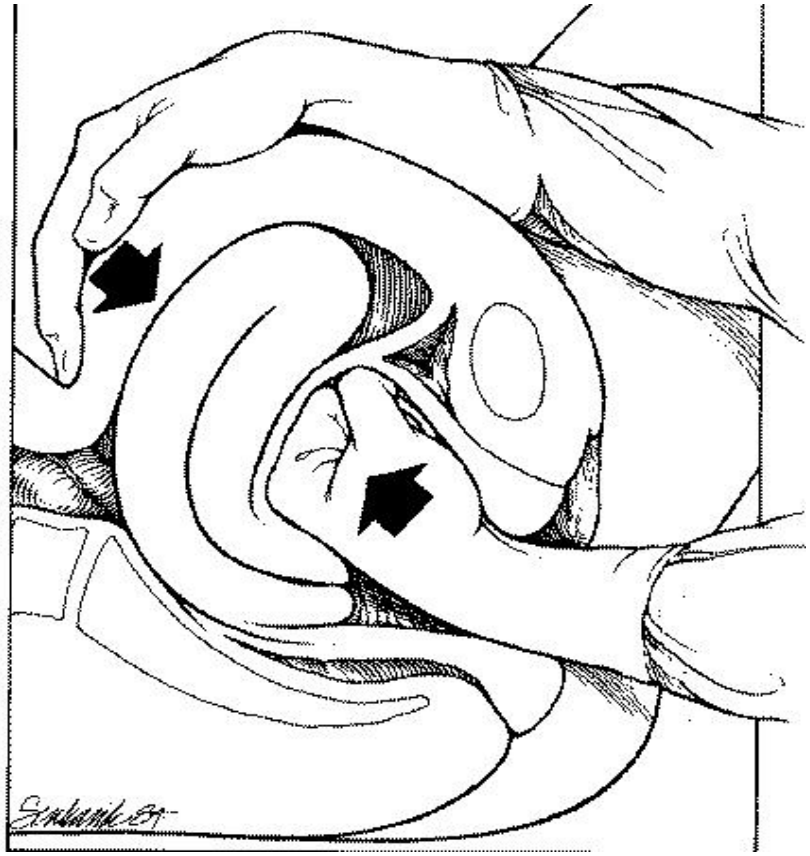
Management of PPH

- **Organization**
- 1-Call experienced staff (including obstetrician and anesthetist).
- 2-Designate a nurse to record vital signs, urine output, and fluids and drugs administered.
- 3-Place operating theater on standby.

Management of PPH

- **Resuscitation** Administer oxygen by mask.
- 1-Place 2 large-bore (14-gauge) intravenous lines.
- 2-Take blood for crossmatch of 6 U PRBCs, and obtain a CBC count, coagulation screen, urea level, creatinine value, and electrolyte status.
- 3-Begin immediate rapid fluid replacement with NS or Ringer lactate solution.
- 4-Transfuse with PRBCs
- 5-Consider Cell Saver

Uterine Massage

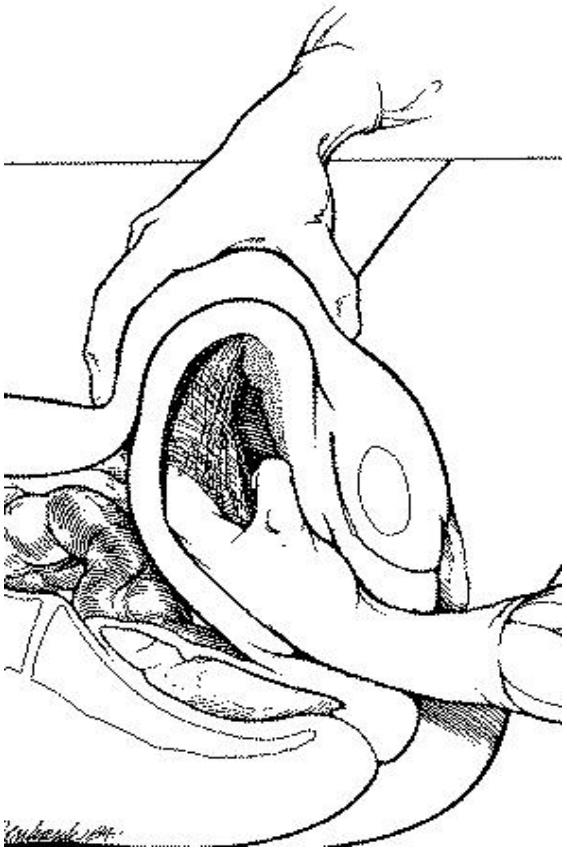


Management

- Oxytocin : 5-U IV bolus, as 20 U in 1 L of NS IV free, or as 10 U intramyometrially with a spinal needle .
- Ergonovine (or ergotrate) 100 or 125 mcg IV or intramyometrially or 200 or 250 mcg OR IM , maximum 1.25 mg(5).
- Carboprost 250 mcg IM or intramyometrially, not to exceed 2 mg (8 doses).(Asthma)
- Misoprostol 1000 mcg given rectally , sublingual/buccal misoprostol will improve its efficacy in the setting of acute PPH.

Explore Etiology

- Explore uterine cavity for retained products of conception, uterine rupture, evidence of uterine inversion
- Evaluate lower genital tract for lacerations



Medical Therapy Options

Agent	Dose	Route	Dosing Frequency	Side Effects	Contraindications
Pitocin	10-80 U/L	IV (IM, IU)	Continuous	N/V Water intoxication	None
Methergine (Methyl-ergonovine)	0.2 mg	IM (IU)	Q2-4hr	HTN, N/V, hypotension	HTN, Preeclampsia
Hemabate ($PGF_{2\alpha}$)	0.25mg	IM (IU)	Q15-90min Max = 8	N/V, F/C, diarrhea	Active cardiac, renal, liver, lung disease
Dinoprostone (PGE_2)	20mg	PR	Q2hr	N/V, F/C, diarrhea, HA	Hypotension
Cytotec (Misoprostol)	600-1000 mcg	PO (PR)	Single dose	Fever	None

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Drug*	Dose/Route	Frequency	Comment
Oxytocin (Pitocin)	IV: 10–40 units in 1 liter normal saline or lactated Ringer's solution IM: 10 units	Continuous	Avoid undiluted rapid IV infusion, which causes hypotension.
Methylergonovine (Methergine)	IM: 0.2 mg	Every 2–4 h	Avoid if patient is hypertensive.
15-methyl $PGF_{2\alpha}$ (Carboprost) (Hemabate)	IM: 0.25 mg	Every 15–90 min, 8 doses maximum	Avoid in asthmatic patients; relative contraindication if hepatic, renal, and cardiac disease. Diarrhea, fever, tachycardia can occur.
Dinoprostone (Prostin E_2)	Suppository: vaginal or rectal 20 mg	Every 2 h	Avoid if patient is hypotensive. Fever is common. Stored frozen, it must be thawed to room temperature.
Misoprostol (Cytotec, PGE_1)	800–1,000 mcg rectally		

Have an Operative Plan

- Uterine curettage
- Laceration repair
  - Lower genital tract
  - Uterine
- Arterial ligation/ embolization
- B-Lynch suture
- Packing
- Balloon
- Hysterectomy (Before become too late)

Handle ,optimize clinical management

- Mild to moderate blood loss can be managed with crystalloid or colloid infusions alone.
- Dilutional anaemia and later dilutional coagulopathy , if used in volumes >1.5 L.
- surgical patients with normal coagulation factors, critical levels of platelets (50 × $10^3/mm^3$), fibrinogen (1.0 g/L) .

Fluid Management

- Crystalloid fluid volume → interstitial space,
- Colloid solutions: albumin, dextran, hydroxyethyl starch, and modified fluid gelatin.(1000-1500cc adverse effect)
- A meta-analysis in the Cochrane Library : favored the use of crystalloids with respect to mortality.
- The NS groups had a 1% mortality rate, versus an 11% mortality rate in the colloid group.

Colloid Solutions

Colloid	Dose (mL)	Crystalloid Volume Expansion Equivalent	Duration of Effect (hours)
Albumin			
5% solution	500-700	similar to crystalloid	24
25% solution	100-200	3.5 times crystalloid	24
Hetastarch	500-1000	similar to crystalloid	24-36
Dextran 70	500	1050 mL over two hours	24

Hydroxyethyl starch (Hespan®) banned in Europe. June 2013 FDA issued black box warning against hetastarch.
Meta-analysis published early 2013 reports increased mortality, renal injury and bleeding.

Zarychanski et al. JAMA 2013;309(7):678-688.

Handle ,optimize clinical management

- Generally recommended that replacement of blood components be guided by laboratory tests.
- NOT in situations of large blood losses.
- A protocol based empirical replacement of coagulation factors is, recommended in massive blood losses.

Clinical Findings in Obstetric Hemorrhage

Blood Volume Loss	Blood Pressure (systolic)	Symptoms and Signs	Degree of Shock
500-1000 mL (10-15%)	Normal	Palpitations, tachycardia, dizziness	Compensated
1000-1500 mL (15-25%)	Slight fall (80-100 mm Hg)	Weakness, tachycardia, sweating	Mild
1500-2000 mL (25-35%)	Moderate fall (70-80 mm Hg)	Restlessness, pallor, oliguria	Moderate
2000-3000 mL (35-50%)	Marked fall (50-70 mm Hg)	Collapse, air hunger, anuria	Severe

Blood loss,ml (Blood loss, %BV)	Up to 750 (Up to 15%)	750-1500 (15-30%)	1500-2000 (30-40%)	2000 or more (40% or more)
Pulse rate	<100	>100	>120	>140
Blood pressure	Normal	Normal	Decreased	Decreased
Respiratory rate	14-20	20-30	30-40	>35
Urine output (ml/hr)	>30	20-30	5-15	Negative
CNS-mental status	Slightly anxious	Mildly anxious	Lethargic, confusion	Confusion, lethargy, coma
Gastrointestinal		Anorexia	Anorexia, vomiting	Ileus
Fluid replacement (3:1 rule)	Crystalloid	Crystalloid	Crystalloid + blood	Crystalloid + blood

ACOG Patient Safety Checklist for Postpartum hemorrhage

The American College of Obstetricians and Gynecologists
WOMEN'S HEALTH CARE PHYSICIANS

Patient Safety Checklist ✓

Number 10 • May 2013

POSTPARTUM HEMORRHAGE FROM VAGINAL DELIVERY

Date_____ Patient _____ Date of birth_____ MR # _____
Physician or certified nurse–midwife _____ Last menstrual period _____
Gravidity/Parity_____ Estimated date of delivery_____

For hemorrhage of more than 500 mL estimated blood loss, but less than 1,000 mL, from vaginal delivery:

- ❑ Start intravenous (IV) line if not present
- ❑ Increase IV fluid rate
- ❑ Increase IV oxytocin by increasing infusion rate, or by increasing concentration to 40–80 international units/L
- ❑ Empty bladder
- ❑ Conduct vigorous fundal massage
- ❑ Administer 0.2 mg of methylergonovine intramuscularly every 2–4 hours if patient is not hypertensive
- ❑ Type and crossmatch 2 units packed red blood cells
- ❑ Evaluate for retained product of conception, lacerations, uterine atony, and uterine inversion
- ❑ Administer 0.25 mg of 15-methyl prostaglandin $F_{2\alpha}$ intramyometrially or intramuscularly (may repeat every 15–90 minutes for a maximum of eight doses), or 800–1,000 micrograms of misoprostol rectally (1)

If no response by 1,000 mL estimated blood loss:

- ❑ Call for help—second obstetrician, anesthesia, and blood bank
- ❑ Order stat complete blood cell count and coagulation studies, including hematocrit, platelets, fibrinogen, and prothrombin time and partial thromboplastin time
- ❑ Begin blood product transfusion based on clinical signs and judgment
- ❑ Establish second large-bore IV line
- ❑ Administer oxygen as needed to maintain oxygen saturation greater than 95% (2)
- ❑ Consider move to operating room for dilation and curettage or laceration repair
- ❑ Consider intrauterine balloon or uterine packing
- ❑ Consider warm blanket to prevent hypothermia
- ❑ Type and crossmatch 2–4 additional units packed red blood cells and thaw 2–4 units fresh frozen plasma
- ❑ Place Foley catheter with urometer

If no response by 1,500 mL estimated blood loss:

- ❑ Initiate massive transfusion protocol
- ❑ Consider transfusion protocol of packed red blood cells, fresh frozen plasma, and platelets at a ratio of 1:1:1
- ❑ Consider uterine artery ligation, B-Lynch sutures, or hysterectomy

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Technique	Comment
Uterine tamponade	
—Packing	—4-inch gauze; can soak with 5,000 units of thrombin in 5 mL of sterile saline
—Foley catheter	—Insert one or more bulbs; instill 60–80 mL of saline
—Sengstaken–Blakemore tube	
—SOS Bakri tamponade balloon	—Insert balloon; instill 300–500 mL of saline

Blood transfusion

- PRBCs are initially used uncross matched O-type with other blood components and given only if indicated.

- Rapidly transfuse 2-4 U of PRBCs to replace lost oxygen-carrying capacity and volume.
- Adding 100 mL of NS to each unit. **Do not use LRS** calcium contained in the solution may cause clotting.

Blood transfusion

- difference between **resuscitation** and **treatment**.
- New principle : trying to replace the **whole blood** lost through rapid hemorrhage with whole blood, or the modern equivalent .
- The treatment of choice was a massive transfusion with both RBCs and of FFP. It's 1:1 ratio was associated with a three-fold ↓ in mortality rate.

Blood transfusion

- So every obstetric unit should have a massive transfusion protocol:
- After the first unit or two the red cells you should **move to replace with whole blood** or its equivalent which is a 1 to 1 ratio of red cells and FFP and every **fifth** unit with platelets.(A.COG :1:1:1)

Evaluation of response

- Monitor:

1- Pulse rate,

2- Blood pressure,

3- A.blood gas ,

4- Acid-base ,

5- Monitoring C.V.P

- Measure intake out put.

- Regular CBC counts and coagulation tests.

ACOG Medical Management of Postpartum Hemorrhage

Product	Volume (mL)	Contents	Effect (per unit)
Packed red cells	240	Red blood cells, white blood cells, plasma	Increase hematocrit 3 percentage points, hemoglobin by 1 g/dL
Platelets	50	Platelets, red blood cells, white blood cells, plasma	Increase platelet count 5,000–10,000/mm^3 per unit
Fresh frozen plasma	250	Fibrinogen, antithrombin III, factors V and VIII	Increase fibrinogen by 10 mg/dL
Cryoprecipitate	40	Fibrinogen, factors VIII and XIII, von Willebrand factor	Increase fibrinogen by 10 mg/dL

Component	Contents	Indications	Volume	Shelf life	Effect
PRBC's	RBC's, WBC's, plasma	Anemia	300	42 days	Increase Hgb 1g
Platelets	Platelets, plasma	Bleeding due to low plts	50	5 days	Increase Plt count 7500/unit
FFP	FBG, plasma, clotting factors	DIC, coagulation disorder, reverse warfarin	250	12 mo frozen 2 hr thawed	Increase FBG 10-15
Cryoppt	FBG, factor VIII, vWf, XIII	DIC, von Willebrands, hemophilia A	40	4-6 h thawed	Increase FBG 10-15

Defective blood coagulation

- Order coagulation screen (PTT)
- Give FFP if coagulation test results are abnormal and sites are oozing.
- Give cryoprecipitate if abnormal coagulation test results are not corrected with FFP and bleeding continues.
- Give platelet concentrates if the platelet count is less than 50 X 10^9/L and bleeding continues.
- Use cryoprecipitate and platelet concentrates before surgical intervention.

Definition of massive transfusion

- Massive transfusion, defined as the replacement by transfusion of more than 50 percent of a patient's blood volume in 12 to 24 hours.
- The replacement of equivalent to or greater than ,the patient total blood volume in less than 24 hrs.

Intraoperative Cell Salvage in Obstetrics

- Considered safe in obstetric patients
- Automated system can provide 225 cc of washed, saline suspended RBC with Hct of 50% in 3 minutes
- ACOG recommends considering its use when available in patients with suspected accreta

- "Classic" (relative) contraindications:
  - Malignancy
  - Amniotic fluid contamination
  - Bacterial contamination (abscess, bowel perf)
  - Betadine
  - Topical hemostatics (Avitene, etc)

Principles of Massive Transfusion

- Manage airway and breathing
- Evaluate and address cause of hemorrhage
- Establish two large bore peripheral intravenous lines
- Consider central line and arterial line placement
- Administer crystalloid (1-2 L) initially
- Initiate massive transfusion protocol, if available
- Administer PRBCs, FFP, and platelets in a timely fashion
- Ratio FFP:PRBCs 1:1.5 - 1:1.8
- Maintain core temperature >35°C
- Monitor CBC, PT, PTT, fibrinogen every 30 min
- Correct hypocalcemia
- Correct hyperkalemia
- Correct acidosis (pH = 7.4, normal base deficit, normal lactate)

Continue product replacement until: hemodynamically stable, platelet count >50,000, INR <1.5

Mechanical

- Uterine packing
  - With oxytocic infusion
  - Atonia, praevia
  - Systematic packing from fundus downwards
  - Generally left for 24 hours
- Balloon tamponade
  - Foley's: 110 mls air, left for 8 hours
  - S-Blackmore: 75-150 mls saline, 12-24 hours, upper vagina packed
  - Rusch catheter: 400-500 mls saline
  - Bakri catheter

Definition of Massive Transfusion

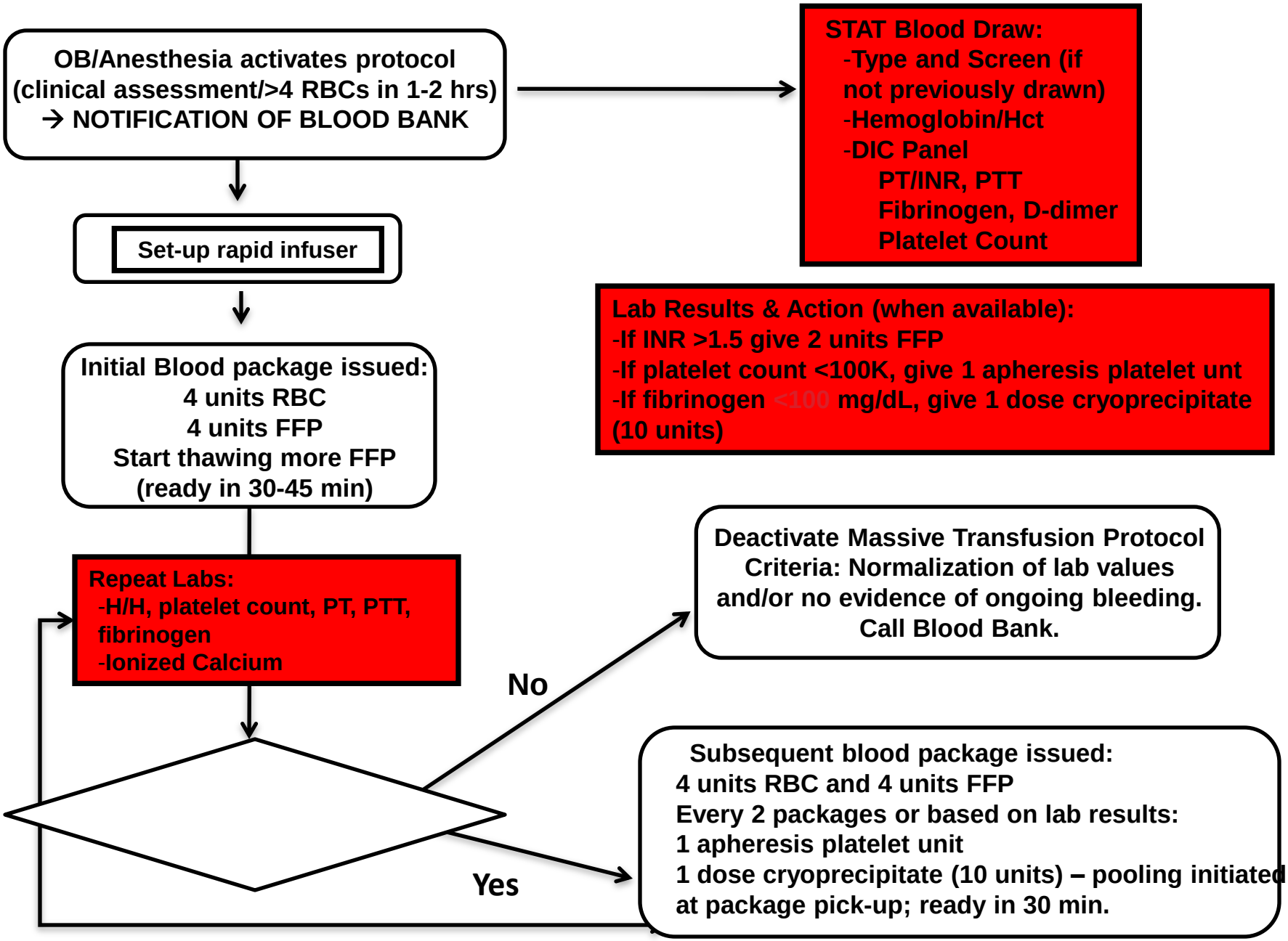
Massive Blood Transfusuin

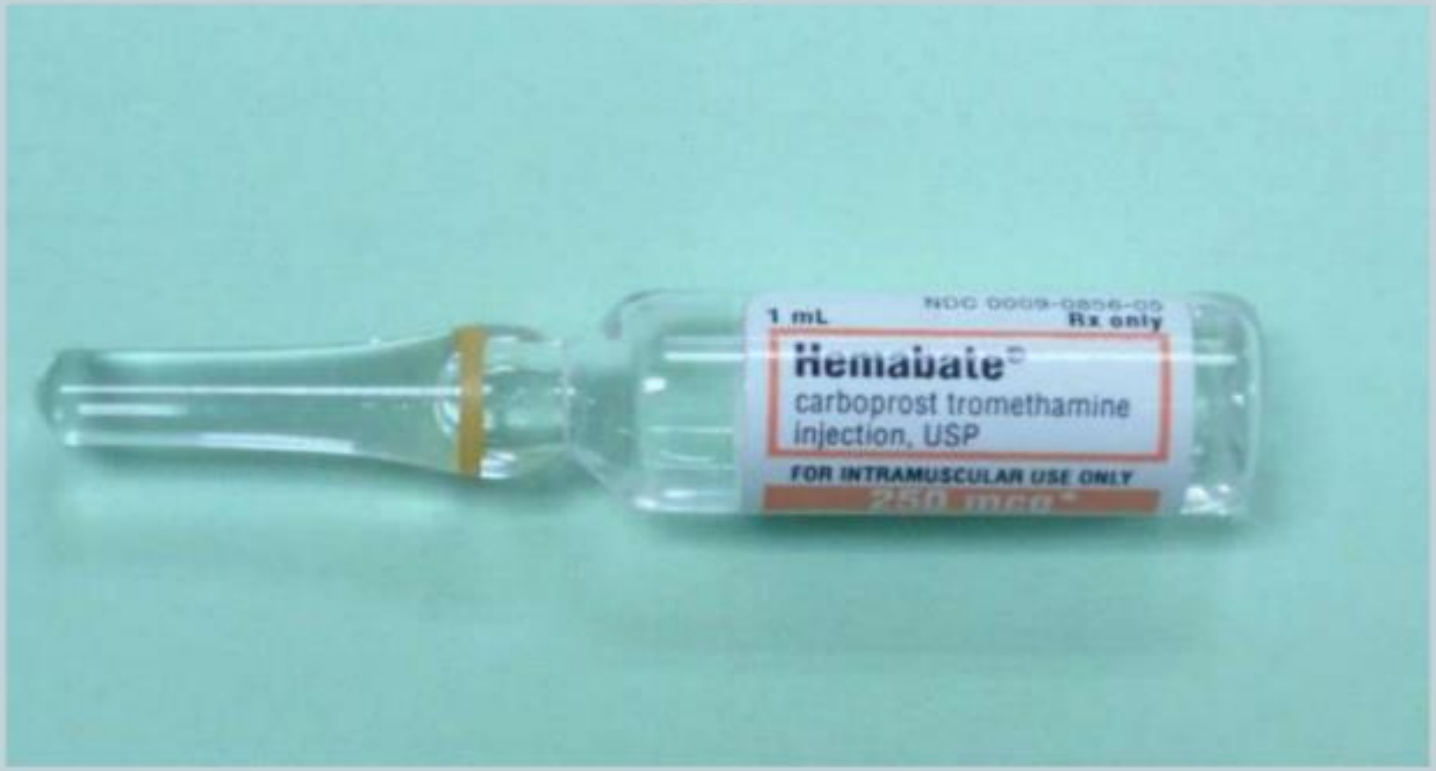
- Transfusion of ≥10 red blood cell (RBC) units, which approximates the total blood volume (TBV) of an average adult patient, within 24 h,
- Transfusion of >4 RBC units in 1 h with anticipation of continued need for blood product support
- Replacement of >50% of the TBV by blood products within 3 h.
- Transfusion support to loss of blood >150ml/min

In Paediatric pts

- Transfusion of >100% TBV within 24 h,
- Transfusion support to replace ongoing haemorrhage of >10% TBV /min
- Replacement of>50% TBV by blood products within 3 h.

Sample Massive Transfusion Protocol




1 mL
NDC 0009-0856-05
Rx only
Hemabate
carboprost tromethamine
injection, USP
FOR INTRAMUSCULAR USE ONLY

Route and dose

- **Intravenous infusion** — Oxytocin is usually infused into a maternal vein. The dose as a prophylactic agent vary widely among institutions.
- A commonly used dose is 10 to 20 units of oxytocin per 500 mL 0.9 percent saline, with the rate of infusion adjusted, as needed, to prevent uterine atony
- In a randomized trial comparing two oxytocin doses (80 units/500 mL versus 10 units/500 mL infused over one hour), there was no significant difference between the doses in the composite outcome of atony or hemorrhage requiring treatment (uterotonic drugs, transfusion, tamponade, embolization, surgery) .

- We suggest oxytocin for active management of the third stage of labor.
- After delivery of the anterior fetal shoulder to ensure that shoulder dystocia, undelivered twin before initiating active management.
- Adverse effects, dose related : hypotension, tachycardia, increased cardiac output, myocardial ischemia, flushing, nausea, vomiting, and mild antidiuresis .

- **Timing** — The optimum timing of oxytocin administration is unclear .
- It has been given before placental separation to expedite the process and after placental expulsion to enhance contraction of the uterus and reduce the volume of blood loss.
- Most randomized trials have administered the drug prior to placental separation (after delivery of the anterior shoulder); there are fewer data on administration after placental expulsion.

- A **Sengstaken–Blakemore tube** is a medical device inserted through the nose or mouth and used occasionally in the management of upper gastrointestinal hemorrhage due to esophageal varices (distended and fragile veins in the esophageal wall, usually a result of cirrhosis).

SOS BAKRI TAMPONADE BALLOON CATHETER

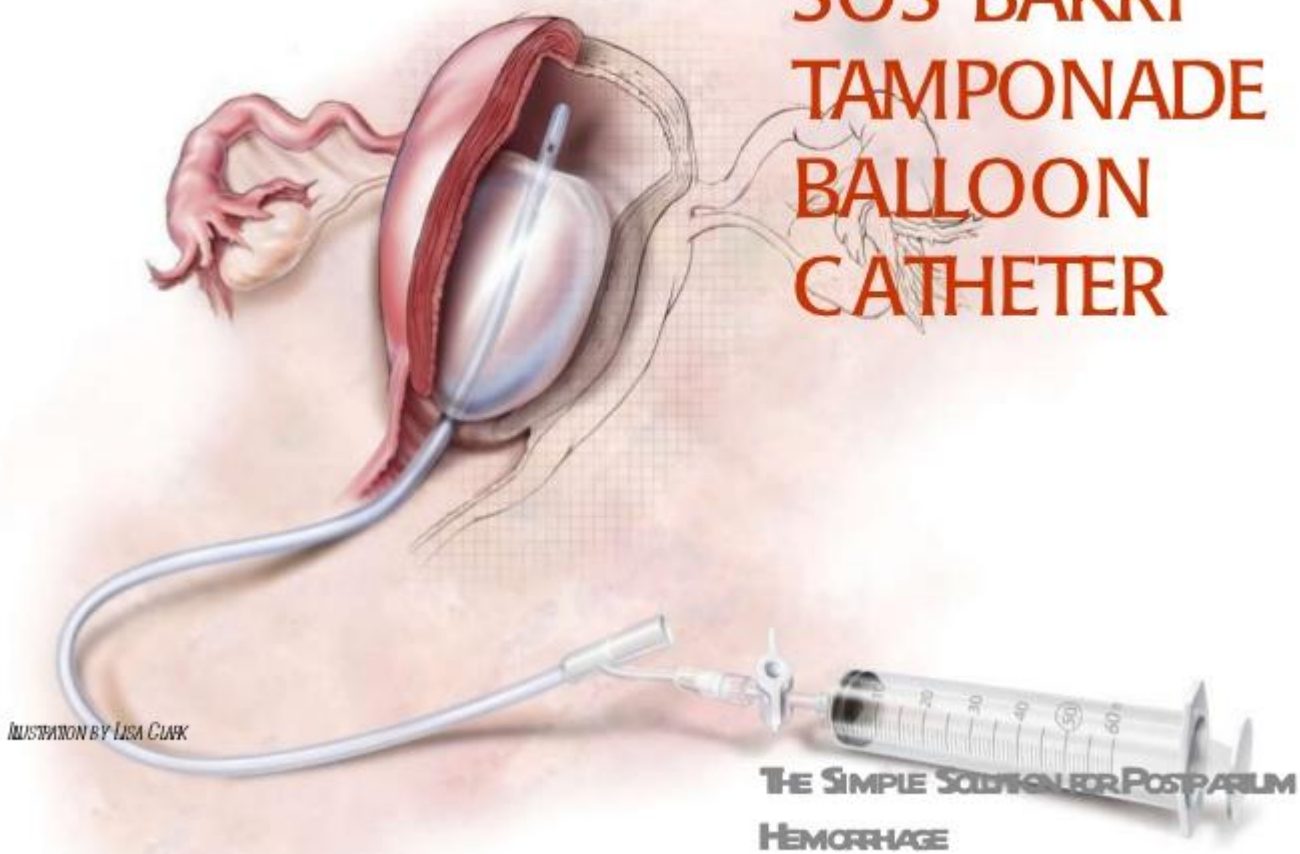


ILLUSTRATION BY LISA CLARK

THE SIMPLE SOLUTION FOR POSTPARTUM HEMORRHAGE

- , dilutional coagulopathy is not usually observed until approximately 80% of the original blood volume has been replaced.
- Infuse fresh frozen plasma (FFP), beginning with 4 U and following with additional units to normalize the coagulation test findings. Many authorities recommend the addition of 1 U of FFP for every 5 U of PRBCs for patients who require continued transfusion.
- Thrombocytopenia is likely after 1.5-2 times the blood volume has been replaced. Each unit of platelets increases the platelet count by approximately 10 X 10^9/L. (Platelets are usually given in packs of 5-6 U.) If bleeding is continuing and the platelet count is less than 50 X 10^9/L, administer 10-12 U initially.

- Cryoprecipitate may be useful along with FFP because of the markedly depressed fibrinogen levels.
- Cryoprecipitate is commonly given in 6- to 12-U doses and may also be helpful immediately before any surgical intervention in patients with abnormal coagulation test results.
- Interest in and experience with recombinant activated factor VIIa (RFVIIa) in massive hemorrhage situations is growing

Response to resuscitation

- Pay close attention to the patient's level of consciousness, pulse, blood pressure, and urine output during the course of the management of massive hemorrhage. A urine output of 30 mL/h or more likely indicates adequate renal perfusion. Closely monitor the CBC count, coagulation, and blood gas values in addition to acid-base status. Pulse oximetry is useful for evaluating tissue perfusion and oxygen saturation. Frequent auscultation of the lung fields helps detect pulmonary edema or the development of adult respiratory distress syndrome.

Summary and recommendations

- Postpartum hemorrhage can be defined as excessive bleeding that makes the patient symptomatic (eg, lightheaded, palpitations, diaphoresis, confusion) and/or results in signs of hypovolemia (eg, hypotension, tachycardia, oliguria, decreased oxygen saturation).
- The most common causes of postpartum hemorrhage are atony, trauma, and acquired or congenital coagulation defects.
- Although there are many known risk factors for postpartum hemorrhage, knowledge of these risk factors is not clinically useful in prevention of hemorrhage.
- The approach to management of postpartum hemorrhage varies depending on the cause and whether the patient has had a vaginal birth or cesarean delivery. Traumatic, hemorrhaging lesions are managed surgically and coagulopathy is managed medically, with replacement of blood products. The treatment of atony depends on the route of delivery, as there is less concern about the morbidity of open operative interventions when the patient's abdomen is already open.
- For secondary postpartum hemorrhage, we suggest administration of uterotonic agents and/or antibiotics (Grade 2C). If unsuccessful, we suggest suction curettage to evacuate potential retained products of conception (Grade 2C). (See 'Secondary postpartum hemorrhage' above.)
- Because of ease of treatment and a lesser incidence of severe side effects, we recommend that patients with anemia be treated with an oral, rather than a parenteral, iron preparation (Grade 1B).
- Women with a prior PPH have as much as a 10 percent risk of recurrence in a subsequent pregnancy.

CMQCC
CALIFORNIA MATERNAL QUALITY CARE COLLABORATIVE

Obstetric Hemorrhage Care Summary: Table Chart Format version 1.4

	Assessments	Meds/Procedures	Blood Bank
Stage 0	**Every woman in labor/giving birth**		
Stage 0 focuses on risk assessment and active management of the third stage.	• Assess every woman for **risk factors** for hemorrhage • **Ongoing quantitative evaluation of blood loss** on every birth	**Active Management 3rd Stage:** • **Oxytocin** IV infusion or 10u IM • **Fundal Massage**- vigorous, 15 seconds min.	• If **Medium Risk:**T&Scr • If **High Risk:** T&C 2 U • If **Positive Antibody Screen** (prenatal or current, exclude low level anti-D from RhoGam):T&C 2 U

Stage 1	**Blood loss: >500 ml vaginal <u>or</u> >1000 ml Cesarean, <u>or</u> VS changes (by >15% <u>or</u> HR ≥110, BP ≤85/45, O2 sat <95%)**		
Stage 1 is short: activate hemorrhage protocol, initiate preparations and give Methergine IM.	• Activate OB Hemorrhage Protocol and Checklist • Notify Charge nurse, Anesthesia Provider • VS, O2 Sat q5' • Calculate **cumulative** blood loss q5-15' • **Weigh** bloody materials • Careful inspection <u>with good exposure</u> of vaginal walls, cervix, uterine cavity, placenta	• **IV Access:** at least 18gauge • Increase IV fluid (LR) and **Oxytocin** rate, and repeat **fundal massage** • **Methergine** 0.2mg IM (if not hypertensive) May repeat if good response to first dose, BUT otherwise **<u>move on</u>** to 2nd level uterotonic drug (see below) • Empty bladder: straight cath or place foley with urimeter	• **T&C 2 Units PRBCs** (if not already done)

Stage 2	Continued bleeding with total blood loss under 1500ml		
Stage 2 is focused on sequentially advancing through medications and procedures, mobilizing help and Blood Bank support, and keeping ahead with volume and blood products.	**OB back to bedside** (if not already there) • **Extra help**: 2nd OB, Rapid Response Team (per hospital), assign roles • VS & **cumulative** blood loss q 5-10 min • Weigh bloody materials • **Complete evaluation** of vaginal wall, cervix, placenta, uterine cavity • Send additional labs, including DIC panel • If in Postpartum: Move to L&D/OR • Evaluate for special cases: -Uterine Inversion -Amn. Fluid Embolism	**2nd Level Uterotonic Drugs:** • **Hemabate** 250 mcg IM or • **Misoprostol** 800-1000 mcg PR **2nd IV Access** (at least 18gauge) Bimanual massage **Vaginal Birth:** (typical order) • Move to OR • Repair any tears • D&C: r/o retained placenta • Place intrauterine balloon • Selective Embolization (Interventional Radiology) **Cesarean Birth:** (still intra-op) (typical order) • Inspect broad lig, posterior uterus and retained placenta • B-Lynch Suture • Place intrauterine balloon	• **Notify Blood Bank of OB Hemorrhage** • **Bring 2 Units PRBCs to bedside, transfuse per clinical signs – do not wait for lab values** • Use blood warmer for transfusion • Consider thawing 2 FFP (takes 35+min), use if transfusing >2u PRBCs • Determine availability of additional RBCs and other Coag products

Stage 3	Total blood loss over 1500ml, or >2 units PRBCs given or VS unstable or suspicion of DIC		
Stage 3 is focused on the Massive Transfusion protocol and invasive surgical approaches for control of bleeding.	• **Mobilize team** -Advanced GYN surgeon -2nd Anesthesia Provider -OR staff -Adult Intensivist • **Repeat labs** including coags and ABG's • Central line • Social Worker/ family support	• **Activate Massive Hemorrhage Protocol** • Laparotomy: -B-Lynch Suture -Uterine Artery Ligation -Hysterectomy • Patient support -Fluid warmer -Upper body warming device -Sequential compression stockings	**Transfuse Aggressively** Massive Hemorrhage Pack • Near 1:1 PRBC:FFP • 1 PLT pheresis pack per 6units PRBCs **Unresponsive Coagulopathy:** After 10 units PRBCs and full coagulation factor replacement: may consider **rFactor VIIa**

Management of PPH

First line of Therapy

Uterotonic agents

- ✓ Oxytocin
- ✓ Ergot-alkaloids (Ergometrine, Methyl Ergonovine)
- ✓ Prostaglandins (Dinoprostone, Misoprostol)

Second Line of Therapy

- ✓ Surgical Interventions e.g. artery ligation
- ✓ Radiological embolisation
- ✓ Haemostatic drugs e.g. Tranexamic acid

D C Dutta. Text book of Obstetrics.5th Edn. 2001.

Cochrane Database of Systematic Reviews 2007, Issue 1. Art. No.: CD003249.

Oxytocin

- Oxytocin is a synthetic form of the nanopeptide produced in the posterior pituitary.
- It stimulates the (upper) active segment of the myometrium to contract rhythmically, which constricts spiral arteries & decreases blood flow through the uterus.
- Clinical response is rapid & occurs within 3 to 5 minutes.
- Oxytocin is dosed at 10 to 40 U/L .
- Side effects are very rare, but occasional causes nausea & vomiting.
- The only serious side effect is dilutional hyponatremia, which may happen with prolonged use.
- Rapid IV infusion is associated with hypotension & tachycardia.

http://www.uspharmacist.com/content/d/in-service/c/28279/

Carboprost

- It is synthetic prostaglandin analogue of PGF2α which enhance uterine contractility and cause vasoconstriction
- IM dosing, initial: 250 mcg; if needed, may repeat at 15- to 90-minute intervals; maximum total dose, 2 mg (8 doses).
- In 75% of cases, a successful clinical response is reached within 30 min.
- Clinical response may be enhanced with concomitant use of oxytocin.
- The reported side effects include nausea, vomiting, diarrhea, bronchospasm, & hypertension.
- The recommendation is that the drug be given with caution to patients with hepatic or cardiovascular disease, asthma, or hypersensitivity to the drug.

http://www.uspharmacist.com/content/d/in-service/c/28279/

Methylergonovine Maleate

- It is a semisynthetic ergot alkaloid.
- It causes generalized smooth-muscle contraction in which the upper and lower segments of the uterus contract tetanically.
- It is available as 0.2mg tablets & is used 0.2mg 3 to 4 times/day in the puerperium for 2 to 7 days.
- Onset of action (tablet) is within 5 to 10 minutes
- Onset of the IM dose is 2 to 5 minutes
- Side effects are very rare, but occasional causes nausea & vomiting.
- This drug should be used with extreme caution in patients with hypertension or preeclampsia, especially if ephedrine (a vasoconstrictive agent) is already given.

http://www.uspharmacist.com/content/d/in-service/c/28279/

Misoprostol Advantages

- ✓ Thermostable
- ✓ Affordable uterotonic agent compared with other
- ✓ Ease of administration
- ✓ Useful in poor resource sources – skilled workers

- Standard management[#] with 600mcg Misoprostol lowered maternal mortality by 81%.**
- Oral Misoprostol was associated with significant ↓ in the rate of acute PPH and mean blood loss. ***

[#]Standard management defined as delivery attendance by a village health worker without administration of medication.

*Int Congr Series 1279 (2005) 358–363

**Int J Gynaecol Obstet. 2010 Mar;108(3):289-94.

***Lancet.2006;368(9543):1248-53

- **Current data supports the use of Misoprostol in PPH.**
- **Safe & Effective treatment option in management of PPH.**
- **Oxytocin is a gold standard treatment in PPH.**
- **Increasing clinical evidences suggest Misoprostol as an alternative to Oxytocin.**

ACOG Patient Safety Checklist for Postpartum hemorrhage

EXAMPLE

Obstetric Hemorrhage Checklist

Complete all steps in prior stages plus current stage regardless of stage in which the patient presents.

RECOGNITION:

☐ Call for assistance (Obstetric Hemorrhage Team)

Designate: ☐ Team leader _____ ☐ Checklist reader/recorder ☐ Primary RN

Announce: ☐ Cumulative blood loss ☐ Vital signs _____ ☐ Determine stage

STAGE 1: BLOOD LOSS > 500 mL vaginal OR blood loss > 1000 mL cesarean with normal vital signs and lab values

INITIAL STEPS:

☐ Ensure 16G or 18G IV Access
☐ Increase IV fluid (crystalloid without oxytocin)
☐ Insert indwelling urinary catheter
☐ Fundal massage

MEDICATIONS:

☐ Increase oxytocin, additional uterotonics

BLOOD BANK:

☐ Type and Crossmatch 2 units RBCs

ACTION:

☐ Determine etiology and treat
☐ Prepare OR, if clinically indicated (optimize visualization/examination)

Oxytocin (Pitocin):
10-40 units per 500-1000mL solution

Methylergonovine (Methergine):
0.2 milligrams IM

15-methyl $PGF_2\alpha$ (Hemabate, Carboprost):
250 micrograms IM
(may repeat in q15 minutes, maximum 8 doses)

Misoprostol (Cytotec):
800-1000 micrograms PR
600 micrograms PO or 800 micrograms SL

Tone (i.e., atony)
Trauma (i.e., laceration)
Tissue (i.e., retained products)
Thrombin (i.e., coagulation dysfunction)

ACOG Patient Safety Checklist for Postpartum hemorrhage

Stage 2: Continued Bleeding (EBL up to 1500mL OR > 2 uterotonics) with normal vital signs and lab values

Initial Steps:

- ☐ Mobilize additional help
- ☐ Place 2nd IV (16-18G)
- ☐ Draw STAT labs (CBC, Coags, Fibrinogen)
- ☐ Prepare OR

Medications:

- ☐ Continue Stage 1 medications

Blood Bank:

- ☐ Obtain 2 units RBCs (DO NOT wait for labs. Transfuse per clinical signs/symptoms)
- ☐ Thaw 2 units FFP

Action:

- ☐ Escalate therapy with goal of hemostasis

Huddle and move to Stage 3 if continued blood loss and/or abnormal VS

Revised October 2015

ACOG Patient Safety Checklist for Postpartum hemorrhage

STAGE 3: CONTINUED BLEEDING (EBL > 1500mL OR > 2 RBCs given OR at risk for occult bleeding/coagulopathy OR any patient with abnormal vital signs/labs/oliguria)

INITIAL STEPS:

- ☐ Mobilize additional help
- ☐ Move to OR
- ☐ Announce clinical status (vital signs, cumulative blood loss, etiology)
- ☐ Outline and communicate plan

MEDICATONS:

- ☐ Continue Stage 1 medications

BLOOD BANK:

- ☐ Initiate Massive Transfusion Protocol (If clinical coagulopathy: add cryoprecipitate, consult for additional agents)

ACTION:

- ☐ Achieve hemostasis, intervention based on etiology

Oxytocin (Pitocin):
10-40 units per 500-1000mL solution

Methylergonovine (Methergine):
0.2 milligrams IM

15-methyl $PGF_2\alpha$ (Hemabate, Carboprost):
250 micrograms IM
(may repeat in q15 minutes, maximum 8 doses)

Misoprostol (Cytotec):
800-1000 micrograms PR
600 micrograms PO or 800 micrograms SL

ACOG Patient Safety Checklist for Postpartum hemorrhage

Stage 4: Cardiovascular Collapse (massive hemorrhage, profound hypovolemic shock, or amniotic fluid embolism)

Initial Step:

- ☐ Mobilize additional resources

Medications:

- ☐ ACLS

Blood Bank:

- ☐ Simultaneous aggressive massive transfusion

Action:

- ☐ Immediate surgical intervention to ensure hemostasis (hysterectomy)

Post-Hemorrhage Management

- Determine disposition of patient
- Debrief with the whole obstetric care team
- Debrief with patient and family
- Document

Massive Transfusion

Recombinant Activated Factor VIIa (Novoseven)

- Enhances platelet aggregation
- Promotes clotting through extrinsic pathway (binds to tissue factor)
  - Complexes with tissue factor → activates Factor IX and X, and generates thrombin
- Dose 40-60 mcg/Kg IV bolus, repeat in 15-30 minutes
- Controls bleeding rapidly – 10 minutes!
- Very few adverse effects reported < 1%
- Short ½ life (2 hours)
- High Cost – 1400.00/milligram

Prevention

- Noteworthy is the finding that early administration of oxytocin (before placental delivery) did not increase the rate of retained placenta. Additionally, the trial showed trends toward a benefit for early administration of oxytocin, including a 25% reduction in PPH and a 50% reduction in the need for transfusion.
- Increase the rate of retained placenta?.
- Following delivery, administering a uterotonic drug that lasts at least 2-3 hours is reasonable.
- All medical facilities should have protocols for dealing with PPH and obstetric hemorrhage

Pathophysiology

- Over the course of a pregnancy, maternal blood volume increases by approximately 50% (from 4 L to 6 L). The plasma volume increases somewhat more than the total RBC volume, leading to a fall in the hemoglobin concentration and hematocrit value.
- The increase in blood volume serves to fulfill the perfusion demands of the low-resistance uteroplacental unit and to provide a reserve for the blood loss that occurs at delivery.
- At term, the estimated blood flow to the uterus is 500-800 mL/min, which constitutes 10-15% of cardiac output.
- The blood vessels are compressed and kinked by this crisscross latticework, and, normally, blood flow is quickly occluded. This arrangement of muscle bundles has been referred to as the "living ligatures" or "physiologic sutures" of the uterus.

Contraindications

- Surgical intervention is a last resort. (uterine rupture)genital tract trauma has occurred and surgical repair is clearly indicated.
- Some women may refuse such an intervention on personal or religious grounds. Jehovah's Witnesses. (patient wishes)
- Significant increased risk of maternal mortality 6-fold in a recent national review of 23 year.
- when medical management has failed, surgery is most likely the only life-saving option
- Even an unstable condition cannot be considered a true contraindication.
-

Laboratory Studies

- In the antenatal period, a **CBC** ,Anemia Hemoglobin levels below 10-10.5 g/dL have been associated with adverse pregnancy outcome.
- Thrombocytopenia will be identified.
- New CBC in addmission .
- Blood typing and antibody screening tests.
- A sample to be held in the blood bank, in case blood is urgently needed.
- In a patient at high risk of PPH, cross matching of 2-6 U of blood before delivery is prudent. Examples include previous severe PPH, placenta previa, possible placenta accreta, multiple previous cesarean deliveries, known coagulation disorders, or severe thrombocytopenia. The American Association of Blood Banks currently recommends retesting women at high risk every 72 hours for the development of antibodies.

Laboratory Studies

- Once the diagnosis of PPH has been made, a CBC and baseline coagulation studies should be performed.
- Initially, the hemoglobin value does not reflect the amount of blood loss.
- A crossmatch for 4-6 U of PRBCs should be requested and consideration given to notifying the blood bank of the possible need for additional blood products in short order.
- Initial coagulation study findings are usually within reference ranges; however, abnormalities may be noted. This is most common when PPH is preceded by abruptio placenta, HELLP syndrome, fatty liver of pregnancy, intrauterine fetal demise, embolic events, or septicemia.
- If the international normalized ratio and/or activated partial thromboplastin time are elevated, the use of fibrinogen, a thrombin time measurement, D-dimers, and a blood film should be considered. In late pregnancy, fibrinogen levels are 2-3 times the upper reference range limit in the nonpregnant state, and a level within the nonpregnant reference range should be viewed with caution if the clinical picture suggests coagulopathy

Laboratory Studies

- The onset of PPH is generally rapid. With proper diagnosis and treatment, resolution usually occurs before further laboratory work or imaging can be undertaken. In experienced hands, bedside ultrasound may help reveal clots or retained products; however, the treatment of PPH includes manual exploration if bleeding persists. This renders ultrasound redundant in the acute setting at a time when treatment must not be delayed. Antenatal ultrasound is indispensable for detecting high-risk patients with predisposing factors for PPH, such as placenta previa, and is becoming increasingly sensitive and specific in the diagnosis of placenta accreta and its variants. Pelvic vessel angiography is discussed in Treatment.
- PPH usually manifests with such rapidity that diagnostic procedures are almost entirely limited to a physical examination of the involved structures.
- Assessment of uterine tone and size is accomplished using a hand resting on the fundus and palpating the anterior wall of the uterus. The presence of a boggy uterus with either heavy vaginal bleeding or increasing uterine size establishes the diagnosis of uterine atony. The presence of uterine atony and resulting hemorrhage usually prevents the diagnosis of PPH from other causes because of an inability to visualize other sites. For this reason, and because of the rapidity of blood loss secondary to atony, management and control of atony is paramount.
- If the placenta has been delivered, inspection findings suggest whether portions of it have been retained. If it is undelivered or if retained clots or placental fragments are distending the uterus and bleeding is persisting despite appropriate ongoing treatment, manual exploration and removal should be undertaken. This is simultaneously therapeutic by emptying the uterus and permitting contraction while also aiding in the diagnosis of placenta accreta and uterine rupture. Cervical and vaginal lacerations may also be palpated at this time.
- If uterine atony has been controlled and bleeding from the uterus is minimal, careful inspection of the lower genital tract reveals bleeding sites in this area. Palpation and inspection may also reveal hematomas that require treatment. The cervix and vagina should be completely visualized following all operative vaginal deliveries.
-

Imaging studies

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Diagnostic procedure

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Secondary postpartum hemmorage

- Secondary PPH refers to excessive uterine bleeding occurring between 24 hours and 12 weeks postpartum. It affects 0.5 to 2 percent of women in developed countries The pathogenesis may be diffuse uterine atony or subinvolution of the placental site secondary to retained products of conception and/or infection. A bleeding diathesis may also be responsible. Pseudoaneurysm of the uterine artery and arteriovenous malformations are rare causes of secondary PPH described in case reports . Choriocarcinoma is rare, but may present as prolonged, new, or increased bleeding postpartum. Sometimes the cause cannot be determined.
- Unlike primary PPH, bleeding usually is not catastrophic. A previous history of secondary PPH appears to predispose to a recurrence, as with primary PPH