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POSTPARTUM HEMORRHAGE

Methodical handbook for students of medical institutions, clinical residents and doctors

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The methodological guide outlines practical recommendations for the detection, diagnosis, choice of treatment method and management in obstetrical tactics for postpartum hemorrhage, in accordance with the principles by evidence-based medicine and worldwide clinical protocols in obstetrics and gynecology, which was also approved by the Ministry of Health of the Kyrgyz Republic № 691 from September 9, 2016, taking into account the recommendations from ACOG, RCOG and NICE.

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TERMINOLOGICAL DICTIONARY

ACOG	American College of Obstetricians and Gynecologists
RCOG	Royal College of Obstetricians and Gynecologists
NICE	National Institute for Health and Clinical Excellence
BP	Blood pressure
PPH	Postpartum hemorrhage
IUD	Intra uterine device
APTT	Activated partial thromboplastin time
DFP	Degradation products of fibrin-fibrinogen
DIC	Disseminated intravascular coagulation
IRA	Intraoperative reinfusion of autoerythrocytes
CS	Cesarean section
ICD-10	International classification of diseases of the 10th revision
CBC	Complete blood count
CBV	Circulating blood volume
PT	Prothrombin time
FDP	Fibrinogen degradation products
PDNLP	Premature detachment of a normally located placenta
PI	Prothrombin index
ROTEM	Rotary thromboelastometry
RDS	Respiratory distress syndrome
FFP	Fresh frozen plasma
TEG	Thromboelastography
RR	Respiration rate
HR	Heart rate
ECG	Electrocardiography
ACA	American cardiology association
MVV	Minute ventilation volume

ICU	Intensive care unit
PEEP	Positive end- expiratory pressure positive pressure at the end of exhalation
ET	Endotracheal tube
CPAP	Continuous positive airway –continuous positive airway pressure
SV	Stroke volume
BR	Breathing rate
ABC	Airway (respiratory tract), Breathing (respiration), with Circulation (blood circulation) resuscitation algorithm
CBV	Circulating blood volume
MV	Mechanical ventilation
AV	Assisted ventilation
Pa CO2	Partial pressure of CO2 in the alveolar air
Pa O2	Partial pressure of O2 in the alveolar air
PaCO2	Partial pressure of CO2 in arterial blood
PaO2	Partial pressure of O2 in arterial blood
CVC	Central venous catheter
MVV	Minute volume of ventilation

INTRODUCTION

Relevance. Maternal mortality is unacceptably high. About 295 000 women died during and following pregnancy and childbirth in 2017. The vast majority of these deaths (94%) occurred in low-resource settings, and most could have been prevented [23].

Sub-Saharan Africa and Southern Asia accounted for approximately 86% (254 000) of the estimated global maternal deaths in 2017. Sub-Saharan Africa alone accounted for roughly two-thirds (196 000) of maternal deaths, while Southern Asia accounted for nearly one-fifth (58 000) [10].

Women die as a result of complications during and following pregnancy and childbirth. Most of these complications develop during pregnancy and most are preventable or treatable. Other complications may exist before pregnancy but are worsened during pregnancy, especially if not managed as part of the woman's care. The major complications that account for nearly 75% of all maternal deaths are [22]:

- severe bleeding (mostly bleeding after childbirth)
- infections (usually after childbirth)
- high blood pressure during pregnancy (pre-eclampsia and eclampsia)
- complications from delivery
- unsafe abortion.

Maternal Mortality Ratio(MMR) of India for the period 2016-18, as per the latest report of the national Sample Registration system (SRS) data is 113/100,000 live births, declining by

17 points, from 130/ 100,000 live births in 2014-16. The Government of India has been focusing on initiatives to improve maternal health indicators. Much progress has been made in ending preventable maternal deaths in the past two decades: Globally the number of women and girls who die each year due to issues related to pregnancy and childbirth has dropped considerably, from 451,000 in 2000 to 295,000 in 2017, a 38 per cent decrease [16].

In India sample registration scheme (SRS), during survey of causes of death 1998, reported that PPH was a major cause of maternal mortality and responsible for 30 % of maternal deaths and according to SRS 2001-2003, PPH accounts 38 percent of maternal deaths. Estimates of maternal mortality ratio in India done by Indian Council of Medical Research (ICMR) in 2003 also showed PPH as a leading cause of maternal mortality in study population [1].

It is interesting to note that, according to the NSC data, maternal death cases prevailed in the urban population till 2000 (which is more to do with under-registration of maternal death cases in the rural areas). Since 2000, the ratio has changed: the MM rate dropped down in the urban 25 population from 60.3 in 2000 to 32,1 in 2010, and MM rate has significantly increased in the rural population - from 39,4 in 2010 up to 61,3 in 2010. According to 2010 data, the MMR in rural women is generally higher than that of women living in urban areas across Kyrgyzstan by 1, 9 times [7].

Table. 1. Main causes of Maternal Mortality (% of total), 1999-2011.

	1999	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011
Direct obstetrics causes, including:	-	-	89,3	86,3	89,6	100	87	82,7	74,5	70,3	76,1
Obstetric bleedings	22,9	13	18	31,8	43,3	34,4	52,2	29	35,5	44,2	42,6
Gestosis/ Hypertension disorders	-	-	40	22,7	26,7	34,4	22,4	22,6	26,3	23,1	22,2
Toxicosis	37,5	38	-		-	-	-	-	-	-	-
Septic complications	12,5	18	16	11,4	10	7,8	10,4	21	18,4	3,8	20,4
Uterus rupture	8,3	2,2	4	6,8	3,3	1,6	0	1,6	0	0	1,9
Other	18,8	29	22	27,3	16,7	21,9	14,9	25,8	19,7	28,8	12,9
Indirect obstetrics causes	-	-	10,7	13,7	10,4	0	13	17,3	25,5	29,7	23,9

Source: Republican Medical Information Center

According to the data of the Republican Medical Information Center of the Kyrgyz Republic, the main causes of maternal mortality by direct obstetrical cases are 76, 1%, of which from obstetric bleeding (postpartum hemorrhage) (42,6%), hypertensive disorders (22,2%), sepsis (20,4%) and extra genital diseases (23,9%).

The purpose of the lesson:

Able to apply the knowledge gained in practical classes on postpartum hemorrhage; learn how to diagnose the etiology of the bleeding with other pathological conditions in the pregnant women, determine the specific antenatal care on depending on the specific clinical situation, evaluate the effectiveness of the treatment and carry out operative accommodations.

A list of the basic concepts that the student will learn in this specified lesson:

1. Definition of postpartum hemorrhage concepts.
2. Determination of the source of bleeding according to the rule of “4T”.

3. Clinical features, diagnosis, differential diagnosis, choice of treatment tactics for uterine atony.
4. Clinical features, diagnosis, differential diagnosis, choice of treatment tactics for tissue retention in the uterine cavity.
5. Clinical features, diagnosis, differential diagnosis, choice of treatment tactics for trauma of the birth canal.
6. Clinical features, diagnostics, differential diagnostics, choice of treatment tactics for coagulation disorders.
7. Hemorrhagic shock;
8. Hemostatic therapy for uterine hypotension;
9. DIC syndrome;
10. Infusion-transfusion therapy;
11. Uterotonic drugs**.**
12. Prevention of postpartum hemorrhage during vaginal childbirth.
13. Prevention of postpartum bleeding during cesarean section.

The list of skills that a student should acquire:

1. Correctly evaluate the clinical picture of various pathological conditions during and after childbirth;
2. Diagnostic investigations for the postpartum hemorrhage;
3. Diagnostic procedures to determine the cause of the postpartum bleeding;
4. Identifying the cause of postpartum bleeding according to the rule of “4T”;
5. Selection the choice of tactics in obstetrical treatment;
6. Replenishment of circulating blood volume from the severity of bleeding;
7. Choosing obstetric treatment tactics;

8. Own methods of stopping bleeding;
9. Demonstration of obstetric procedures to stop bleeding;
10. Evaluation of patients according to the ABCD system;
11. Drug therapy for postpartum hemorrhage;
12. Evaluate the effectiveness of therapy using virtual monitoring.

CLINICAL GUIDELINES FOR MANAGEMENT OF THE THIRD STAGE OF LABOR

To understand the mechanisms of development of a number of critical emergency conditions, for their adequate correction and for a reasonable and rational choice of anesthetic aid, we need an understanding of physiological changes and adaptive mechanisms during pregnancy, childbirth and the postpartum period.

The third stage of labor has traditionally been defined as the time between the birth of the baby and the delivery of the placenta and membranes. It is the third stage that is the most perilous for the woman because of the risk of postpartum hemorrhage (PPH). The third stage of labor typically lasts between 10 and 30 minutes; if the placenta fails to separate within 30 minutes after childbirth, the third stage is considered to be prolonged. If the third stage of labor lasts longer that 18 minutes, it is associated with a significant risk of PPH; and there is a six-fold increase in PPH when the third stage of labor lasts longer than 30 minutes.

MANAGEMENT OF THE THIRD STAGE OF LABOR

The third stage of labor may be managed expectantly or actively. In expectant (physiological) management, uterotonic drugs are not given prophylactically, the cord may or may not be clamped early, and the placenta is delivered by maternal effort. In active management, uterotonic drugs are given before delivery of the placenta, the cord is usually cut 2–3 minutes after birth, and the placenta is delivered by controlled cord traction (CCT). Two important trials have demonstrated that active management prevents up to 60% of PPH and provides several benefits for the woman compared to expectant management.

THE COMPONENTS OF ACTIVE MANAGEMENT OF THE THIRD STAGE OF LABOR

The routine care for the woman and her newborn and have been refined to include the following:

I. **Step I:** Place the baby in skin-to-skin contact on the abdomen of the mother, dry the baby, assess the baby's breathing and perform resuscitation if needed. Cover the baby's head with a cloth or, preferably a hat/bonnet. Cover the woman and baby. (***Fig.1***);

II. **Step II:** Administer an uterotonic (oxytocin or misoprostol) within 1 minute after the baby's birth and after ruling out the presence of another baby (the uterotonic of choice is oxytocin 10 IU IM). (***Fig.2***);

III. **Step III:** Clamp and cut the cord after cord pulsations have ceased or approximately 2–3 minutes after birth of the baby, whichever comes first. Cover the cord with a piece of gauze when cutting the cord to avoid splashing blood. (***Fig.3***);

IV. **Step IV:** Perform controlled cord traction (CCT): (i) Place the clamp near the woman's perineum to make CCT easier. Hold the cord close to the perineum using a clamp. Place the palm of the other hand on the lower abdomen just above the woman's pubic bone to assess for uterine contractions. If a clamp is not available, CCT can be applied by encircling the cord around the hand. Encourage maternal effort to bear down with contractions. If necessary, help the woman into an upright position to assist with delivery of the placenta. (***Fig.4***);

V. **Step V:** When there is a contraction, apply external pressure on the uterus in an upward direction (toward the woman's head) with the hand just above the pubic bone. At the same time with your other hand, pull with firm and steady tension on the cord in a downward direction (follow the direction of the birth canal). (***Fig.5***);

VI. **Step VI:** Deliver the placenta slowly and support it with both hands. (***Fig.6***)**;**

VII. **Step VII:** As the placenta is delivered, hold and gently turn it with both hands until the membranes are twisted. Slowly pull to complete the delivery. Gently move membranes up and down until delivered. (***Fig.7***);

VIII. **Step VIII:** Massage the uterus immediately after delivery of the placenta and membranes until it is firm.(***Fig.8***);

IX. **Step IX:** During recovery, assist the woman to breastfeed if this is her choice, monitor the newborn and woman closely, palpate the uterus through the abdomen every 15 minutes for 2 hours to make sure it is firm and monitor the amount of vaginal bleeding. Provide prevention of mother-to-child transmission care as needed. (***Fig.9***)

ASSESSMENT

Step 1

Fig.1.

Step II

Fig.2.

Step III

Fig.3.

Step IV

Fig.4.

Step V

Fig.5.

Step IV

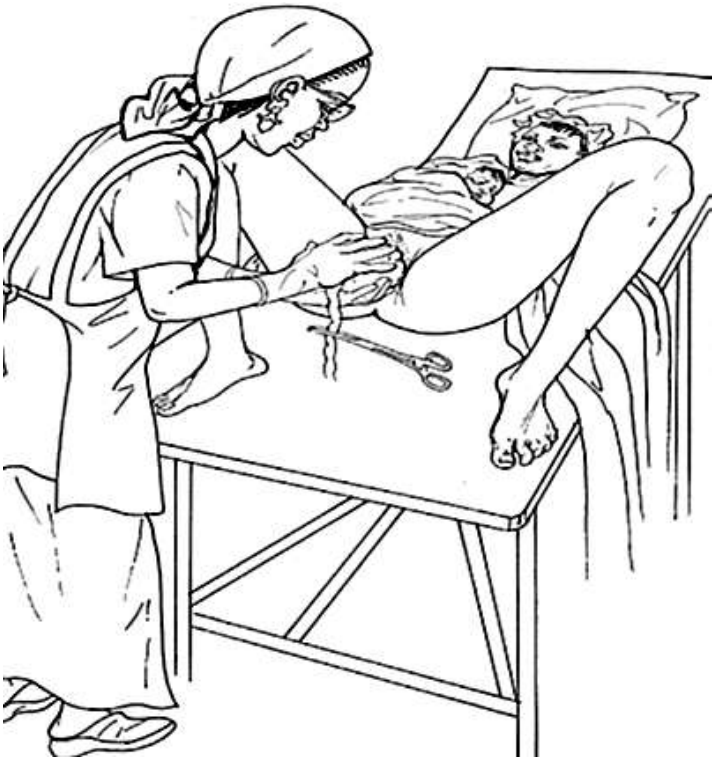


Fig. 6.

Step VII

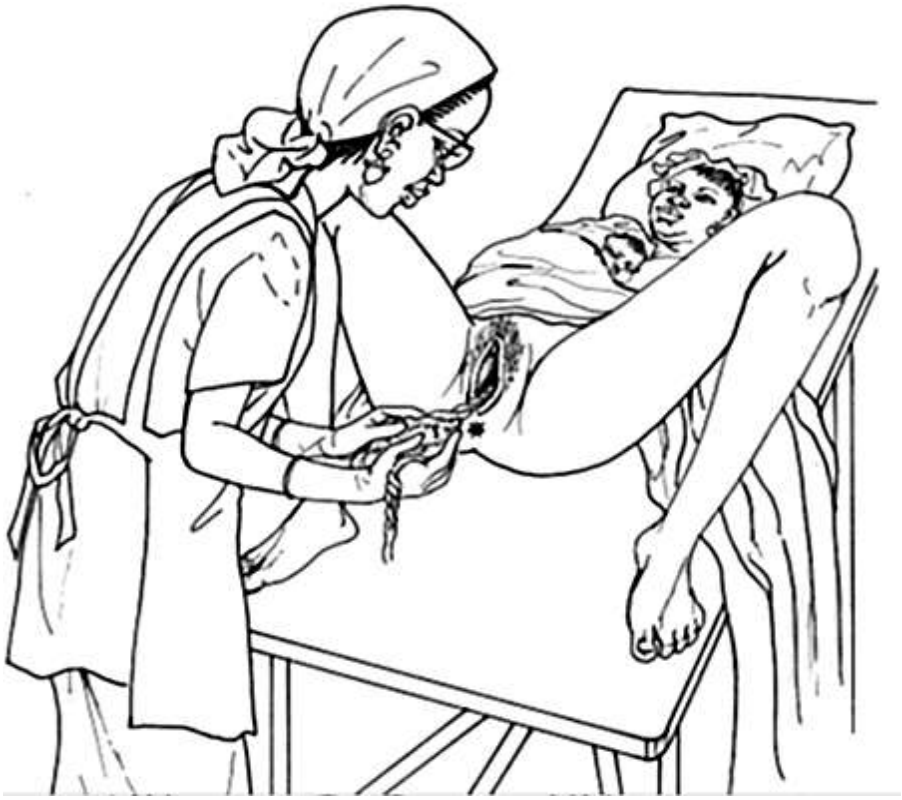


Fig.7.

Step VIII

Fig.8.

Step IX

Fig.9.

Of all the stages of labor, third stage is the most crucial one for mother. Fetal complications ,au appear unexpectedly in an otherwise uneventful first or second stage.

The following are the important complications:

- Postpartum hemorrhage;
- Retention of placenta;
- Shock- hemorrhagic or non-hemorrhagic;
- Pulmonary embolism either by amniotic fluid or by air;
- Uterine inversion.

POSTPARTUM HEMORRHAGE (PPH)

DEFINITION. Postpartum hemorrhage (PPH) – is blood loss ≥ 500 ml during vaginal delivery and ≥ 1000 ml during caesarean section (CS) or any clinically significant amount of blood loss (leading to hemodynamic instability) occurring 42 days (6 weeks) after birth of the fetus.

Common causes of postpartum hemorrhage are impaired uterine contractility (90%) and trauma to the birth canal (7%). 3% of postpartum hemorrhages are associated with the presence of remnants of placental tissue or disorders in the hemostatic system.

The average blood loss following vaginal delivery, cesarean delivery and cesarean hysterectomy is 500 ml, 1000 mL and 1500 mL.

Depending upon the amount of blood loss, PPH can be:

- **Minor (<1L);**
- **Major (>1L) or**
- **Severe (>2L).**

Incidence: The incidence widely varies mainly because of lack of uniformity in the criteria used in definition. The incidence is about 4-6% of all deliveries.

Types: ***Primary** ***Secondary**

Primary: Hemorrhage occurs within 24 hours following birth of the baby. In the majority, hemorrhage occurs within two hours following delivery.

These are of two types:

- **Third-stage hemorrhage** – bleeding occurs before expulsion of placenta.

- **True postpartum hemorrhage –** bleeding occurs subsequent to expulsion of placenta (majority).

Secondary: hemorrhage occurs beyond 24 hours and within puerperal hemorrhage.

Table 2. The main etiological factors of postpartum hemorrhage, depending on the period of its occurrence.

Early (primary)	**Late (secondary)**
Uterine atony	Subinvolution of the uterus
Injuries to the birth canal	Retained parts of the placenta and membranes
Placenta remnants	Postpartum infections
Placenta accrete	Congenital defects of the hemostasis system (eg, Von Willebrand factor deficiency)
Defects in the hemostasis system	
Uterine inversion	

Table 3. The stratification of the risk of bleeding during pregnancy and childbirth.

Stratification the risk of postpartum bleeding.		
Low risk	**Medium risk**	**High risk**
Singleton pregnancy	Multiple pregnancy	Placenta previa, placenta accrete
< 4 deliveries	> 4 deliveries	Hematocrit < 30
Non-operated uterus	Previous caesarean section or uterine surgery	Bleeding on admission
Absence of postpartum bleeding in history	Big sizes of uterine fibroids	Identified defect in the blood coagulation system
	Chorioamnionitis	Presence of postpartum bleeding in history
	Magnesium sulfate	Hemodynamic

	induction	disorder (tachycardia,hypotension)
	Labor induction by oxytocin	

Table 4. Causes for PPH may be considered by 4 main disorders ("4 Ts")

Cause	Explanation		Incidence in %
1. T (tonus)	Violation of uterine contraction	Uterine atony	**75%**
2. T (tissue)	Retention of placental tissue	Retained tissues	**10%**
3. T (trauma)	Trauma to the birth canal	Trauma	**15%**
4. T(thrombin)	Blood clotting disorders	Blood coagulopathy	**0,01%**

Table 5. Predisposing factors for PPH.

Atonic PPH (80%)	Traumatic PPH (20%)	Blood coagulopathy
• Grand multipara • Malnutrition and anemia • Multiple pregnancy • Hydramnios • Macrosomia • Antepartum hemorrhage • Prolonged labor • Precipitate delivery • Mismanaged 3rd stage of labor • Malformation of uterus • Inadequate used oxytocin	• Forceps or instrument used delivery • Injury to the labor tract: cervix, vagina, perineum (episiotomy wound and lacerations) • Assisted breech delivery	• Abruption placenta • HELLP-syndrome • Jaundice in pregnancy • Thrombocytopenic purpura • IUD

Table 6. Antenatal and intranatal risk factors for PPH.

Etiology	Primary cause	Risk factors/ Symptoms
Uterine contraction disorder – as uterine atony	Uterine atony	Long-term administration of oxytocin. Great parity. Chorioamnionitis. General anesthesia.
	Overstretching of the uterus	Multiple pregnancies. Polyhydramnios. Macrosomia.
	Myoma of the uterus	Multiple nodes of uterine myoma.
	Inversion of the uterus	Intense traction for the umbilical cord. Short umbilical cord. Attachment of the placenta in the fundus of the uterus.
Injury to the birth canal	Episiotomy. Tears and lacerations of the cervix, vagina, perineum. Uterine rupture.	Operative vaginal delivery. Instrument assisted delivery. Precipitate delivery.
Retention of placental tissue	Retained tissues. Placenta accrete.	Additional placental lobe. Previous operations on the uterus. Incomplete removal the parts of the placenta during labor.
Blood coagulation disorders	Preeclampsia. Congenital hemostasis defects (hemophilia, von Willebrand factor deficiency, etc.). Severe infection. Amniotic fluid embolism. Excessive infusion of crystalloids. Administration of therapeutic anticoagulants.	Hemorrhage. A petechial rash. The death of the fetus. Premature abruption of a normally located placenta. Fever, sepsis. Hemorrhage Conducted antithrombotic therapy.

PRIMARY POSTPARTUM HEMORRHAGE

CAUSES

♦ Atonic ♦ Traumatic

♦ Retained tissues ♦ Blood coagulopathy (Trombin)

Atonic uterus (80%): Atonicity of the uterus is the commonest cause of postpartum hemorrhage. With the separation of the placenta, the uterine sinuses which are torn, cannot be compressed effectively due to imperfect contraction and retraction of the uterine musculature and bleeding continues. The following are the conditions which often interfere with the retraction of the uterus as a whole and of the placental site in particular:

- **Grand multipara**—inadequate retraction and frequent adherent placenta contribute to it. Associated anemia may also probably play a role.
- **Over-distension of the uterus** as in multiple pregnancy, hydramnios and large baby. Imperfect retraction and a large placental site are responsible for excessive bleeding.
- **Malnutrition and anemia**—even slight amount of blood loss may develop clinical manifestations of postpartum hemorrhage.
- **Antepartum hemorrhage**: placenta previa, abruption of placenta and etc.
- **Prolonged labor**: Poor retraction, infection (amnionitis), dehydration are important factors.
- **Anesthesia**: Depth of anesthesia and the anesthetic agents (ether, halothane) may cause atonicity.

- **Initiation or augmentation of delivery by oxytocin**: Post-delivery uterine atonicity is likely unless the oxytocin is continued for at least one hour following delivery.
- **Malformation of the uterus**: Implantation of the placenta in the uterine septum of a septate uterus or in the cornual region of a bicornuate uterus may cause excessive bleeding.
- **Uterine fibroid** causes imperfect retraction mechanically.
- **Mismanaged third stage of labor**. This includes:
  - too rapid delivery of the baby preventing the uterine wall to adapt to the diminishing contents;
  - premature attempt to deliver the placenta before it is separated;
  - kneading and fiddling the uterus;
  - pulling the cord. All these produce irregular uterine contractions leading to partial separation of placenta and hemorrhage;
  - manual separation of the placenta increases blood loss during cesarean delivery.
- **Placenta**: morbidly adherent (accreta, percreta), partially or completely separated and/or retained.
- **Precipitate labor**: in rapid delivery, separation of the placenta occurs following the birth of the baby. Bleeding continues before the onset of uterine retraction. Bleeding may be due to genital tract trauma also.
- **Other causes of atonic hemorrhage are**:
  - Obesity (BMI > 35);
  - Previous PPH;
  - Age (>40 years);
  - Drugs: use of tocolytic drugs (ritodrine), $MgSO_4$, Nifedipine.

Traumatic (20%): Trauma to the genital tract usually occurs following *operative delivery*; even after spontaneous delivery. Blood loss from the *episiotomy* wound is often underestimated. Similarly blood loss in *cesarean section* amounting to 800-1000 mL is most often ignored. **Trauma** involves usually the cervix, vagina, perineum (episiotomy wound and lacerations), paraurethral region and rarely, rupture of the uterus occurs. The bleeding is usually revealed but can rarely be concealed (vulvovaginal or broad ligament hematoma).

- ***Retained tissues***: Bits of placenta, blood clots cause PPH due to imperfect uterine retraction.
- ***Thrombin***: Blood coagulation disorders are less common causes of postpartum hemorrhage. The blood coagulopathy may be due to diminished procoagulants (washout phenomenon) or increased fibrinolytic activity. The firmly retracted uterus can usually prevent bleeding. The conditions where such disorders may occur are abruptio placentae, jaundice in pregnancy, thrombocytopenic purpura, HELLP syndrome or in IUD. Specific therapy following coagulation screen including recombinant activated factor VII may be given.
- ***Combination of atonic and traumatic causes***.

DIAGNOSIS AND CLINICAL EFFECTS

In the majority, the vaginal bleeding is visible outside, as a slow trickle. Rarely, the bleeding is totally concealed either as vulvo-vaginal or broad ligament hematoma. **The effect of blood loss depends on**: predelivery hemoglobin level degree of pregnancy induced hypervolemia and speed at which blood loss

occurs. Alteration of pulse, blood pressure and pulse pressure appears only after class 2 hemorrhage (20-25% loss of blood volume). On occasion, blood loss is so rapid and brisk that death may occur within a few minutes.

State of uterus, as felt per abdomen, gives a reliable clue as regards the cause of bleeding. **In traumatic hemorrhage**, the uterus is found well contracted. **In atonic hemorrhage**, the uterus is found flabby and becomes hard on massaging. However, both the atonic and traumatic cause may co-exist. Even following massive blood loss from the injured area, a state of low general condition can make the uterus atonic.

PROGNOSIS

Postpartum hemorrhage is one of the life-threatening emergencies. It is one of the major causes of maternal deaths both in the developing and developed countries. Prevalence of malnutrition and anemia, inadequate antenatal and intranatal care and lack of blood transfusion facilities, substandard care are some of the important contributing factors. **There is also increased morbidity.**

These include: shock, transfusion reaction, puerperal sepsis, failing lactation, pulmonary embolism, thrombosis and thrombophlebitis.

Late sequelae includes: Sheehan's syndrome (selective hypopituitarism) or rarely diabetes insipidus.

PREVENTION

Postpartum hemorrhage cannot always be prevented. However, the incidence and especially its magnitude can be

reduced substantially by assessing the risk factors and following the guidelines as mentioned below:

However, most cases of PPH have no identifiable risk factors.

I. Antenatal

- **Improvement of the health status** of the woman and to keep the hemoglobin level normal (> 10 g/dL) so that the patient can withstand some amount of the blood loss.
- **High risk patients** who are likely to develop postpartum hemorrhage (such as twins, hydramnios, grand multipara, APH, history of previous PPH, severe anemia) are to be screened and delivered in a well-equipped hospital.
- **Blood grouping** should be done for all women so that no time is wasted during emergency.
- **Placental localization** must be done in all women with previous cesarean delivery by USG or MRI to detect placenta accreta or percreta.
- **All women with prior cesarean delivery** must have their placental site determined by ultrasound/MRI to detect morbid adherent placenta.
- **Women with morbid adherent placenta** are at high risk of PPH. Such a case should be delivered by a senior obstetrician. Availability of blood and or blood products must be ensured beforehand.

II. Intranatal

- *Active management of the third stage, for all women in labor should be a routine as it reduces PPH by 60%.*
- *Cases with induced or augmented labor by oxytocin*, the infusion should be continued for at least one hour after the delivery.

- **Women delivered by cesarean section**, oxytocin 5 IU slow IV are to be given to reduce blood loss. Carbetocin (long- acting oxytocin) 100 gr is very useful to prevent PPH.
- **Exploration of the uterovaginal canal** for evidence of trauma following difficult labor or instrumental delivery.
- **Observation for about two hours** after delivery to make sure that the uterus is hard and well contracted before sending her to ward.
- **Expert obstetric anesthetist** is needed when the delivery is conducted under general anesthesia. **Local or epidural anesthesia** is preferable to general anesthesia, in forceps, ventouse or breech delivery.
- **During cesarean section** spontaneous separation and delivery of the placenta reduces blood loss (30%).
- **Examination of the placenta** and membranes should be a routine so as to detect at the earliest any missing part.

MANAGEMENT OF THIRD STAGE BLEEDING

The principles in the management are:

- **To empty the uterus** of its contents and to make it contract.
- **To replace the blood**. On occasion, patient may be in shock. In that case patient is managed for shock first (see p. 619).
- **To ensure effective haemostasis** in traumatic bleeding.

STEPS OF MANAGEMENT:

♦ **Placental site bleeding** ♦ **Traumatic bleeding**

Placental site bleeding

- **To palpate the fundus and massage** the uterus to make it hard. The massage is to be done by placing four fingers

behind the uterus and thumb in front. However, if bleeding continues even after the uterus becomes hard, suggests, the presence of genital tract injury.

- **To start crystalloid solution** (Normal saline or Ringer's solution) with oxytocin (1 L with 20 units) at 60 drops per minute and to arrange for blood transfusion if necessary.
- **Oxytocin** 10 units IM or methergin 0.2 mg is given intravenously.
- **To catheterize** the bladder.
- **To give antibiotics** (Ampicillin 2 g and Metronidazole 500 mg IV).

During this procedure, if features of placental separation are evident, expression of the placenta is to be done either by fundal pressure or controlled cord traction method. If the placenta is not separated, *manual removal of placenta under general anesthesia is to be done* **(Fig.20)**. *However, if the patient is in shock, she is resuscitated first before undertaking manual removal. If the patient is delivered under general anesthesia,* quick manual removal of the placenta solves the problem. *In cases where oxytocin 10 units is given IM* with the delivery of the anterior shoulder, manual removal is done promptly when two attempts of controlled cord traction fail. *Crede's expression of the placenta is abandoned* as it is not only ineffective, but produces shock and rarely inversion.

Management of traumatic bleeding: The uterovaginal canal is to be explored under general anesthesia after the placenta is expelled and hemostatic sutures are placed on the offending sites.

SECONDARY POSTPARTUM HEMORRHAGE

The bleeding usually occurs between 8th to 14th day of delivery. **The causes of late postpartum hemorrhage are:**

1) Retained bits of cotyledon or membranes (most common);

2) Infection and separation of slough over a deep cervicovaginal laceration;

3) Endometritis and subinvolution of the placental site — due to delayed healing process;

4) Secondary hemorrhage from cesarean section wound usually occurs between 10-14 days.

It is probably due to — separation of slough exposing a bleeding vessel or from granulation tissue. Withdrawal bleeding following estrogen therapy for suppression of lactation. Other rare causes are: chorion- epithelioma—occurs usually beyond 4 weeks of delivery; carcinoma cervix; placental polyp; infected fibroid or fibroid polyp and puerperal inversion of uterus.

DIAGNOSIS

The bleeding is bright red and of varying amount. Rarely may it be brisk. Varying degree of anemia and evidences of sepsis are present. Internal examination reveals evidences of sepsis, subinvolution of the uterus and often a patulous cervical os. **Ultrasonography** is useful in detecting the bits of placenta inside the uterine cavity.

MANAGEMENT

Principles:

- To assess the amount of blood loss and to replace it (transfusion);

- To find out the cause and to take appropriate steps to rectify it.

Supportive therapy:

a) Blood transfusion, if necessary;
b) Administer methergin 0.2 mg intramuscularly, if the bleeding is uterine in origin;
c) Administer antibiotics as a routine.

***Conservative*:** If the bleeding is slight and no apparent cause is detected, a careful watch for a period of 24 hours or so is done in the hospital.

***Active treatment*:** As the most common cause is due to retained bits of cotyledon or membranes, **it is** preferable to explore the uterus urgently under general anesthesia. One should not ignore the small amount of bleeding; as unexpected alarming hemorrhage may follow sooner or later. The products are removed by ovum forceps. Gentle curettage is done by using flushing curette. Methergin 0.2 mg is given intramuscularly. *The materials removed are to be sent for histological examination.*

Presence of bleeding from the sloughing wound of cervicovaginal canal should be controlled by hemostatic sutures.

Secondary hemorrhage following cesarean section may at times require laparotomy. The bleeding from uterine wound can be controlled by hemostatic sutures; may rarely require ligation of the internal iliac artery or may end in hysterectomy.

DIFFERENTIAL DIAGNOSIS BY CLINICAL FEATURES

Table 7. Main clinical features of PPH.

CAUSE	SINGS

T (TONUS)	
Uterine contraction disorder - atony	On palpation - the fundus of the uterus is located above the umbilicus, the uterus is soft in consistency, does not contract.
T (TISSUE)	
Retention of placental tissue in the uterus.	While examining the placenta that was born, there is a violation of its integrity or a lack of its parts.
Placental separation and excretion.	Absence of placental detachment signs.
T (TRAUMA)	
Ruptures of the cervix, vagina, perineum.	Tears and lacerations are visible by eyes.
Hematomas of the vagina or perineum. Pain or sensation of pressure in the perineum, rectum, buttocks.	On examination of the birth canal, there is a painful tumor in the perineal region.
Uterine rupture.	A ruptured uterus may be suspected if a history of uterine surgery has been performed. The uterus is dense, without remnants of placental tissue in the presence of postpartum bleeding.
Uterine inversion.	A hard, bright red mass in the vagina or outside the genital fissure (with or without placenta). On palpation through the anterior abdominal wall, the uterus cannot be felt. Shock that does not match the degree of blood loss (pain shock). Shock accompanied by bradycardia (stimulation of the vagus nerve due to tension in the ovaries and tubes).
T (THROMBIN)	

Coagulopathy	Prolongation of blood clotting time (clotting time in the modification of the Lee-White method > 7 min). Bleeding from the uterus: the blood flowing out does not clot, the clots are loose.

DIAGNOSIS

Careful collection of anamnesis and identification of risk factors allow stratifying patients according to risk groups: low, medium, high. The stratification of the risk of bleeding during pregnancy and childbirth is shown in **Table 2**. There are predisposing factors (**Table 5**) and antenatal with intranatal risk factors (**Table 6**) to determine the cause of bleeding (**Table 3**). Clinical features (**Table 7**) will be confusing in each case, that's why to pay attention!

Scheme 1. POSTPARTUM SCREENING. EVALUATION. MANAGEMENT.

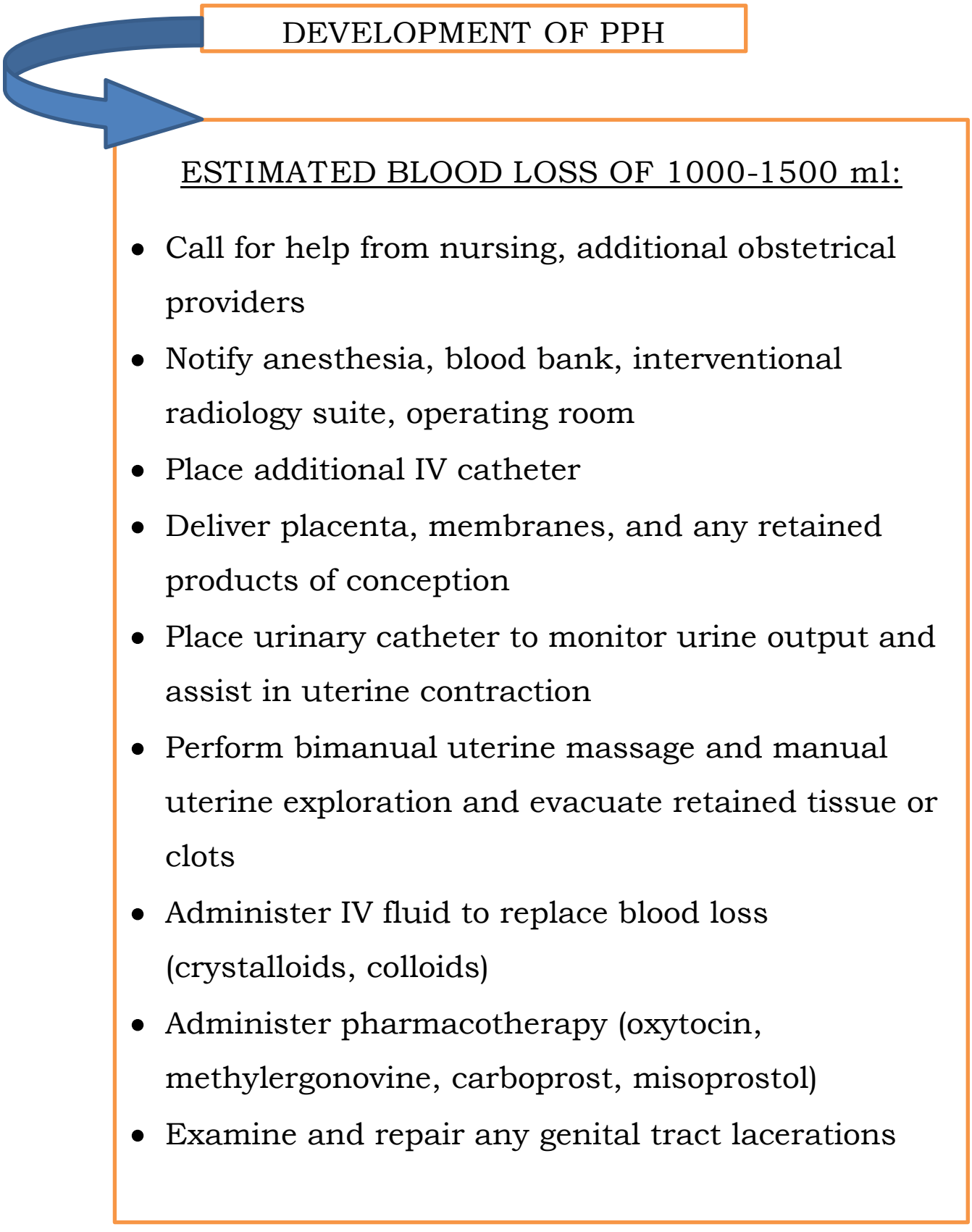
DURING PREGNANCY

- Screen all women for risk factors for PPH;
- Identify women at risk for PPH;
- Optimize hemoglobin levels before delivery;
- Seek multidisciplinary consultation (e.g., for inherited hematologic disorders).

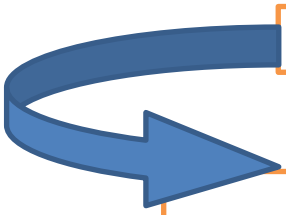
ON ADMISSION IN THE HOSPITAL

- Assess patients for risk factors for PPH;
- Categorize patients into risk strata (low, medium, and high risk for PPH);
- Create IV access with a large-bore cannula (2 IV cannulas for patients at increased risk);
- Obtain baseline laboratory values (CBC, BMP, T and S, fibrinogen, PT, a PTT);
- Notify anesthesia and other consultation services (e.g., hematology, gynecologic oncology);
- Document pertinent contraindications to specific pharmacotherapies (e.g., asthma, hypertension)

Scheme 2. Development of PPH.



DEVELOPMENT OF PPH



ESTIMATED BLOOD LOSS OF >1500–3000 ML:

- Monitor laboratory values (CBC, BMP, T and S, fibrinogen, PT, aPTT, lactate);
- Monitor for coagulation (thromboelastography or rotational thromboelastometry);
- Place arterial catheter, central venous catheters;
- Administer blood and blood products (especially if patient is hemodynamically unstable);
- Continue to administer pharmacotherapy to maximum tolerated doses;
- Place uterine tamponade device (e.g., Bakri or Rusch balloon tamponade);
- Administer tranexamic acid.

DEVELOPMENT OF PPH

ESTIMATED BLOOD LOSS OF > 3000 ML:

- Continue transfusion of red cells, FFP, and platelets according to local protocols (e.g., 1:1:1 ratio);
- Continue to monitor laboratory values (CBC, BMP, T and S, fibrinogen, PT, aPTT, lactate);
- Continue to monitor for coagulation (thromboelastography or rotational thromboelastometry);
- Consider readministration of tranexamic acid;
- Consider recombinant factor VIIa therapy (in hemophilia A or B);
- Consider uterine artery embolization (if patient is stable) with interventional radiology;
- Perform laparotomy;
- Repair any uterine lacerations or uterine rupture;
- Place uterine compression sutures (e.g., B-Lynch, Hayman, Cho, Esike methods);
- Perform stepwise suture ligation;
- Perform bilateral uterine artery ligation (O'Leary sutures);
- Perform bilateral utero-ovarian artery ligation;
- Perform internal iliac artery ligation;
- Perform hysterectomy (total or supracervical — may be appropriate earlier in management, particularly if future childbearing is not desired).

PHYSICAL EXAMINATION.

The management of a patient with postpartum hemorrhage should always begin with establishing the localization of the bleeding (from the uterus, cervix, vagina, perineum and rectum) by examining the birth canal, vaginal examination and manual examination of the uterine cavity.

It is necessary to measure the pulse, blood pressure, make auscultation of the lungs, palpate the abdomen and uterus, assess the volume of blood loss and examine the placenta.

The initial hemoglobin level and woman's body weight should be taken into account when assessing the volume of blood loss. The volume of circulating blood (ml) = body weight, kg * 77 ml/kg.

According to the recommendations of the Royal Society of Obstetricians and Gynecologists PROG, there are several types of calculating the volume of circulating blood:

- Volume of circulating blood depends on body weight. The approximate volume of blood (in liters) corresponds to the body weight in kilograms divided by 12.
- If there is a low hemoglobin level during pregnancy (less than 110 g/l), it is necessary to carry out additional examination and treatment in order to normalize its level before delivery. There is some evidence that iron deficiency anemia can contribute to the development of uterine hypotension due to a reduced level of myoglobin in uteromyocytes, which is necessary for their muscle activity.
- Due to the physiological increase during pregnancy, the volume of circulating blood at full-term is about 100 ml/kg (on average, a woman weighing 70 kg has a total blood volume

of 7000 ml), blood loss of more than 40% of the total blood volume (about 2800 ml) is usually considered as life-threatening.

LABORATORY DIAGNOSTICS

For postpartum hemorrhage on an emergency basis are carried out:

- determination of blood group, Rh factor (if not previously defined);
- complete blood count (CBC) (hemoglobin, hematocrit, erythrocytes, platelets);
- blood clotting indicators: definition time of blood clotting at the patient's bed.

("Bedside test" is a modification of the method yes Lee-White), prothrombin index (PTI), fibrinogen concentration, degradation products dation of fibrin / fibrinogen (PDF), activating delayed partial thromboplastin time (APTT), if possible – thrombus boelastography (TEG), rotational thromboelastometry [ROTEM]).

Table 8. Evaluations of the main laboratory parameters for emergency correction.

Parameter	In case of massive blood loss	Critical changes
Hemoglobin	70 – 90 gr/l	< 70 gr/l
Platelet count	2 – 4 gr/l	150-350 thousand in microliter

Concentration of fibrinogen	1,0 – 1,3	Critical reduction - < 2,0 gr/l
International normalized relation	1,1– 1,3	Critical increase - > 1,5
APTT	28-32 seconds	Critical increase – more then 1,5 times above normal
DFP	Increased	Increased

INSTRUMENTAL DIAGNOSIS

In order to find the source of bleeding, an ultrasound examination (ultrasound) of the uterus can be performed to assess the condition of the uterine cavity and the presence of free fluid in the abdominal cavity.

EVALUATION OF THE SEVERITY OF BLOOD LOSS

Evaluation of the volume and severity of blood loss is carried out: by visual determination of blood loss, gravimetric method and by assessing the clinical symptoms of hypovolemia.

- ***Visual determination*** of blood loss is carried out on the basis of visual assessment of blood loss, to which you need to add 30%. *The level of evidence-based recommendation - C (level reliability of evidence - 3).*

Note: *Visual assessment underestimates real volume of blood loss by an average of 30%, error increases with an increase in the volume of blood loss; therefore, one should focus on the clinical symptoms and the patient's condition.*

- ***The gravimetric method*** is carried out by direct collection of blood in graduated containers (collection bags, cylinders or Cell Saver) together with weighing blood-soaked napkins and

surgical linen. This method is more accurate than visual, but also does not provide accurate information about the volume of blood loss. *The level of evidence-based recommendation - A (level reliability of evidence - 1).*

Note: *Application of graduated containers (collection bags, cylinders or Cell Saver) is an objective instrument used to assess blood loss with an accuracy of 90%. If possible use graduated containers, then apply visual determination of blood loss in addition to it does not make sense, since it leads to overestimation of blood loss and inadequate treatment.*

1) ***Modern guidelines*** for the diagnosis of severity blood loss and choice of patient management tactics require more emphasis on evaluation clinical symptoms of hypovolemia. With this target uses the Advanced Trauma Life scale Support (ATLS) American College of Surgeons (American College of Surgeons) (**Table 9**). *The level of persuasion of the recommendations - B (level of evidence – 3).*

Note: *During physiological pregnancy, BCC in the 3rd trimester increases by 45% and is from 85 to 100 ml / kg. When carrying out medical measures a total assessment of the volume of blood loss is required taking into account the volume of the patient's body weight at all stages of medical care. (**Table 10**)*

Shock index is determined by calculating the ratio of heart rate to systolic blood pressure is an early predictor of hemodynamic disorders and, in comparison with other markers, allows more accurate to identify women in labor at risk of adverse outcomes. Normal postpartum shock index scores are

0.7-0.9. In case of massive obstetric bleeding, the shock index> 1.0 can be used to assess blood loss and to predict the need for transfusion of blood products. *The level of evidence-based recommendation – C (level reliability of evidence - 2).*

Table 9. Evaluation of severity of blood loss by clinical features.

Indication	Grade I	Grade II	Grade III	Grade IV
Blood loss, ml	<750	750-1500	1500-2000	>2000
Pulse, beats in min	<100	100-120	120-140	>140
Systolic blood pressure	Normal	Normal	Decreased	Decreased
Pulse pressure, mm Hg	Normal or increased	Decreased	Decreased	Decreased
Respiratory rate, in min	14-20	20-30	30-40	>40
Diuresis, ml/ hour	>30	20-30	5–15	Anuria
Consciousness	Light concern	Moderate anxiety	Anxiety, confusion	Drowsiness

Table 10. Estimated volume of blood loss depending on body weight.

Body weight (kg)	Circulating Blood Volume (ml)	Blood Loss 15% out of CBV(ml)	Blood Loss 25% out of CBV(ml)	Blood Loss 40% out of CBV(ml)
50	5000	750	1500	2000
55	5500	825	1650	2200
60	6000	900	1800	2400
65	6500	975	1950	2600

BLEEDING WITH LESS BLOOD LOSS, BUT COMBINED WITH CLINICAL SIGNS OF SHOCK - TACHYCARDIA, HYPOTENSION, INCREASED RESPIRATORY RATE, OLIGURIA AND DECREASED PERIPHERAL CAPILLARY FILLING, SHOULD BE CONSIDERED AS SEVERE POSTPARTUM BLEEDING!!!

TREATMENT TACTICS

MANAGEMENT INVOLVES FOUR COMPONENTS, ALL OF WHICH MUST BE UNDERTAKEN SIMULTANEOUSLY:

- Communication;
- Resuscitation;
- Monitoring and investigation;
- Arresting the bleeding.

THE FOLLOWING INITIAL ASSESSMENT AND BASIC TREATMENT SHOULD BE INSTITUTED:

1. Call for help;
2. Assess airway, breathing and circulation (ABC);
3. Provide supplementary oxygen;
4. Obtain an intravenous line;
5. Start fluid replacement with intravenous crystalloid fluid;
6. Monitor blood pressure, pulse and respiration;
7. Catheterize bladder and monitor urinary output;
8. Assess need for blood transfusion;
9. Order laboratory tests-complete blood count, coagulation screen, blood grouping and cross-match;
10. Start intravenous oxytocin infusion.

FOUR COMPONENTS OF MINOR PPH MANAGEMENT:

1. COMMUNICATION:

• Alert the midwife-in-charge;
• Alert first-line obstetric and anaesthetic staff trainted in the management of PPH;
• Alert the blood bank;
• Alert a higher level of care for referral.

2. RESUSCITATION:

• Obtain intravenous access (14-gauge cannula x 1);

• Commence crystalloid infusion.

3. MONITORING AND INVESTIGATION:

• Monitor closely;

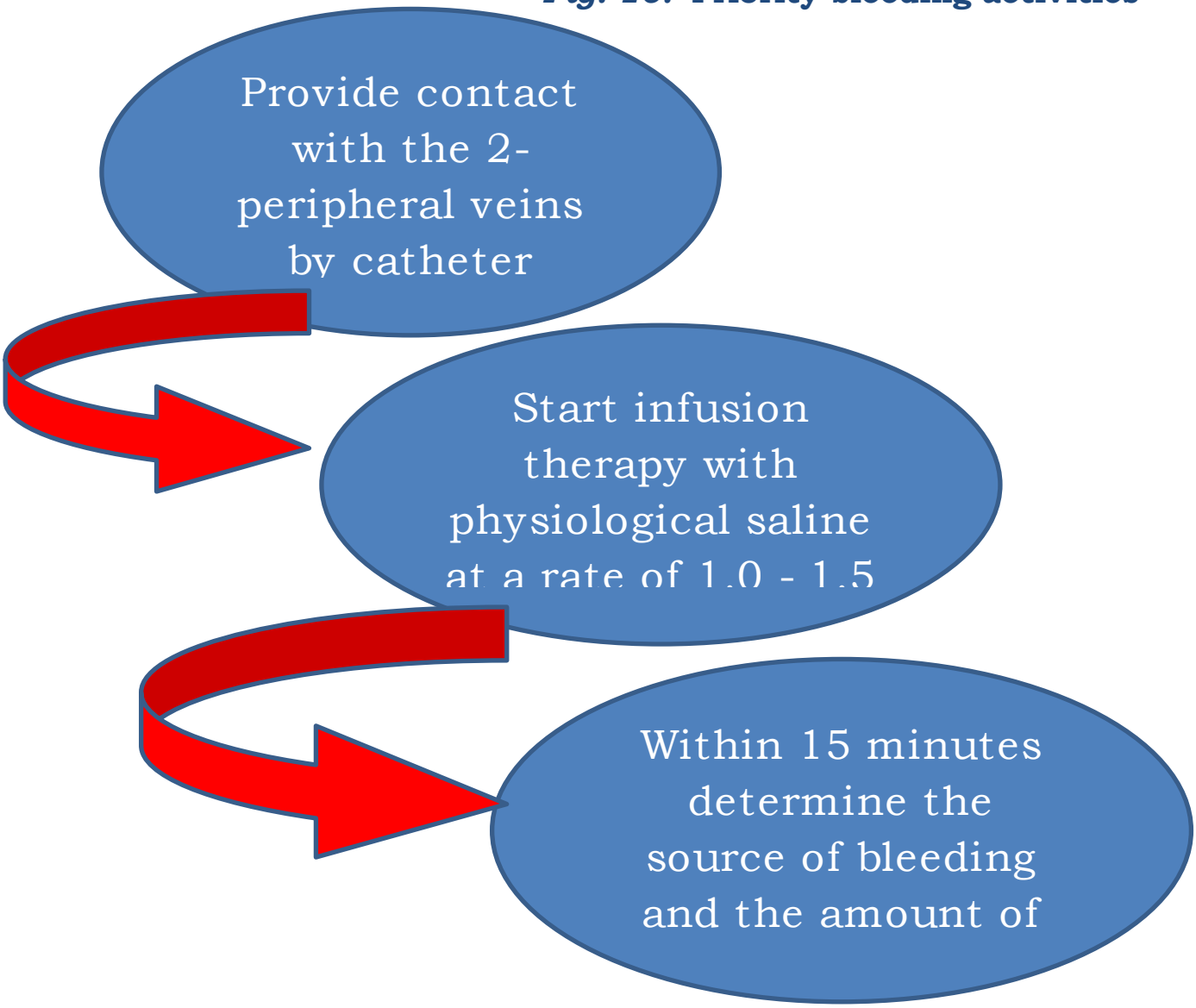
• Consider venepuncture (20mL) for group and screen, full blood count and coagulation screen including fibrinogen;

• Pulse and blood pressure recording every 15 minutes.

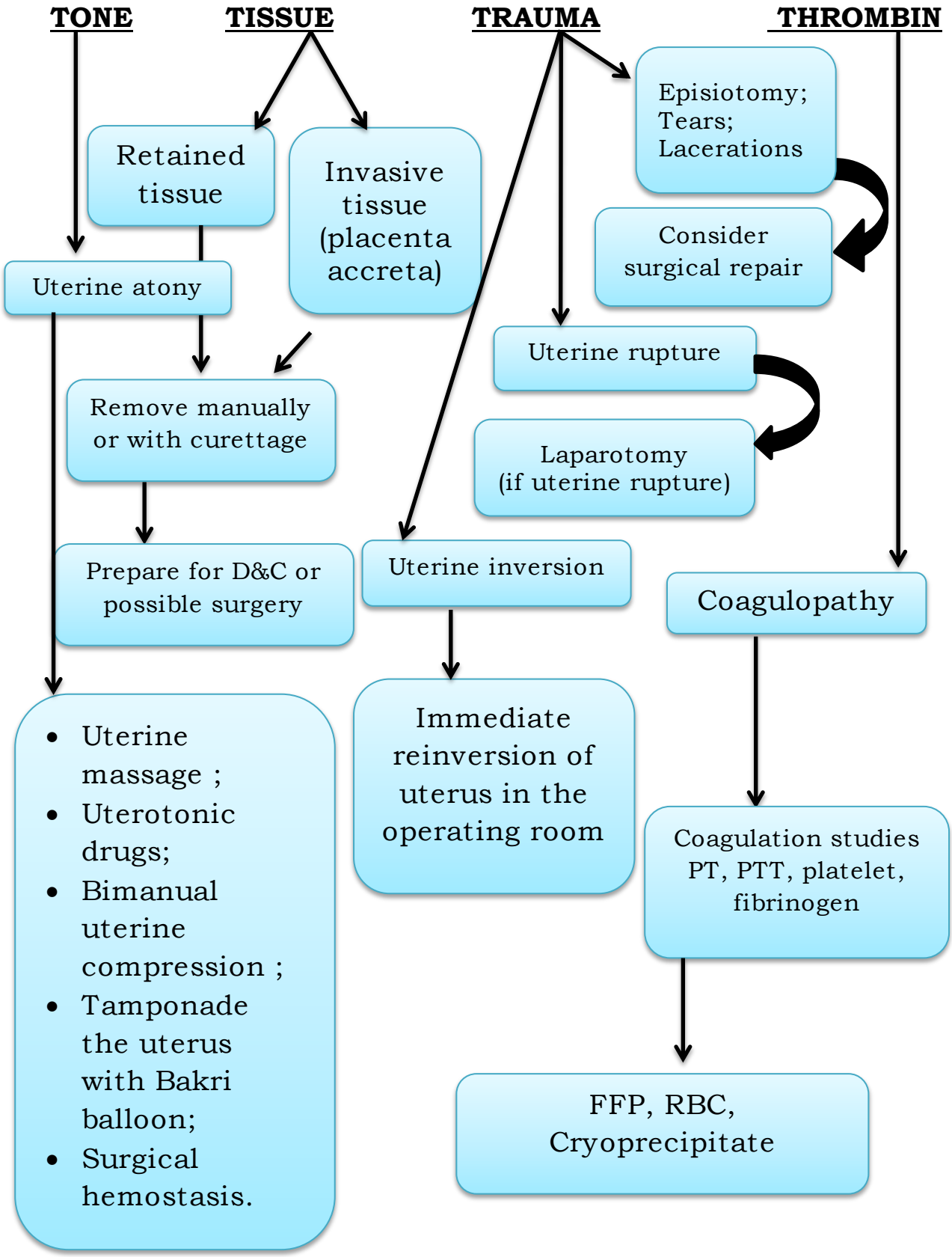
4. ARRESTING THE BLEEDING

• This follows the same pattern as full protocol for major PPH.

Fig. 10. **Priority bleeding activities**



Scheme 3. TREATMENT ACCORDING TO THE CAUSE (4 Ts):



Uterine atony is the most common cause of PPH (70%). Uterotonic drugs can be used to treat uterine atony in the following sequence.

Table 11. Uterotonic drugs

Parameters	Oxytocin	Misoprostol	Ergometrine Methylergo-metrine	Enzaprost
Starting dose and route of administration	10 IU in physiological solution 0,9% -500,0 by i/v jet stream in 10 minutes	800-1000 mcg rectally by single dose	0,2 mg i/m	0,2 mg i/m
Repeated doses	10-20 IU in physiological solution 0.9% -500.0 i/v drip in 1 hour, taking into account the tone of the uterus	-----	Up to 3 times within 2 hours. Repeated dose efficacy is unlikely	Every 20 minutes up to 3 times. The effectiveness of repeated doses - unlikely
Maximum dose	No more than 80 IU in 3 hours	1000 mcg	0,6 mg	No more than 3 doses
Dangerous side effects	Nausea, vomiting, hyponatre-mia, decreased of BP, increased heart rate	Nausea, vomiting, diarrhea, chills, tremors, headache	Nausea, vomiting, severe hypertension	Nausea, vomiting, diarrhea, fever, headache, chills, tremors, hypertension, bronchospasm
Contra-indications Warnings	Hypersensiti-vity	Hypersen-sitivity	Hypertension, gestational hypertension, cardiac pathology hypersensitivity	Liver disease, asthma, hypertension, heart and pulmonary pathology Hypersensitivi ty

COMMUNICATION

Early involvement of appropriate senior staff including an anesthesia team, and laboratory specialist is fundamental to the management of PPH.

1. Call an experienced midwife (in addition to the midwife in charge);
2. Call an obstetric middle grade (senior medical officer in obstetrics) and alert a consultant;
3. Call an anesthetic middle grade (senior medical officer in anesthesia) and alert a consultant;
4. Alert a consultant clinical hematologist on call;
5. Alert a blood transfusion laboratory;
6. Call porters for delivery of specimens/blood.

RESUSCITATION

A primary survey of a collapsed or severely bleeding woman should follow a structured approach of simple **'***ABC' with resuscitation taking place as problems are identified:* so a process of simultaneously evaluating and resuscitating. The urgency and measures undertaken to resuscitate and arrest hemorrhage need to be tailored to the *degree of shock.* Clinical judgments should be applied on each situation. The cornerstones of resuscitation during PPH are:

- **Restoration of blood volume**
- **Restoration of oxygen-carrying capacity**

The main **therapeutic goals** of management of massive blood loss are to maintain:

- Hemoglobin > 8g/dL
- Platelet count >75 x109 / L
- Prothrombin <1.5 x mean control
- Activated prothrombin times <1.5 x mean control
- Fibrinogen >1.0 g/L

ABC protocol includes:

A: Assess **A**irway; seek urgent anaesthetic assistance if compromised

B: Assess **B**reathing

C: Evaluate **C**irculation

- Give oxygen by mask at 10-15 litres/minute regardless of maternal oxygen concentration;
- Obtain intravenous access (14-gauge cannula x 2, orange cannulae);
- Position the woman flat;
- Keep the woman warm using appropriate available measures;
- Until blood is available, infuse **up to 3.5 liters of warmed fluids** as rapidly as required.

Blood volume

- Volume replacement must be undertaken bearing in mind that **blood loss** is often grossly **underestimated**.
- **Compatible blood** (as red cell concentrate) is the best fluid to replace major blood loss and should be transfused as soon as available, if necessary.

- The **clinical picture** should be the main determinant for blood transfusion and time should not be wasted waiting for laboratory results.

Fluid Therapy

The fluid therapy includes:

- **Crystalloid**: isotonic crystalloids are recommended for the initial fluid resuscitation
- Infuse up to 2 liters of Hartmann's solution
- **Colloid**: infuse up to 1-2 liters of colloid until blood arrives. Be aware that high doses may cause adverse effects. The maximum volume of clear fluids that should be infused while awaiting compatible blood is 3.5 liters.

Initial monitoring and Investigation

1. Venipuncture (20mL) for:
   - cross match (4 units minimum)
   - full blood count
   - coagulation screen including fibrinogen
   - renal and liver function for baseline

2. Monitor temperature every 15 minutes

3. Continuous pulse, blood pressure recording and respiratory rate (using oximeter, electrocardiogram and automated blood pressure recording)

4. Foley catheter to monitor urine output

5. Two peripheral cannulas, 14- or 16-gauge

6. Consider arterial line monitoring (once appropriately experienced staff available for insertion).

Arresting the Bleeding

The most common cause of primary PPH is **UTERINE ATONY.** Careful clinical examination should be done to ascertain that the uterus is indeed atonic and that other sources of bleeding, such as genital tract lacerations or uterine inversion, are excluded.

THE FOLLOWING MEASURES SHOULD BE INSTITUTED, IN TURN, UNTIL THE BLEEDING STOPS

ATONIC UTERUS

Step— I:

1) Massage the uterus to make it hard and express the blood clot (***Fig.8***);

2) Methergin 0.2 mg is given intravenously;

3) Injection oxytocin drip is started (10 units in 500 mL of normal saline) at the rate of 40-60 drops per minute;

4) Foley catheter to keep bladder empty and to monitor urine output;

5) To examine the expelled placenta and membranes (***Fig.6***), for evidence of missing cotyledon or piece of membranes. If the uterus fails to contract, proceed to the next step.

Step—II: *The uterus is to be explored under general anesthesia.* Simultaneous inspection of the cervix, vagina especially the paraurethral region is to be done to exclude co-existent bleeding sites from the injured area. **In refractory** cases:

1) Injection 15 methyl PGF2a 250 IM μg in the deltoid muscle every 15 minutes (up to maximum of 2 mg).

OR

2) Misoprostol (PGE1) 1000 μg per rectum is effective.

3) When uterine atony is due to tocolytic drugs, calcium gluconate (1 g IV slowly) should be given to neutralize the calcium blocking effect of these drugs.

Step— III: *Uterine massage and bimanual compression.*

Procedures:

1) The whole hand is introduced into the vagina in cone shaped fashion after separating the labia with the fingers of the other hand;

2) The vaginal hand is clenched into a fist with the back of the hand directed posteriorly and the knuckles in the anterior fornix;

3) The other hand is placed over the abdomen behind the uterus to make it anteverted;

4) The uterus is firmly squeezed between the two hands (***Fig. 11***). It may be necessary to continue the compression for a prolonged period until the tone of the uterus is regained. This is evidenced by absence of bleeding if the compression is released.

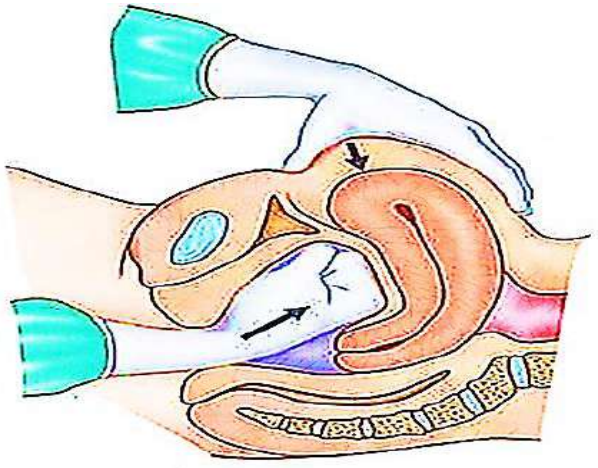


Fig.11. Bimanual uterine compression

During the period, the resuscitative measures are to be continued. If, in spite of therapy, the uterus remains refractory and the bleeding continues, the possibility of blood coagulation disorders should be kept in mind and massive fresh whole blood transfusion should be given until specific measures can be employed. However, with oxytocics and blood transfusion, almost all cases respond well. Uterine contraction and retraction regain and bleeding stops. *But in rare cases, when the uterus fails to contract*, the following may be tried desperately as an alternative to hysterectomy.

Step—IV: *Uterine tamponade – Tight intrauterine packing done uniformly under general anesthesia.*

Procedure: A 5 meters long strip of gauze, 8 cm wide folded twice is required. The gauze should be soaked in antiseptic cream before introduction. The gauze is placed high up and packed into the fundal area first while the uterus is steadied by the external hand. Gradually, the rest of the cavity is packed so that no empty space is left behind. *A separate pack is used to fill the vagina.* An abdominal binder is placed. *Intrauterine plugging acts not only by stimulating uterine contraction but exerts direct hemostatic pressure (tamponade effect) to the open uterine sinuses.* Antibiotic should be given and *the plug should be removed after 24 hours.*

Intrauterine packing is useful in a case of uncontrolled postpartum hemorrhage where other methods have failed and the patient is being prepared for transport to a tertiary care center.

Balloon tamponade (*Fig.13*): Tamponade using various types of hydrostatic balloon catheter has mostly replaced uterine

packing.Mechanism of action is similar to uterine packing. Foley catheter, Bakri balloon, Condom catheter or Sengstaken-Blakemore tube is inserted into the uterine cavity and the balloon is inflated with normal saline (200-500 mL). It is kept for 4-6 hours. It is successful in atonic PPH. This can avoid hysterectomy in 78% cases.

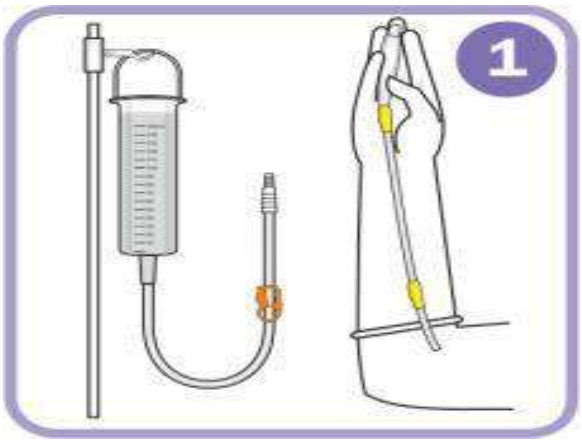
BALLOON TAMPONADE OF THE UTERUS:

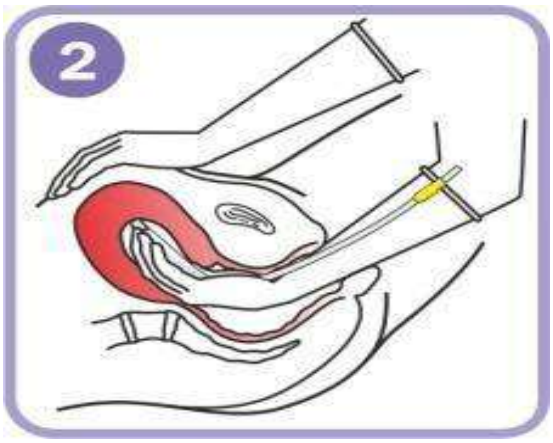
Balloon tamponade can be used to treat PPH and during transport to the operating room.

There are 4 main indications:

1. Hypotonic bleeding;
2. Absence the rupture of the uterus;
3. Absence the rupture of the cervix;
4. Absence of the efficiency from uterotonic drugs.

PROCESS OF INSTALLATION





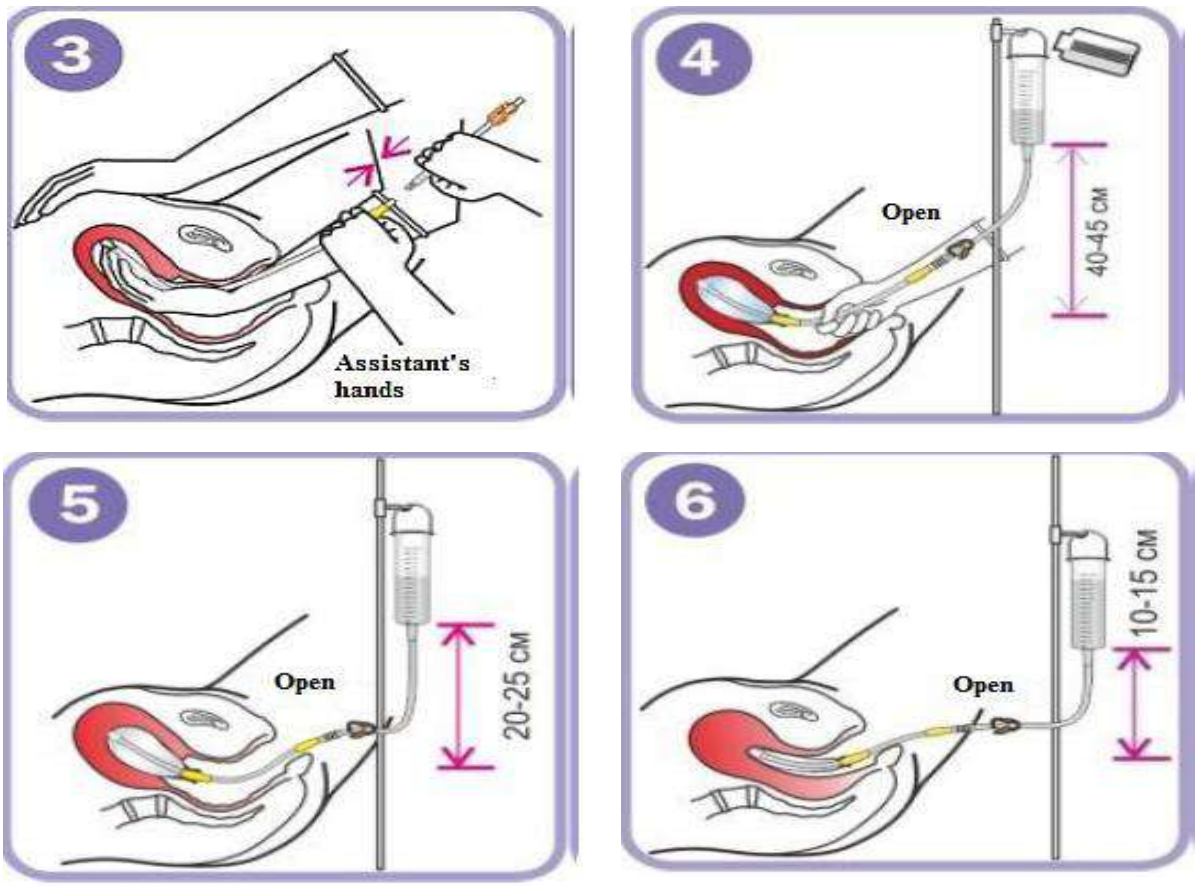


Fig. 12. Uterine tamponade techniques

1. Place the tank on the rack(***Fig.12.1***);
2. Fill the reservoir and tubing with warm sterile solution (***Fig.12.1***);
3. Close the terminal on the tube(***Fig.12.1***);
4. Insert the balloon catheter into the uterine cavity by hand (***Fig.12.2***);
5. Connect the balloon catheter to the reservoir tube and open the terminal (***Fig.12.3***);
6. Replenish the sinking solution in the tank (***Fig.12.4***);
7. Hold the filled balloon catheter in the uterine cavity with the clamp open and a stable solution level in the reservoir (***Fig.12.5***);
8. Step by step reduce the height of the reservoir (in proportion to the spontaneous increase in the level of the solution in the reservoir, which occurs in connection with the restoration of the contractile function of the uterus) (***Fig.12.5***);
9. Remove the balloon catheter (***Fig.12.6***).

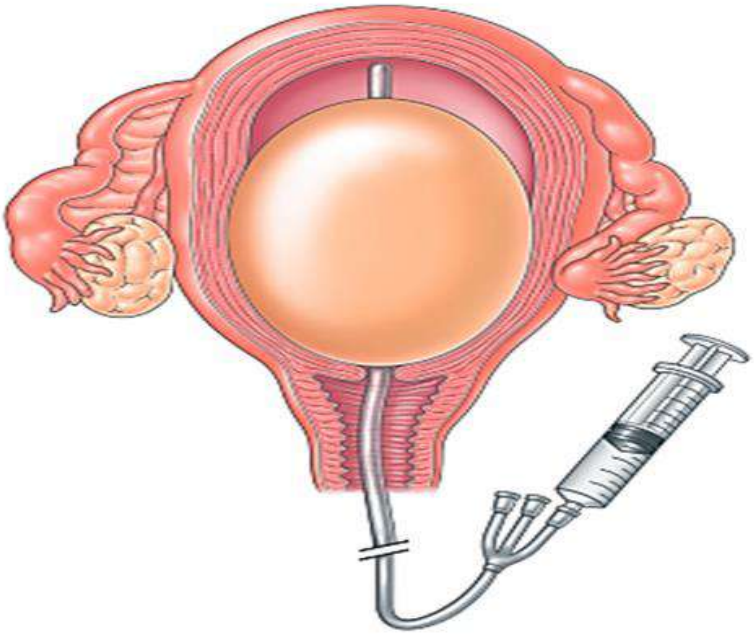


Fig.13. Uterine tamponade using Bakri balloon.

Step V: *Surgical methods* to control PPH are many**.** An outline of stepwise uterine devascularization procedures are given below:

- **Ligation of uterine arteries**—the ascending branch of the uterine artery is ligated at the lateral border between upper and lower uterine segment. The suture (No. 1 chromic) is passed into the myometrium 2 cm medial to the artery (***Fig. 13***). In atonic hemorrhage bilateral ligation is effective in about 75% of cases.
- **Ligation of the ovarian and uterine artery anastomosis** if bleeding continues is done just below the ovarian ligament (***Fig. 13***). Rarely temporary occlusion of the ovarian vessels at the infundibulopelvic ligament may be done by rubber sleeved clamps.

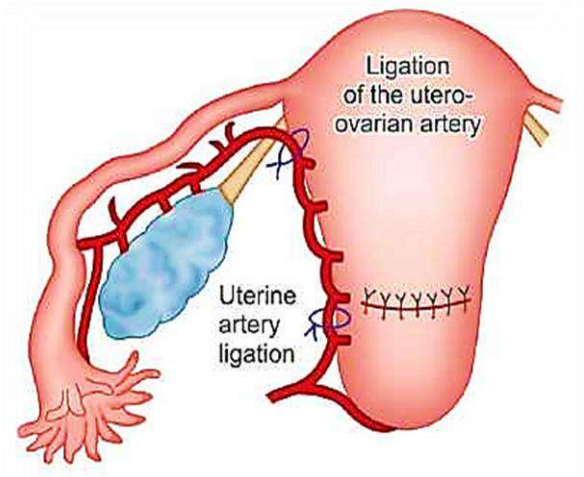


Fig.13: Ligation of the uterine artery and utero-ovarian artery

- **Ligation of anterior division of internal iliac artery** (unilateral or bilateral)—reduces the distal blood flow. It helps stable clot formation by reducing the pulse pressure up to 85%. Due to extensive collateral circulation, there is no pelvic tissue necrosis. Bilateral ligation (not division) can avoid hysterectomy in about 50% of the cases.
- **B-Lynch compression** suture and multiple square sutures: Both these surgical methods work by tamponade (like bimanual compression) of the uterus (***Fig.14***). Success rate is about 80% and it can avoid hysterectomy.

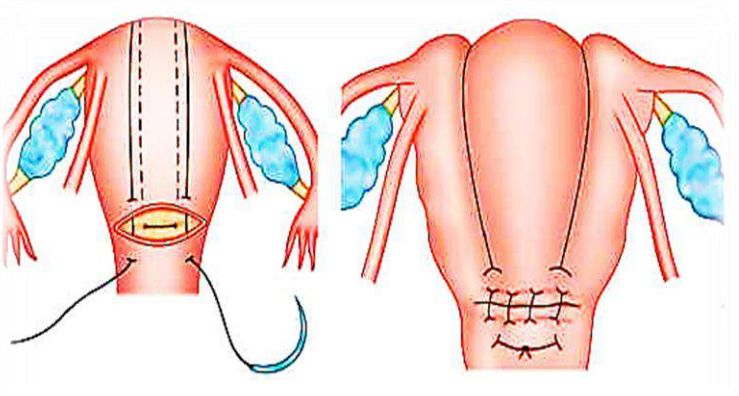


Fig.14. B-Lynch brace suture for control of atonic PPH

- **Angiographic arterial embolization** (bleeding vessel) under fluoroscopy can be done using gel foam. Success rate is more than 90% and it avoids hysterectomy.

THE B-LYNCH SUTURE

INDICATIONS:

1) Uterine atony;

2) Polyhydroamnios;

3) Multiple pregnancy;

4) Big baby;

5) Eclampsia;

6) Uterine anomaly;

7) Abruptio placentae;

8) Abnormal placentation.

REQUIREMENTS:

- Lloyd Davis or frog-legged position essential;
- The uterus must be exteriorised;
- Basic surgical competence required;
- Bi-manual compression to test for potential success;
- Transverse lower segment incision should be made;
- Uterine cavity checked, explored, and evacuated;
- A 70-mm half circle guarded needle (code: w3709) mounted on a 90-cm monocryl No. 1 (Ethicon, Somerville, N.J.) or Catgut suture is appropriate;
- Apply suture correctly with even tension (no shouldering);
- Allow free drainage of blood, debris, and inflammatory material;
- Check bleeding control vainally, using swabs and instruments.

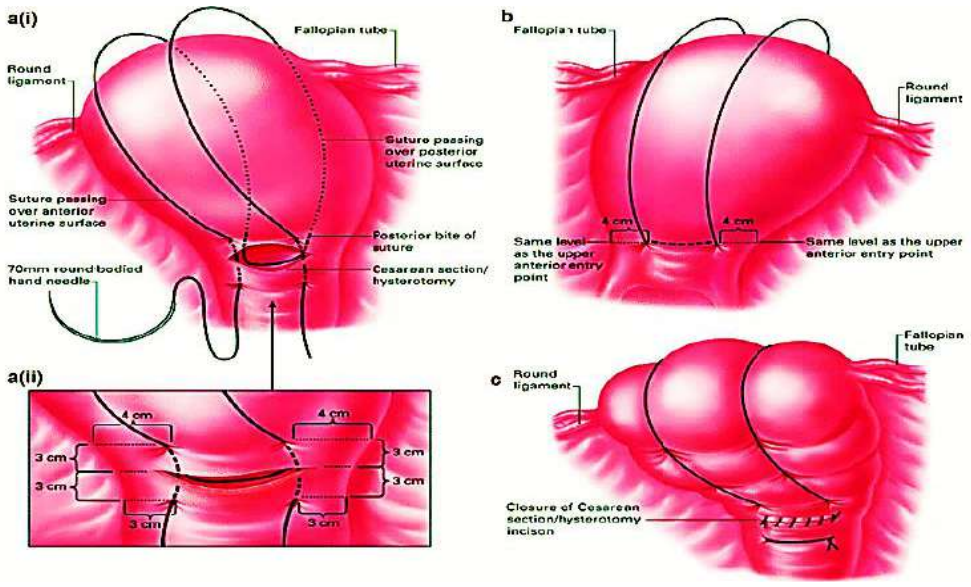


Fig.15.B-Lynch suture

OTHER SURGICAL COMPRESSION METHODS OF UTERUS

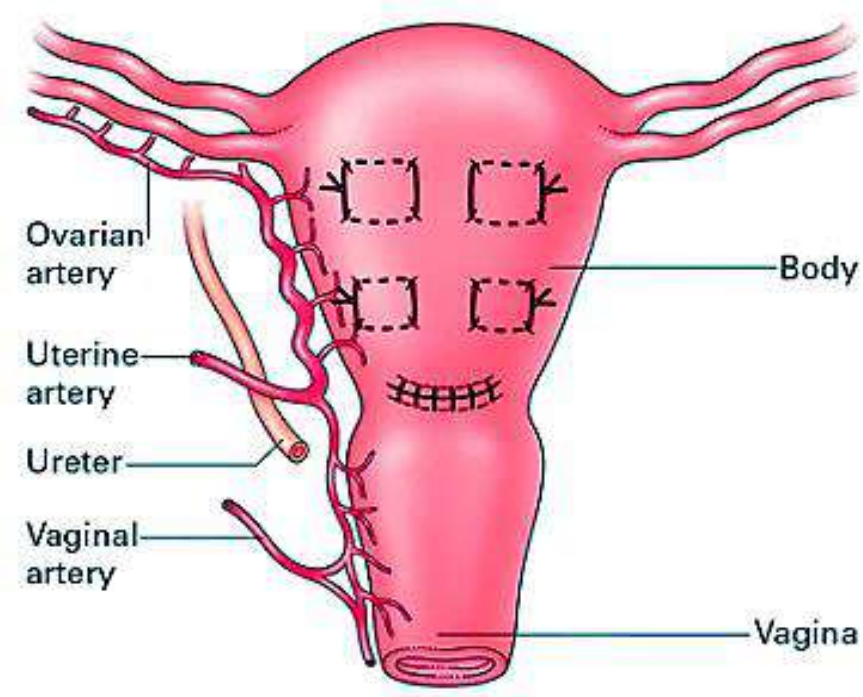


Fig.16. CHO suture

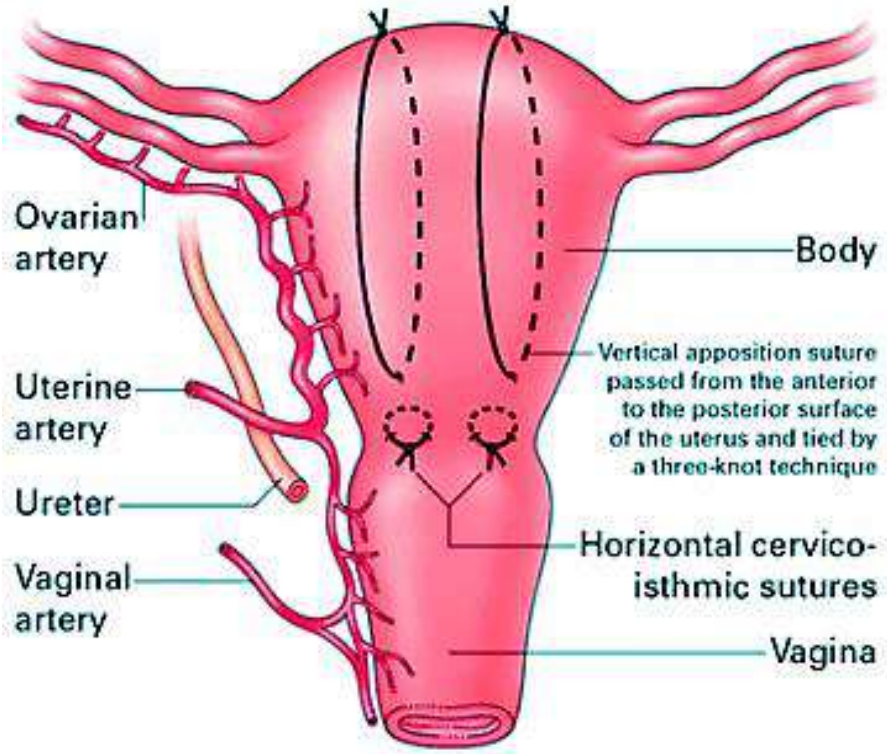


Fig. 17.HAYMAN suture

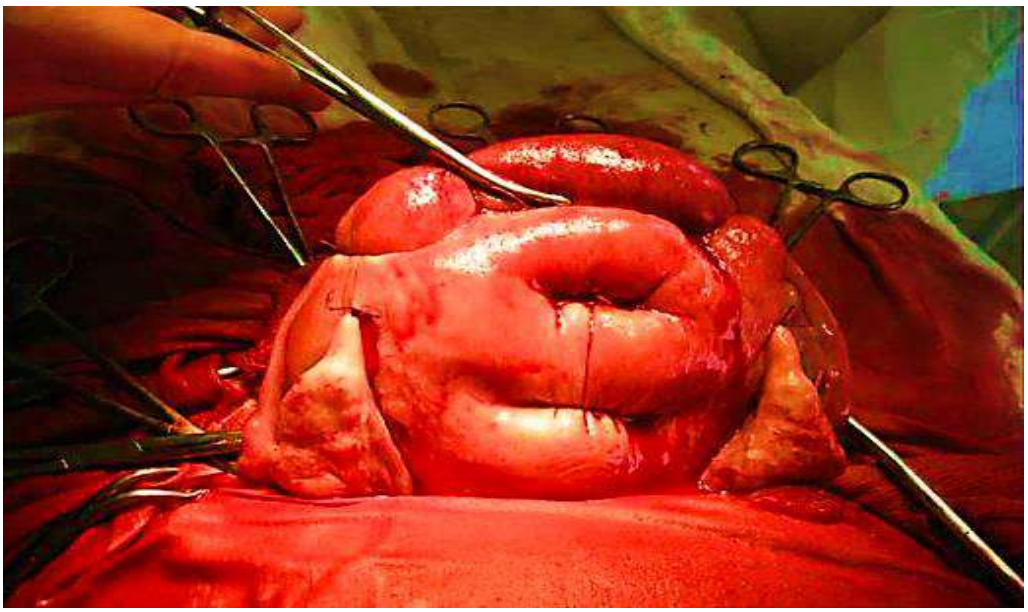


Fig.18. Hemostatic compression suture

Step VI: *Hysterectomy*—rarely uterus fails to contract and bleeding continues in spite of the above measures. Hysterectomy has to be considered involving a second consultant. Decision of hysterectomy should be taken earlier in a parous woman. Depending on the case it may be subtotal or total (***Fig.19***).

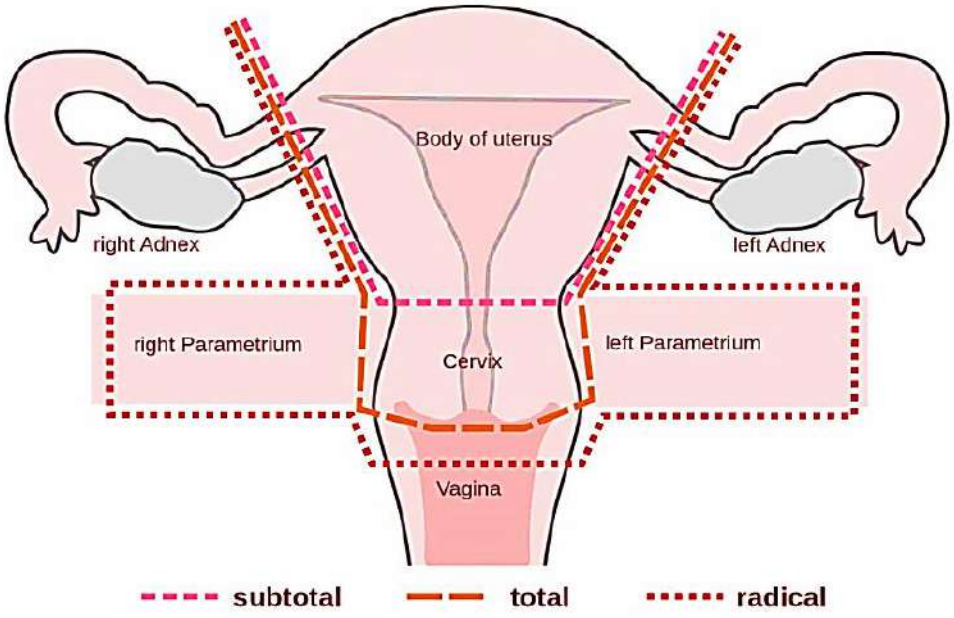


Fig. 19. **Hysterectomy**

TRAUMATIC POSTPARTUM HEMORRHAGE

Maternal injuries following childbirth process are quite common and contribute significantly to maternal morbidity and even to death. Prevention, early detection and prompt and effective management not only minimize the morbidity but prevent many a gynecological problems from developing later in life.

VULVA

Lacerations of the vulval skin posteriorly and the paraurethral tear on the inner aspect of the labia minora are the common sites. Paraurethral tear may be associated with brisk hemorrhage and should be repaired by interrupted catgut sutures, preferably after introduction of a rubber catheter into the bladder to prevent injury of the urethra.

PERINEUM

While minor injury is quite common specially during first birth, *gross injury (third and fourth degree) is invariably a result of mismanaged second stage of labor*. Overall risk is 1% of all vaginal deliveries.

Causes: perineal injury (mainly the third and fourth degree) results from (i) over stretching and/or (ii) rapid stretching of the perineum specially when the perineum is inelastic (elderly primigravida, perineal scar).

Risk factors for 3rd degree perineal tear:

- Big baby (weight > 3 kg);
- Nulliparity;
- Face to pubis delivery;
- Outlet contraction with narrow pubic arch;

- Shoulder dystocia;
- Midline episiotomy;
- Forceps delivery;
- Precipitate labor;
- Scar in the perineum (perineorrhaphy, episiotomy).

PREVENTION: Proper conduct in the second stage of labor taking due care of the perineum when it is likely to be damaged.

PERINEAL TEAR

First degree: Injury to perineal skin only

Second degree: Injury to perineum involving perineal body (muscles) but not involving the anal sphincter.

Third degree: Injury to perineum, involving the anal sphincter complex (both external and internal).

Fourth degree: Injury to perineum involving the anal sphincter complex (EAS and IAS) and anal epithelium.

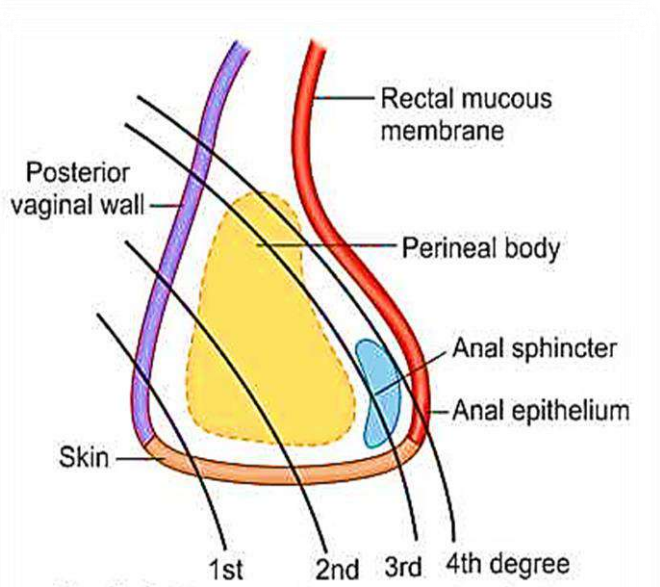


Fig.20. Diagrammatic representation showing different degrees of perineal

(EAS = External anal sphincter; IAS = Internal anal sphincter)

MANAGEMENT

Recent tear should be repaired immediately following the delivery of the placenta. This reduces the chance of infection and minimizes the blood loss. *In cases of delay beyond 24 hours,* the repair is to be withheld.

Antibiotics should be started to prevent infection. **The complete tear, should be repaired after 3 months, if delayed beyond 24 hours.**

REPAIR OF COMPLETE PERINEAL TEAR:

Step-I: Patient is put in lithotomy position. Antiseptic cleaning of the local area is done. Repair may be done with local infiltration of 1% lignocaine hydrochloride (10-15 mL) or with pudendal block or preferably under general anesthesia.

Step-II: Dissection is not required as in an old complete perineal tear.

1) The rectal and anal mucosa is first sutured from above downwards by atraumatic needle, interrupted stitches with knots inside the lumen is used. The rectal muscles including the pararectal fascia are then sutured by interrupted sutures using the same suture material.

2) The torn ends of the sphincter ani externus are then exposed by Allis's tissue forceps. The sphincter is then reconstructed with a figure of eight stitch, and it is supported by another layer of interrupted sutures.

3) For repair of EAS either an overlapping or end to end approximation method can be used with similar outcome. IAS repair is done by interrupted suture.

Step-III: Repair of perineal muscle is done by interrupted sutures using dexon or polyglactin (vicryl).

Step-IV: The vaginal wall and the perineal skin are opposed by interrupted sutures.

Suture material: For repair of EAS, monofilament sutures such as polydiaxanone (PDS) or polyglactin (vicryl) can be used.

Repair of IAS is done with fine suture size such as 3-0 PDS and 2-0 vicryl as they cause less irritation and discomfort.

AFTER CARE: Special care following repair of complete tear:

1) A low residual diet consisting of milk, bread, egg, biscuits, fish, sweets, etc. is given from 3rd day onwards.

2) Lactulose 8 mL twice daily beginning on the second day and increasing the dose to 15 mL on the third day is a satisfactory regime to soften the stool.

3) Any one of the broad spectrum antibiotics (IV cefuroxime 1.5 g) is used during the intraoperative and the post-operative period. Metronidazole 400 mg thrice daily is to be continued for 5-7 days to cover the anerobic contamination of fecal matter. The woman is reviewed again 6-12 weeks postpartum. In case of persistent incontinence of flatus and feces, endo anal USG and anorectal manometry should be considered to detect any residual defects (20-30%).

VAGINA

Isolated vaginal tears or lacerations without involvement of the perineum or cervix are not uncommon. These are usually seen following instrumental or manipulative delivery. In such cases, the tears are extensive and often associated with brisk hemorrhage.

TREATMENT: Tears associated with brisk hemorrhage, require exploration under general anesthesia with a good light. The tears are repaired by interrupted or continuous sutures using chromic catgut. In case of extensive lacerations, in

addition to sutures, hemostasis may be achieved by intravaginal plugging by roller gauze, soaked with glycerine and acriflavine. **The plug should be removed after 24 hours.** Selective arterial embolization may also be done if bleeding persists.

COLPORRHEXIS: **Rupture of the vault of the vagina is called colporrhexis**. It may be primary where only the vault is involved or secondary when associated with cervical tear (common). It is said to be complete when the peritoneum is opened up. Posterior fornix usually ruptures, however, cervical tear is usually associated with tear of the lateral fornix.

Treatment*:* If the tear is limited to the vault close to the cervix, the repair is done from below. If however, the cervical tear extends high up into the lower segment or major branches of uterine vessels are damaged, laparotomy is to be done simultaneously with resuscitative measures. Evacuation of hematoma and arterial ligation may be needed.

CERVIX

Minor degree of cervical tear is invariable during first delivery and requires no treatment. Extensive cervical tear is rare. It is the commonest cause of traumatic postpartum hemorrhage. Left lateral tear is the commonest.

CAUSES:

- ***Iatrogenic***—*Attempted* forceps delivery or breech extraction through incompletely dilated cervix.
- ***Rigid cervix***—*This* may be congenital or more commonly following scar from previous operations on the cervix like

amputation, conisation or presence of a lesion like carcinoma cervix.

- ***Strong uterine contractions as*** in precipitate labor or extremely vascular cervix as in placenta previa.
- ***Detachment***—Detachment of the cervix may be annular which involved the entire circumference of the cervix. This occurs following prolonged labor in primary cervical dystocia. It may, however, involve only the anterior lip when it is nipped between the head and the symphysis pubis in association with the sacral os. In both varieties, the bleeding is minimal and healing occurs through epithelialization.

DIAGNOSIS: *Excessive vaginal bleeding immediately following delivery in presence of a hard and contracted uterus—raises the suspicion of a traumatic bleeding.* Exploration of the uterovaginal canal under good light not only confirms the diagnosis but also helps to know the extent of the tear.

DANGERS:

Early:

- Deep cervical tears involving the major vessels lead to severe postpartum hemorrhage ;
- Broad ligament hematoma ;
- Pelvic cellulitis;
- Thrombophlebitis.

Late:

- Ectropion;
- Cervical incompetence with mid-trimester abortion.

TREATMENT:

Only deep cervical tear associated with bleeding should be repaired soon after delivery of the placenta. **Repair should be done under general anesthesia, in lithotomy position with a good light.** The prerequisites are - Sims' posterior vaginal speculum and vaginal wall retractors, at least two sponge holding forceps and an assistant.

Procedures: The anterior and posterior margins of the torn cervix are grasped by the sponge holding forceps (**Fig.27A**). Instead of giving traction to the forceps, it is better to push down the fundus gently by the assistant. This makes the tear more accessible for effective suturing. **The apex is to be identified first and the first vertical mattress suture is placed just above the apex** using polyglactin (vicryl) or chromic catgut No. "0" taking whole thickness of the cervix (**Fig.27B**).The bleeding stops immediately. The rest of the tear is repaired by similar mattress sutures. Mattress suture is preferable as it prevents rolling in of the edges. **A helpful guide for proper exposure** in such a case is to start suture at the proximal end and using the suture for traction, more distal tear area is exposed until the apex is in view and is repaired.

The cervical tears extending to the lower segment or vault with broad ligament hematoma, are managed as outlined in rupture uterus**.**

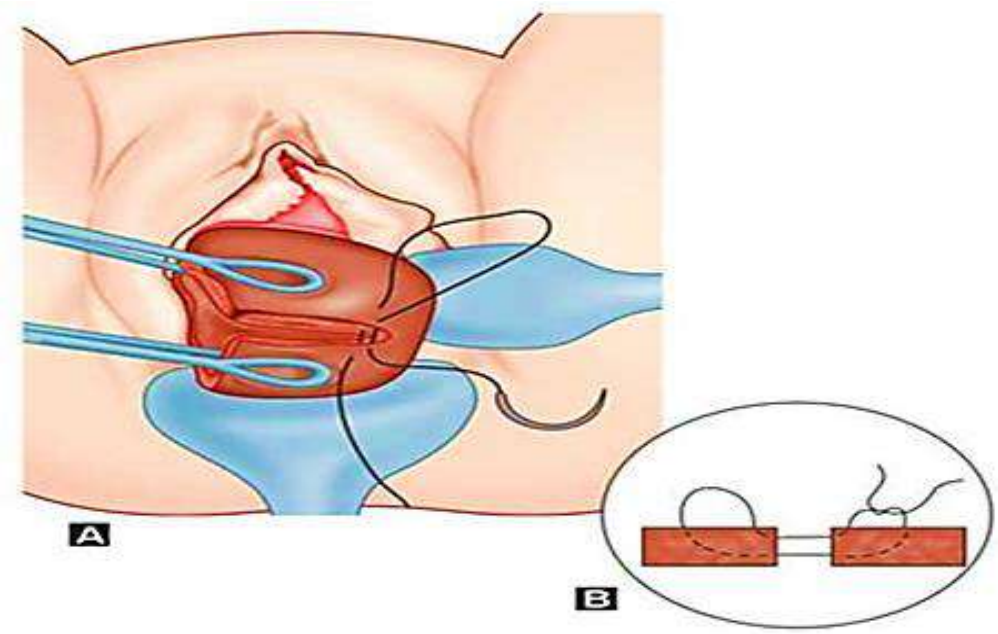


Fig.21. **Methods of repair of the cervical tear with vertucal mattress suture.**

RUPTURE OF THE UTERUS

DEFINITION: Disruption in the continuity of the all uterine layers (endometrium, myometrium and serosa) any time beyond 28 weeks of pregnancy is called rupture of the uterus. Small rupture to the wall of the uterus in early months is called perforation either instrumental or perforating hydatidiform mole. Rupture of a rudimentary pregnant horn has got a special clinical entity and is grouped in ectopic pregnancy.

INCIDENCE: The prevalence widely varies from 1 in 2000 to 1 in 200 deliveries. During the past few decades, the prevalence has been found to be almost static. Whereas improved obstetric care reduces the rupture from obstructed labor but there has been increased prevalence of scar rupture following increased incidence of caesarean section over the years.

ETIOLOGY

The causes of rupture of the uterus are broadly divided into:

- **SPONTANEOUS** - **SCAR RUPTURE** - **IATROGENIC**

SPONTANEOUS

During pregnancy: It is indeed rare for an apparently uninjured uterus to give way during pregnancy.

The causes are:

- Previous damage to the uterine walls following dilatation and curettage operation or manual removal of placenta;
- Rarely in grand multipara due to thin uterine walls;
- Congenital malformation of the uterus (bicornuate variety) is a rare possibility;
- In Couvelaire uterus.

Spontaneous rupture during pregnancy is usually complete, involves the upper segment and usually occurs in later months of pregnancy. On rare occasion, spontaneous rupture may occur even in early months.

During labor: Spontaneous rupture which occurs predominantly in an otherwise intact uterus during labor is due to:

- **Obstructive rupture** - This is the end result of an obstructed labor. The rupture involves the lower segment and usually extends through one lateral side of the uterus to the upper segment.
- **Non-obstructive rupture** - Grand multipara are usually affected and rupture usually occurs in early labor. Weakening of the walls due to repeated previous births as mentioned earlier may be the responsible factor. The rupture usually involves the fundal area and is complete.

SCAR RUPTURE: With the liberal use of primary cesarean

section, scar rupture constitutes significantly to the overall incidence of uterine rupture. *The incidence of lower segment scar rupture* **(Fig.23)** *is about 1-2%, while that following classical one is 5-10 times higher. Uterine scar, following operation on the non-pregnant uterus* such as myomectomy or metroplasty hardly rupture as the wound heals well because the uterus remains quiescent following operation. Uterine scar following hysterectomy behaves like that of a classical scar and is of growing concern.

During pregnancy: **Classical cesarean or hysterectomy scar is likely to give way during later months of pregnancy.** The weakening of such scar is due to implantation of the placenta over the scar and consequent increased vascularity. Right angle stretching effect by the increased transverse diameter of the enlarging uterus puts an additional effect in disruption of the upper segment scar. *Lower segment scar rarely ruptures during pregnancy.*

During labor: The classical or hysterectomy scar is more vulnerable to rupture during labor. Although rare, lower segment scar predominantly ruptures during labor.

IATROGENIC OR TRAUMATIC

During pregnancy:

1) Injudicious administration of oxytocin;

2) Use of prostaglandins for induction of abortion or labor;

3) Forcible external version specially under general anesthesia;

4) Fall or blow on the abdomen.

During labor:

1) Internal podalic version—specially following obstructed

labor;

2) Destructive operation;

3) Manual removal of placenta;

4) Application of forceps or breech extraction through incompletely dilated cervix;

5) Injudicious administration of oxytocin for augmentation of labor.

PATHOLOGY

TYPES: *Pathologically, it is customary to distinguish between complete and incomplete rupture depending on whether the peritoneal coat is involved or not.* So far from the treatment point of view, it matters little. In incomplete rupture, the peritoneum remains intact.

Incomplete rupture usually results from rupture of the lower segment scar or extension of a cervical tear into the lower segment with formation of a broad ligament hematoma.

Complete rupture usually occurs following disruption of the scar in upper segment (**Fig.22**). It may also be due to spontaneous rupture of both obstructive and non-obstructive type.

SITES: Spontaneous non-obstructive rupture usually involves the upper segment and often involves the fundus. Whereas, in obstructive type, the rupture involves the anterior lower segment transversely and often extends upwards along the lateral uterine wall. The margins are ragged and necrosed. On occasion, the posterior wall may be involved due to friction with the sacral promontory.

Not infrequently, the tear extends downwards to involve the cervix and the vaginal wall (colporrhexis). The bladder may

be involved, at times.

Rupture over the previous scar is almost always located at the site of the scar. The margins of the ruptured cesarean scar are usually clean and look fibrosed. The rent over the lower segment scar may extend to one or both the sides to involve the major branches of uterine vessels.

Fig. 22. Diagrammatic representation showing rupture of the uterus

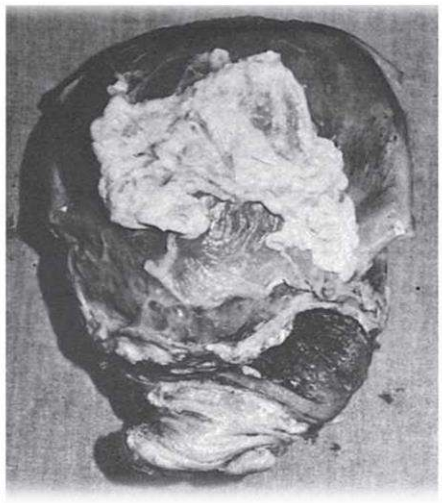


Fig. 23. Lower segment scar rupture.

The morbid pathology of traumatic rupture following destructive operation or internal version is almost similar to that met in spontaneous obstructive variety. This may at times be indistinguishable.

DIAGNOSIS OF RUPTURE UTERUS

It is indeed difficult to categorize an universal clinical feature applicable to all the varieties of uterine rupture. However, the salient diagnostic features of different varieties are described but it should be remembered that one should be conscious of the entity for an early diagnosis.

DURING PREGNANCY:

• **SCAR RUPTURE • SPONTANEOUS •IATROGENIC**

Scar rupture: **Classical or hysterectomy** — the patient complains of a dull abdominal pain over the scar area with slight vaginal bleeding. There is varying degrees of tenderness on uterine palpation. FHS may be irregular or absent. The features may not be always dramatic in nature (silent phase). Sooner or later, the rupture becomes complete. There is a sense of something giving way accompanied by acute abdominal pain and collapse. The diagnosis is self-evident. However, an acute dramatic onset may occur from the beginning.

Spontaneous rupture in uninjured uterus — the rupture is usually confined to the high parous women. The onset is usually acute but sometimes insidious. In acute types, the patient has acute pain abdomen with fainting attacks and may collapse. The diagnosis is established by the presence of features of shock, acute tenderness on abdominal examination, palpation of superficial fetal parts, if the rupture is complete and absence of fetal heart rate. *However, with insidious onset, the diagnosis is often confused with concealed accidental hemorrhage or rectus sheath hematoma.*

Rupture following fall, blow or external version or use of oxytocic's — there is history of such an accident followed by acute pain abdomen and slight vaginal bleeding. Rapid pulse and tender uterus raise the suspicion of rupture. The confirmation is done by laparotomy. *This is too often confused with accidental hemorrhage.*

DURING LABOR:

• **SCAR RUPTURE** • **SPONTANEOUS OBSTRUCTIVE**

•SPONTANEOUS •NON-OBSTRUCTIVE • IATROGENIC

Scar rupture: ***Classical or hysterectomy scar rupture*** — the features are the same as those occur during pregnancy. The onset is usually acute.

Lower segment scar rupture — the onset is insidious. The confirmation is by laparotomy. The features of scar rupture are not as dramatic as those following obstructed labour (vide infra) and hence called "silent rupture".

Spontaneous obstructive rupture - this type of spontaneous rupture has got a distinct premonitory phase prior to rupture.

Premonitory phase: The patient is usually a multipara who is in labour with features of obstruction. *Initially, the pains become severe in an attempt to overcome the obstruction and come at quick intervals. Gradually, the pains become continuous and mainly confined to the suprapubic region.* On examination, *the patient is dehydrated and exhausted. The pulse rate and temperature rise.* Abdominal examination reveals *a distended tender lower segment. Bandl's ring may be visible and there are evidences of fetal distress or FHS may be absent.* On vaginal examination, *the presenting part is found jammed in the pelvis and the vagina becomes dry and edematous.*

Phase of rupture*:* (1) There is a sense of something giving way at the height of uterine contraction (2) The constant pain is changed to dull aching pain with cessation of uterine contractions (3) **General examination** reveals features of exhaustion and shock (4) Abdominal examination reveals—(i) superficial fetal parts (ii) absence of FHS (iii) absence of uterine contour and (iv) two separate swellings, one contracted uterus

and the other — fetal ovoid (5) Vaginal examination reveals — (i) recession of the presenting part and (ii) varying degrees of bleeding.

Spontaneous non-obstructive rupture: This is rare and solely confined to high parous women. The patient, at the height of uterine contraction is suddenly seized with an agonising bursting pain followed by a relief, with cessation of contractions. The diagnostic features of the catastrophe are— presence of shock, evidences of internal hemorrhage, tenderness over the uterus and varying amount of vaginal bleeding.

Rupture following manipulative or instrumental delivery: Sudden deterioration of the general condition of the patient with varying amount of vaginal bleeding following manipulative or instrumental delivery raises the suspicion. Exploration of uterus to feel the rent confirms the diagnosis. Not infrequently, the diagnosis is not revealed until after varying intervals following development of shock or broad ligament hematoma or peritonitis. Shortening of the cord immediately following a difficult vaginal delivery is pathognomonic of uterine rupture, the placenta being extruded out into the abdominal cavity, through the rent in the uterus.

MANAGEMENT OF RUPTURE UTERUS

PROPHYLAXIS: The following guidelines are helpful to prevent or to detect at the earliest the tragic occurrence of rupture uterus:

- **The at-risk mothers, likely to rupture, should have mandatory hospital delivery. These are:**

a) Contracted pelvis;
b) Previous history of cesarean section, hysterotomy or myomectomy;
c) Uncorrected transverse lie;
d) Grand multiparity;
e) Known case of hydrocephalus.

- **General anesthesia should not be used** to give undue force in external version.
- **Undue delay in the progress of labor** in a multipara with previous uneventful delivery should be viewed with concern and the cause should be sought for.
- **Judicious selection of cases with previous history of cesarean sections** for vaginal delivery.
- **Judicious selection of cases** and careful watch are mandatory during oxytocin infusion either for induction or augmentation of labor.
- **There is hardly any place of internal podalic version** in singleton fetus in present day obstetrics. *It should never be done in obstructed labor* as an alternative to destructive operation or cesarean delivery.
- **Attempted forceps delivery or breech extraction** through incompletely dilated cervix should be avoided.
- **Destructive vaginal operations** should be performed by skilled personnel and exploration of the uterus should be done as a routine following delivery.
- **Manual removal in morbid adherent placenta**—should be done by a senior person.

TREATMENT: • **Resuscitation** • **Laparotomy**

Depending upon the state of the clinical condition, either

resuscitation is to be done followed by laparotomy or in acute conditions; resuscitation and laparotomy are to be done simultaneously.

LAPAROTOMY: *Any of the three procedures may be adopted following laparotomy.*

Hysterectomy: **Hysterectomy is the surgery for rupture uterus unless there is sufficient reason to pre**serve it. This is specially indicated in spontaneous obstructive rupture, so common in the developing countries. Considering the low general condition and disturbed morbid anatomical changes near the cervico-vaginal region, it is preferable to perform a quick subtotal hysterectomy, rather than total hysterectomy. Chance of injury to the ureters or bladder is thereby minimized. However, if the condition permits and/or there is colporrhexis, a total hysterectomy may be done.

Repair: This is mostly applicable to a scar rupture where the margins are clean. Repair is done by excision of the fibrous tissue at the margins. One may have to repair a spontaneous obstructive rupture in odd circumstances (desirous of having child), if possible. In such cases, however, there is chance of peritonitis and septicaemia. Remote prognosis during future pregnancy is very much unfavorable because of high risk of scar rupture.

Repair and sterilization: This is mostly done in patients with a clean cut scar rupture having desired number of children. The trauma to the perineum, vagina and the cervix is to be searched under good light by speculum examination and hemostasis is achieved by appropriate catgut sutures. The repair is done under general anesthesia, if necessary**.**

PLACENTAL SITE BLEEDING

If features of placental separation are evident, expression of the placenta is to be done either by fundal pressure or controlled cord traction method. If the placenta is not separated, manual removal of placenta under general anesthesia is to be done. However, if the patient is in shock, she is resuscitated first before undertaking manual removal. If the patient is delivered under general anesthesia, quick manual removal of the placenta solves the problem. In cases where oxytocin 10 units is given IM with the delivery of the anterior shoulder, manual removal is done promptly when two attempts of controlled cord traction fail. Crede's expression of the placenta is abandoned as it is not only ineffective, but produces shock and rarely inversion.

STEPS OF MANUAL REMOVAL OF PLACENTA

Step-I: The operation is done under general anesthesia**. In extreme urgency where anesthetist is not available**, the operation may have to be done under deep sedation with 10 mg diazepam given intravenously. The patient is placed in lithotomy position. With all aseptic measures, the bladder is catheterized.

Step-II: One hand is introduced into the uterus after smearing with the antiseptic solution in cone shaped manner following the cord, which is made taut by the other hand (**Fig. 24)**. While introducing the hand, the labia are separated by the fingers of the other hand. The fingers of the uterine hand should locate the margin of the placenta.

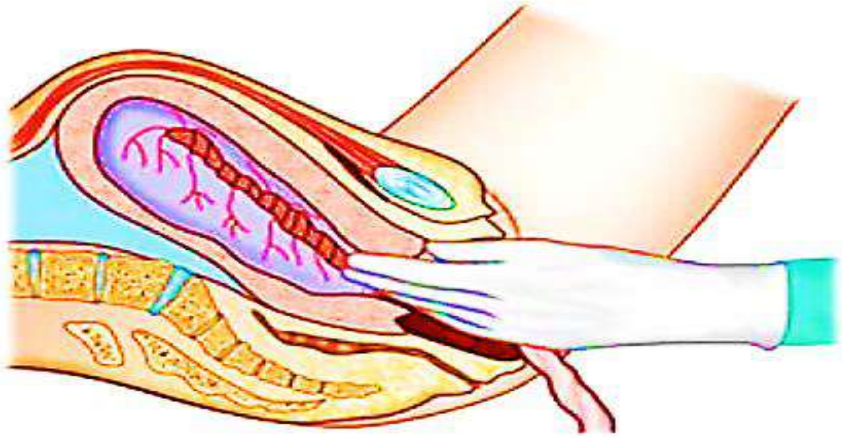


Fig.24. **Introduction of the hand into the uterus in a cone shaped manner following the taut umbilical cord.**

Step-III: Counter pressure on the uterine fundus is applied by the other hand placed over the abdomen. The abdominal hand should steady the fundus and guide the movements of the fingers inside the uterine cavity till the placenta is completely separated.

Step-IV: As soon as the placental margin is reached, the fingers are insinuated between the placenta and the uterine wall with the back of the hand in contact with the uterine wall. The placenta is gradually separated with a sideways slicing movement of the fingers, until whole of the placenta is separated.(**Fig.25 A and B**).

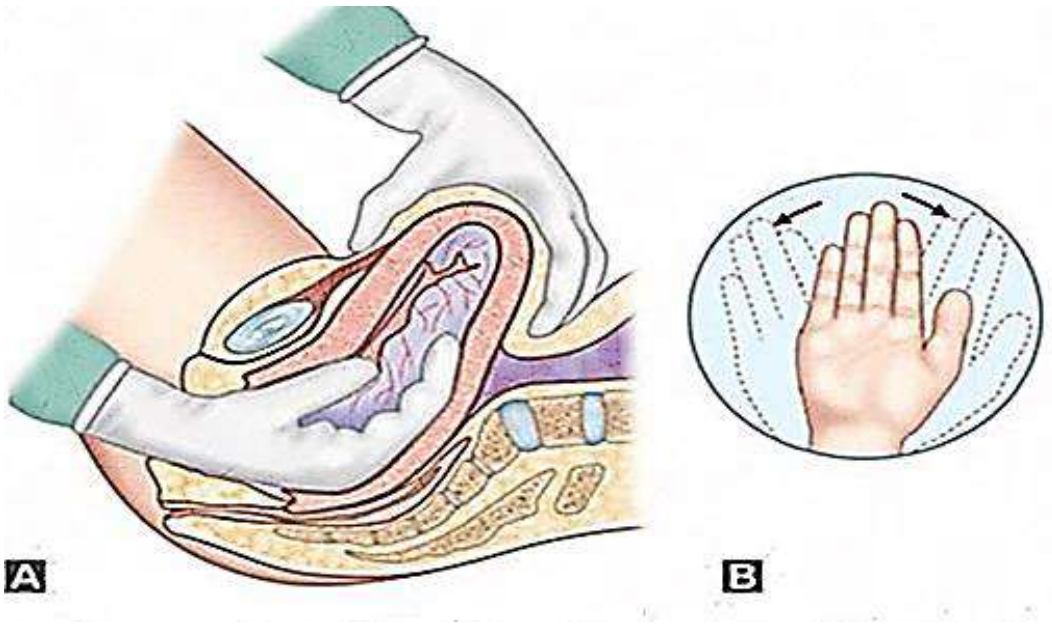


Fig.25. A- The placenta is separated by (A) keeping the back of the hand in the contact with the uterine wall (B) with slicing movements of the hand

Step-V: When the placenta is completely separated, it is extracted by traction of the cord by the other hand. The uterine hand is still inside the uterus for exploration of the cavity to be sure that nothing is left behind.

Step-VI: Intravenous methergin 0.2 mg is given and the uterine hand is gradually removed while massaging the uterus by the external hand to make it hard. After the completion of manual removal, inspection of the cervicovaginal canal is to be made to exclude any injury.

Step-VII: The placenta and membranes are inspected for completeness and be sure that the uterus remains hard and contracted.

Difficulties:

- Hour-glass contraction leading to difficulty in introducing the hand.
- Morbid adherent placenta which may cause difficulty in getting to the plane of cleavage of placental separation. In such a case placenta is removed gently in fragments using

an ovum forceps.

Complications:

- Hemorrhage due to incomplete removal;
- Shock;
- Injury to the uterus;
- Infection;
- Inversion (rare);
- Subinvolution;
- Thrombophlebitis;
- Embolism. In such cases placenta is removed in fragments using an ovum forceps or a flushing curette.

RETAINED PLACENTA

DEFINITION: The placenta is said to be retained when it is not expelled out even 30 minutes after the birth of the baby (WHO 15 minutes).

CAUSES: There are three phases involved in the normal expulsion of placenta:

1) Separation through the spongy layer of the decidua;

2) Descent into the lower segment and vagina;

3) Finally its expulsion to outside.

Interference in any of these physiological processes, results in its retention.

- **Placenta completely separated but retained** is due to poor voluntary expulsive efforts.
- **Simple adherent placenta** is due to uterine atonicity in cases of grand multipara, over distension of uterus, prolonged labor, uterine malformation or due to bigger placental surface area. *The commonest cause of retention of non-separated placenta is atonic uterus.*
- **Morbid adherent placenta**—partial or rarely, complete.

- **Placenta incarcerated following** partial or complete separation due to constriction ring (hour-glass contraction), premature attempts to deliver the placenta before it is separated.

DIAGNOSIS: The diagnosis of retained placenta is made by an arbitrary time (15 minutes) spent following delivery of the baby. Features of placental separation are assessed (**Fig.6**). The hour-glass contraction or the nature of adherent placenta (simple or morbid) can only be diagnosed during manual removal.

DANGERS: The risks involved in prolonged retention of placenta are:

1) Hemorrhage;
2) Shock is due to:
   a) blood loss;
   b) at times unrelated to blood loss, especially when retained more than one hour;
   c) frequent attempts of abdominal manipulation to express the placenta out;
3) Puerperal sepsis;
4) Risk of its recurrence in next pregnancy.

MANAGEMENT

PERIOD OF WATCHFUL EXPECTANCY

- During the period of arbitrary time limit of half an hour, the patient is to be watched carefully for evidence of any bleeding, revealed or concealed and to note the signs of separation of placenta.
- The bladder should be emptied using a rubber catheter.
- Any bleeding during the period should be managed as outlined in third stage bleeding.

RETAINED PLACENTA:

• Separated • Unseparated • Complicated

Placenta is separated and retained — to express the placenta out by controlled cord traction (**Fig.7**).

Unseparated retained placenta (apparently uncomplicated): Manual removal of placenta is to be done under general anesthesia (**Fig.24**).

PLACENTA ACCRETA

Placenta accreta is an extremely rare form in which the placenta is directly anchored to the myometrium partially or completely without any intervening decidua (**Fig.26**). The probable cause is due to absence of decidua basalis and poor development of fibrinoid layer. Overall incidence of placenta accreta or its variations is 1 in 550 deliveries.

Risk factors for placenta accrete: Most important are the placenta previa and prior cesarean delivery. Other risk factors include prior uterine surgery (dilatation and curettage, manual removal of placenta, synecolysis or myomectomy) increasing maternal age and parity.

The risk of placenta accreta with placenta previa in an unscarred uterus is about 3%. The risk rises sharply with increasing number of cesarean delivery. Placenta previa with one prior cesarean section, the risk of being accreta is about 11%, whereas with two it is 40% and it is 67% with four or more cesarean sections.

The diagnosis is made only during attempted manual removal when the plane of cleavage between the placenta and the uterine wall cannot be made out. **Ultrasound imagings, color Doppler and MRI** have all been valuable in the diagnosis of placenta accreta, increta and percreta during pregnancy.

USG findings suggestive of placenta accreta are:

a) loss of normal hypoechoic retroplacental myometrial zone,
b) thinning and disruption of the uterine serosa-bladder interface and focal exophytic masses invading the bladder. within the placenta.

Color flow Doppler study and MRI are also useful. Unexplained rise of maternal serum aFP is observed with placenta accreta. **Pathological confirmation includes**—(a) absence of decidua basalis (b) absence of Nitabuch's fibrinoid layer and (c) varying degree of penetration of the villi into the muscle bundles (increta) or up to the serosal layer (percreta). The risks include hemorrhage, shock, infection and rarely inversion of the uterus.

MANAGEMENT:

- **In partial placenta accreta (focal)** → Remove the placental tissue as much as possible. Effective uterine contraction and hemostasis are achieved by oxytocics and if necessary by intrauterine plugging. In cases following cesarean delivery bleeding areas are over sewed. If the uterus fails to contract, an early decision of hysterectomy may have to be taken and this is preferable in multiparous women.

- **In total placenta accreta**, hysterectomy is indicated in parous women, while in patients desiring to have a child, conservative attitude may be taken. This consists of incising the uterus above the placental attachment and clamping and cutting the umbilical cord as close to its base as possible and leaving behind the placenta which is expected to be autolyzed in due course of time. Appropriate antibiotics should be given. Disruption of implantation site may cause massive hemorrhage. Uterine artery embolization or therapy with methotrexate has been done for conservation of the uterus.

- **In a rare case**, placenta accreta may invade the bladder. In that case try to avoid placental removal. It may need hysterectomy and partial cystectomy.

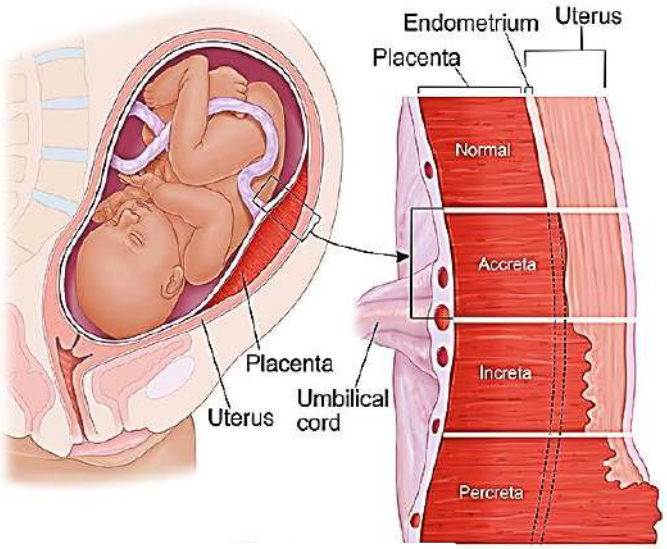


Fig. 26. **Placenta accreta**

UTERINE INVERSION

It is an extremely rare but a life-threatening complication in third stage in which the uterus is turned inside out partially or completely (Fig.27). The incidence is about 1 in 20,000 deliveries. The obstetric inversion is almost always an acute one and usually complete.

VARIETIES

- **First degree:** there is dimpling of the fundus, which still remains above the level of internal os (**Fig.27A**).
- **Second degree:** the fundus passes through the cervix but lies inside the vagina (**Fig.27B**).
- **Third degree (complete):** the endometrium with or without the attached placenta is visible outside the vulva. The cervix and part of the vagina may also be involved in the process (**Fig.27C**).

It may occur before or after separation of placenta.

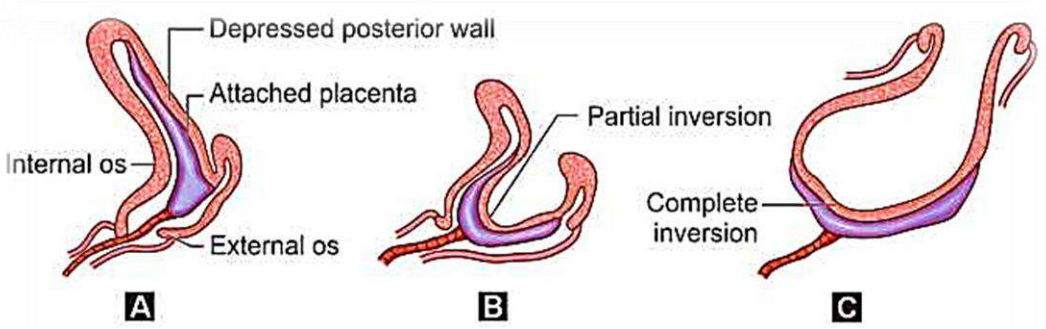


Fig.27. Inversion of uterus – A- First degree; B- Second degree; C-Third degree.

ETIOLOGY: The inversion may be spontaneous or more commonly induced.

Spontaneous (40%): This is brought about by localized atony on the placental site over the fundus associated with sharp rise of intra-abdominal pressure as in coughing, sneezing or bearing down effort. Fundal attachment of the placenta (75%), short cord and placenta accreta are often associated.

Iatrogenic: This is due to the mismanagement of third stage of labor.

- **Pulling the cord** when the uterus is atonic especially when combined with fundal pressure.
- **Fundal pressure** while the uterus is relaxed—Faulty technique in manual removal.

Common risk factors are uterine over enlargement, prolonged labor, fetal macrosomia, uterine malformations, morbid adherent placenta, short umbilical cord, tocolysis and manual removal of placenta. It is more common in women with collagen disease like Ehler Danlos syndrome.

DANGERS:

1) Shock is extremely profound mainly of neurogenic origin due to:

a) tension on the nerves due to stretching of the infundibulopelvic ligament;
b) pressure on the ovaries as they are dragged with the fundus through the cervical ring;
c) peritoneal irritation.

2) Hemorrhage, especially after detachment of placenta;

3) Pulmonary embolism;

4) If left uncared for, it may lead to

a) Infection;
b) uterine sloughing;
c) chronic one.

MANAGEMENT:

•Call for extra help •Before the shock develops, urgent manual replacement even without anesthesia, if it is not readily available, is the essence of treatment for a skilled accoucheur.

Principal steps:

1) To replace that part first which is inverted last with the placenta attached to the uterus by steady firm pressure exerted by the fingers(**Fig.28A**);

2) To apply counter support by the other hand placed on the abdomen(**Fig.28B**);

3) After replacement, the hand should remain inside the uterus (Fig.28C) until the uterus becomes contracted by parenteral oxytocin or PGF2a**;**

4) The placenta is to be removed manually only after the uterus becomes contracted. The placenta may however be removed prior to replacement

a) to reduce the bulk which facilitates replacement or
b) if partially separated to minimize the blood loss

5) Usual treatment of shock, including blood transfusion should be arranged simultaneously.

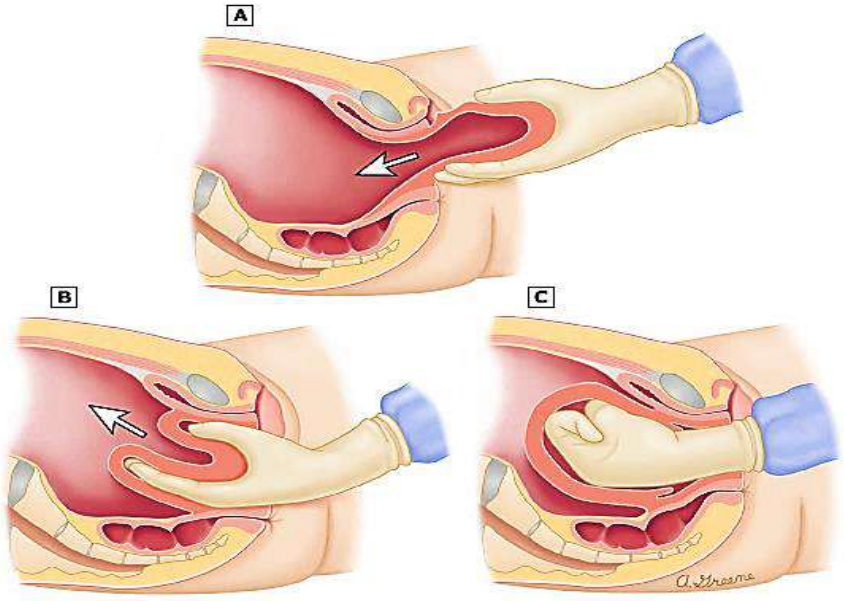


Fig. 28. **Manual reverse inversion**

If treatment is not successful, laparotomy will be performed to correct the inversion.

If laparotomy correction is not successful done the next step considered to be a hysterectomy.

THROMBIN (COAGULATION DEFECTS)

Coagulation defects can cause a hemorrhage or be the result of one. These defects should be suspected in patients who have not responded to the usual measures to treat postpartum hemorrhage or who are oozing from puncture sites. A coagulation defect should also be suspected if blood does not clot in bedside receptacles or red-top (no additives) laboratory collection tubes within five to 10 minutes. Coagulation defects may be congenital or acquired.

Evaluation should include a platelet count and measurement of prothrombin time, partial thromboplastin time,

fibrinogen level; fibrin split products, and quantitative D-dimer assay. Physicians should treat the underlying disease process, if known, and support intravascular volume, serially evaluate coagulation status, and replace appropriate blood components using an emergency release protocol to improve response time and decrease risk of dilutional coagulopathy.

ONGOING OR SEVERE HEMORRHAGE

Significant blood loss from any cause requires immediate resuscitation measures using an interdisciplinary, stage-based team approach. Physicians should perform a primary maternal survey and institute care based on American Heart Association standards and an assessment of blood loss. Patients should be given oxygen, ventilated as needed, and provided intravenous fluid and blood replacement with normal saline or other crystalloid fluids administered through two large-bore intravenous needles. Fluid replacement volume should initially be given as a bolus infusion and subsequently adjusted based on frequent reevaluation of the patient's vital signs and symptoms. The use of 0 negative blood may be needed while waiting for type-specific blood.

Elevating the patient's legs will improve venous return. Draining the bladder with a Foley catheter may improve uterine atony and will allow monitoring of urine output. Massive transfusion protocols to decrease the risk of dilutional coagulopathy and other postpartum hemorrhage complications have been established. These protocols typically recommend the use of four units of fresh frozen plasma and one unit of platelets for every four to six units of packed red blood cells used.

Uterus-conserving treatments include uterine packing (plain gauze or gauze soaked with vasopressin, chitosan, or carboprost [Hemabate]), artery ligation, uterine artery embolization, B-lynch compression sutures, and balloon tamponade. Balloon tamponade (in which direct pressure is applied to potential bleeding sites via a balloon that is inserted through the vagina and cervix and inflated with sterile water or saline), uterine packing, aortic compression, and nonpneumatic antishock garments may be used to limit bleeding while definitive treatment or transport is arranged. Hysterectomy is the definitive treatment in women with severe, intractable hemorrhage.

Follow-up of postpartum hemorrhage includes monitoring for ongoing blood loss and vital signs, assessing for signs of anemia (fatigue, shortness of breath, chest pain, or lactation problems), and debriefing with patients and staff. Many patients experience acute and posttraumatic stress disorders after a traumatic delivery. Individual, trauma-focused cognitive behavior therapy can be offered to reduce acute traumatic stress symptoms.

SYSTEMS APPROACH TO PREVENTION AND TREATMENT

Complications of postpartum hemorrhage are common, even in high-resource countries and well-staffed delivery suites. Based on an analysis of systems errors identified in The Joint Commission's 2010 Sentinel Event Alert, the commission recommended that hospitals establish protocols to enable an optimal response to changes in maternal vital signs and clinical condition. These protocols should be tested in drills, and

systems problems that interfere with care should be fixed through their continual refinement. In response, The Council on Patient Safety in Women's Health Care outlined essential steps that delivery units should take to decrease the incidence and severity of postpartum hemorrhage.

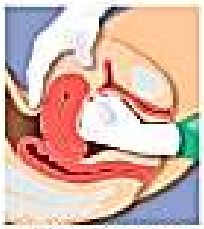
APPENDIX № 1

POSTPARTUM HEMORRHAGE

PPH MANAGEMENT FOR THE OUT OF HOSPITAL MIDWIFE

PPH?

KEEP CALM AND CHECK YOUR 4 TS



1. TONE
--Pitocin with or just after birth 10-40u
--If brisk bleeding, start at 20u
--Sublingual misoprostol 300- 800 *safe with placenta in*
--Controlled traction delivery of placenta
--Uterine Massage

STILL BOGGY?
--If not used yet, Sublingual misoprostol 300- 800 *and*
--Start an IV, 10-30u Pitocin in LR or NaCl 9% *then*
--Methergine 0.2 mg IM *safe with placenta out, acts on lower uterine segment, effective for grand multips* (NO: ci for High BP or Seizure, Antidepressent or Migraine meds) (WATCH: BP, nausea vomiting)

STILL BOGGY?
--Bi-Manual compression, call 911 or
--Tampanade with gauze, call 911 or
--Bakri balloon catheter

2. TRAUMA
--Genital tract tear (immediately suture, ligate vessels as needed)
--Inversion of the uterus (replace)
--Hematoma >5cm (drain, call 911 if filling)

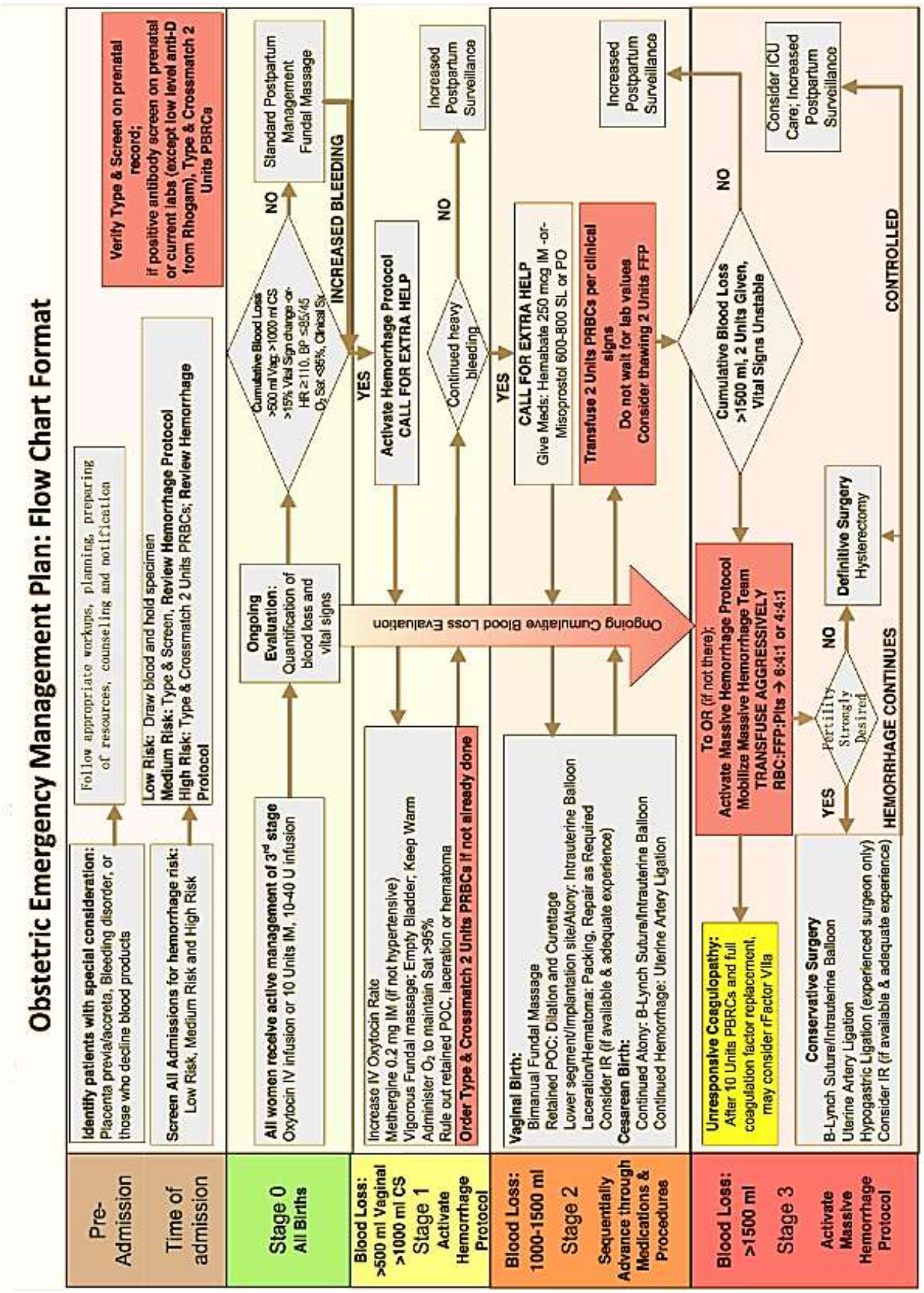
3. TISSUE
--Placental Tissue Retained?
--Inspect placenta
--Manual removal

4. THROMBIN
--Mix the blood with your gloved hand or your foot. Does it look and act like koolaid? No thickness, no clots?
--Bimanual Compression, call 911
--2 Large Bore IVs open and running
--nasal or mask oxygen on mom
--monitor vitals
--Ask yourself: DIC? AFI? HELLP? Pre-e?
report platelet deficiency and potential for need for massive transfusion protocol when calling 911

Chart
- Time of each action
- Response to each action
- What is seen (brisk hemorrhage, trickle = >500cc, etc..)
- Who acted
- Estimated Blood Loss at each stage

Check in and Debrief
- Parents
- Providers
- Review with team, chart in hand, each member speaks, each member learns

APPENDIX № 2


Obstetric Emergency Management Plan: Flow Chart Format
Pre-Admission
Identify patients with special consideration: Placenta previa/accreta, Bleeding disorder, or those who decline blood products
Follow appropriate workups, planning, preparing of resources, counseling and notification
Screen All Admissions for hemorrhage risk: Low Risk, Medium Risk and High Risk
Time of admission
Low Risk: Draw blood and hold specimen
Medium Risk: Type & Screen, Review Hemorrhage Protocol
High Risk: Type & Crossmatch 2 Units PRBCs; Review Hemorrhage Protocol
Verify Type & Screen on prenatal record;
If positive antibody screen on prenatal or current labs (except low level anti-D from Rhogam), Type & Crossmatch 2 Units PBRCs
Stage 0
All Births
All women receive active management of 3rd stage
Oxytocin IV infusion or 10 Units IM, 10-40 U infusion
Ongoing Evaluation: Quantification of blood loss and vital signs
Cumulative Blood Loss >500 ml Vag, >1000 ml CS >15% Vital Sign change -or- HR ≥ 110, BP ≤95/45 O2 Sat <95%, Clinical Sx
NO
Standard Postpartum Management
Fundal Massage
INCREASED BLEEDING
YES
Blood Loss: >500 ml Vaginal >1000 ml CS
Stage 1
Activate Hemorrhage Protocol
Increase IV Oxytocin Rate
Metheraine 0.2 mg IM (if not hypertensive)
Vigorous Fundal massage; Empty Bladder; Keep Warm
Administer O2 to maintain Sat >95%
Rule out retained POC, laceration or hematoma
Order Type & Crossmatch 2 Units PRBCs if not already done
Activate Hemorrhage Protocol
Continued heavy bleeding
NO
Increased Postpartum Surveillance
Ongoing Cumulative Blood Loss Evaluation
Blood Loss: 1000-1500 ml
Stage 2
Sequentially Advance through Medications & Procedures
Vaginal Birth:
Bimanual Fundal Massage
Retained POC: Dilation and Curettage
Lower segment/Implantation site/Atony: Intrauterine Balloon
Laceration/Hematoma: Packing, Repair as Required
Consider IR (if available & adequate experience)
Cesarean Birth:
Continued Atony: B-Lynch Suture/Intrauterine Balloon
Continued Hemorrhage: Uterine Artery Ligation
YES
CALL FOR EXTRA HELP
Give Meds: Hemabate 250 mcg IM -or- Misoprostol 600-800 SL or PO
Transfuse 2 Units PRBCs per clinical signs
Do not wait for lab values
Consider thawing 2 Units FFP
Increased Postpartum Surveillance
Blood Loss: >1500 ml
Stage 3
Activate Massive Hemorrhage Protocol
Unresponsive Coagulopathy:
After 10 Units PBRCs and full coagulation factor replacement, may consider rFactor VIIa
To OR (if not there);
Activate Massive Hemorrhage Protocol
Mobilize Massive Hemorrhage Team
TRANSFUSE AGGRESSIVELY
RBC:FFP:Plts → 6:4:1 or 4:4:1
Cumulative Blood Loss >1500 ml, 2 Units Given, Vital Signs Unstable
NO
Consider ICU Care; Increased Postpartum Surveillance
Conservative Surgery
B-Lynch Suture/Intrauterine Balloon
Uterine Artery Ligation
Hypogastric Ligation (experienced surgeon only)
Consider IR (if available & adequate experience)
YES
Fertility Strongly Desired
NO
Definitive Surgery
Hysterectomy
HEMORRHAGE CONTINUES
CONTROLLED

APPENDIX № 3

CHECKLIST FORMAT

Prenatal Assessment & Planning

- ☐ **Identify and prepare for patients with special considerations:** Placenta Previa/Accreta, Bleeding Disorder, or those who Decline Blood Products
- ☐ **Screen and aggressively treat severe anemia:** if oral iron fails, initiate IV Iron Sucrose Protocol to reach desired Hgb/Hct, especially for at risk mothers.

Admission Assessment & Planning

Verify Type & Antibody Screen from prenatal record

If not available,
- ☐ Order Type & Screen (lab will notify if 2nd clot needed for confirmation)

If prenatal or current antibody screen positive (if not low level anti-D from Rho-GAM),
- ☐ Type & Crossmatch 2 units PRBCs

All other patients,
- ☐ Send Clot to blood bank

Evaluate for ***Risk Factors*** (see below)

If medium risk:
- ☐ Order Type & Screen
- ☐ Review Hemorrhage Protocol

If high risk:
- ☐ Order Type & Crossmatch 2 units PRBCs
- ☐ Review Hemorrhage Protocol
- ☐ Notify OB Anesthesia

Identify women who may decline transfusion
- ☐ Notify OB provider for plan of care
- ☐ Early consult with OB anesthesia
- ☐ Review Consent Form

Ongoing risk Assessment

- ☐ **Evaluate for development of additional risk factors in labor**:
  - Prolonged 2nd Stage labor
  - Prolonged oxytocin use
  - Active bleeding
  - Chorioamnionitis
  - Magnesium sulfate treatment
- ☐ **Increase Risk level** (see below) **and convert to Type & Screen or Type & Crossmatch**
- ☐ **Treat multiple risk factors as High Risk**

Admission Hemorrhage Risk Factor Evaluation

Low (Clot only)	**Medium** (Type and Screen)	**High** (Type and Crossmatch)
No previous uterine incision	Prior cesarean birth(s) or uterine surgery	Placenta previa, low lying placenta
Singleton pregnancy	Multiple gestation	Suspected Placenta accreta or percreta
≤4 previous vaginal births	>4 previous vaginal births	Hematocrit <30 AND other risk factors
No known bleeding disorder	Chorioamnionitis	Platelets <100,000
No history of PPH	History of previous PPH	Active bleeding (greater than show) on admit
	Large uterine fibroids	Known coagulopathy
	Estimated fetal weight greater than 4 kg	
	Morbid obesity (BMI >35)	

STAGE 0: All Births: Prevention & Recognition of PPH

Active Management of Third Stage

- ☐ Oxytocin infusion: 10-20 units oxytocin/1000ml solution titrate infusion rate to uterine tone; or 10 units IM; do not give oxytocin as IV push
- ☐ Vigorous **fundal** massage for at least 15 seconds

Ongoing Quantitative Evaluation of Blood Loss

- ☐ Using formal methods, such as graduated containers, visual comparisons and weight of blood soaked materials (**1gm = 1ml**) **Ongoing Evaluation of Vital Signs**

If: Cumulative Blood Loss >500ml vaginal birth or >1000ml C/S -OR- Vital signs >15% change or HR 110, BP 85/45, O2 sat <95% -OR-Increased bleeding during recovery or postpartum, proceed to

STAGE 1

STAGE 1: PPH

Cumulative Blood Loss >500ml vaginal birth or >1000ml C/S -OR- Vital signs >15% change or HR 110, BP 85/45, O2 sat <95% -OR- Increased bleeding during recovery or postpartum

MOBILIZE	ACT	THINK
Primary nurse, **Physician or Midwife** to: ☐ Activate OB Hemorrhage Protocol and Checklist **Primary nurse** to: ☐ Notify obstetrician (in-house and attending) ☐ Notify charge nurse ☐ Notify anesthesiologist	**Primary nurse**: ☐ Establish IV access if not present, at least 18 gauge Increase IV fluids rates (Lactated Ringers preferred) and increase Oxytocin rate (500 mL/hour of 10-40 units/1000mL solution); Titrate Oxytocin infusion rate to uterine tone ☐ Continue vigorous fundal massage ☐ Administer Methergine 0.2 mg IM per protocol (if not hypertensive); give once, if no response, move to alternate agent; if good response, may give additional doses q 2 hr ☐ Vital Signs, including O2 sat & level of consciousness (LOC) q 5 minutes ☐ Weigh materials, calculate and **record** cumulative blood loss q 5-15 minutes ☐ Administer oxygen to maintain O2 sats at >95% ☐ Empty bladder: straight cath or place Foley with urimeter	Consider potential etiology: • Uterine atony • Trauma/Laceration • Retained placenta • Amniotic Fluid Embolism • Uterine Inversion • Coagulopathy • Placenta Accreta • Uterine Rupture

	☐ Type and Crossmatch for 2 units Red Blood Cells STAT (if not already done) ☐ Keep patient warm **Physician or midwife:** ☐ Rule out retained Products of Conception, laceration, hematoma **Surgeon (if cesarean birth and still open)** ☐ Inspect for uncontrolled bleeding at all levels, esp. broad ligament, posterior uterus, and retained placenta	**Once stabilized:** Modified Postpartum management with increased surveillance
If: Continued bleeding or Continued Vital Sign instability, and <1500 mL cumulative blood loss proceed to STAGE 2		

UTEROTONIC AGENTS for POSTPARTUM HEMORRHAGE

Drug	Dose	Route	Frequency	Side Effects	Contraindications	Storage
Pitocin (Oxytocin) 10 units/ml	10-40 units per 1000 ml, rate titrated to uterine tone	IV infu-sion	Continuous	Usually none Nausea, vomiting, hyponatremia ("water intoxication") with prolonged IV admin. BP and HR with high doses, esp IV push	Hypersensitivity to drug	Room temp
Methergine (Methylergonivine) 0.2mg/ml	0.2 mg	IM (**not** given IV)	-Q 2-4 hours -If no response after first dose, it is unlikely that additional doses will be of	Nausea, vomiting Severe hypertension, esp. with rapid administration or in patients with HTN or PIH	Hypertension, PIH, Heart disease Hypersensitivity to drug **Caution** if multiple doses of ephedrine have been	Refrigerate Protect from light

			benefit		used, may exaggerate hypertensive response w/possible cerebral hemorrhage	
Hemabate (15-methyl PG F2a) 250mcg/ml	250 mcg	IM or intra-myometrial (**not** given IV)	-Q 15-90 min -Not to exceed 8 doses/24 hrs -If no response after 3 doses, it is unlikely that additional doses will be of benefit.	Nausea, vomiting, Diarrhea Fever (transient), Headache Chills, shivering Hypertension Bronchospasm	Caution in women with hepatic disease, asthma, hypertension, active cardiac or pulmonary disease Hypersensitivity to drug	Refrigerate
Cytotec (Misoprostol) 100 or 200mcg tablets	800-1000mcg	Per rectum (PR)	One time	Nausea, vomiting, diarrhea Shivering, Fever (transient) Headache	Rare Known allergy to prostaglandin Hypersensitivity to drug	Room temp

STAGE 2: PPH

Continued bleeding or Vital Sign instability, and <1500 mL cumulative blood loss

MOBILIZE	ACT	THINK
Primary nurse (or charge nurse): ☐ Call obstetrician to bedside ☐ Call Anesthesiologist ☐ Activate Response Team: **PHONE #:**_____	**Team leader** (OB physician): ☐ Additional uterotonic medication: Hemabate 250 mcg IM [if not contraindicated] **OR** Misoprostol 800-1000 mcg PR o Can repeat	**Sequentially advance through procedures** and other interventions based on etiology: **Vaginal birth** If **trauma (vaginal, cervical or uterine):**

☐ Notify Blood bank of hemorrhage; order products as directed **Charge nurse:** ☐ Notify Perinatologist or 2nd OB ☐ Initiate OB Hemorrhage Record ☐ If selective embolization, call-in Interventional Radiology Team and second anesthesiologist ☐ Notify nursing supervisor ☐ Assign single person to communicate with blood bank ☐ Call medical social worker or assign other family support person	Hemabate up to 3 times every 20 min; (note-75% respond to first dose) **Do not delay other interventions (see right column) while waiting for response to medications** ☐ Bimanual uterine massage ☐ Move to OR (if on postpartum unit, move to L&D or OR) ☐ Order 2 units PRBCs and bring to the bedside ☐ Order labs STAT (CBC/Plts, Chem 12, PT/aPTT, Fibrinogen, ABG) ☐ **Transfuse PRBCs based on clinical signs** and response, **do not wait** for lab results **Primary nurse**: ☐ Establish 2nd large bore IV, at least 18 gauge. Maintain adequate fluid volume with Lactated Ringers and adequate uterine tone with oxytocin infusion ☐ Assess and announce Vital Signs and cumulative blood loss q 5-10 minutes ☐ Set up blood administration set and blood warmer for transfusion ☐ Administer meds, blood products and draw labs, as ordered ☐ Keep patient warm **Second nurse** (or charge nurse): ☐ Place Foley with urimeter (if not already done) ☐ Obtain portable light and OB procedure tray or Hemorrhage cart ☐ Obtain blood products from the Blood Bank ☐ Assist with move to OR (if indicated) **Blood Bank:** ☐ Determine availability of thawed plasma, fresh frozen plasma, and platelets; initiate delivery of platelets if not present on-site ☐ Consider thawing 2 FFP (takes 30 min), use if transfusing >2 units PRBCs ☐ Prepare for possibility of massive hemorrhage	• Visualize and repair If retained placenta: • D&C If **uterine atony** or lower uterine segment bleeding: • Intrauterine Balloon If **above measures unproductive:** • Selective embolization (Interventional Radiology if available & adequate experience) **C-section**: • Uterine hemostatic suture, e.g.,B-Lynch Suture, O'Leary, Multiple Squares; • Intrauterine Balloon If **Uterine Inversion**: • Anesthesia and uterine relaxation drugs for manual reduction If **Amniotic Fluid Embolism**: • Maximally aggressive respiratory, vasopressor and blood product support If **vital signs are worse than estimated or measured blood loss**: possible uterine rupture or broad ligament tear with internal bleeding; **move to laparotomy** **Once stabilized:** Modified Postpartum management with increased surveillance
Re-Evaluate Bleeding and Vital Signs. If cumulative blood loss >1500ml, >2 units PRBCs given, VS unstable or suspicion for DIC, proceed to STAGE 3		

STAGE 3: PPH

Cumulative blood loss >1500ml, >2 units PRBCs given, VS unstable or suspicion for DIC

MOBILIZE	ACT	THINK
Nurse or Physician: ☐ Activate Massive Hemorrhage Protocol **PHONE #:**_____ **Charge Nurse or designee:** ☐ Notify advanced Gyn surgeon (e.g. Gyn Oncologist) ☐ Notify adult intensivist ☐ Call-in second anesthesiologist ☐ Call-in OR staff ☐ Reassign staff as needed ☐ Call-in supervisor, CNS, or manager ☐ Continue OB Hemorrhage Record (In OR, anesthesiologist will assess and document VS) ☐ If transfer considered, notify ICU **Blood Bank:** ☐ Prepare to issue additional blood products as needed – **stay ahead**	**Establish team leadership and assign roles** **Team leader** (OB physician + OB anesthesiologist, anesthesiologist and/or perinatologist and/or intensivist): ☐ **Order Massive Hemorrhage Pack** (RBCs + FFP + 1 pheresis pack PLTS—see note in right column ☐ **Move to OR** if not already there ☐ Repeat CBC/PLTS, Chem 12, PT/aPTT, Fibrinogen, ABG STAT q 30-60 min **Anesthesiologist** (as indicated): ☐ Arterial blood gases ☐ Central hemodynamic monitoring ☐ CVP or PA line ☐ Arterial line ☐ Vasopressor support ☐ Intubation **Primary nurse:** ☐ Announce VS and cumulative measured blood loss q 5-10 minutes ☐ Apply upper body warming blanket if feasible ☐ Use fluid warmer and/or rapid infuser for fluid & blood product administration ☐ Apply sequential compression stockings to lower extremities ☐ Circulate in OR **Second nurse and/or anesthesiologist:** ☐ Continue to administer meds, blood products and draw labs, as ordered **Third Nurse (or charge nurse):** ☐ Recorder	• **Selective Embolization (IR)** • **Interventions based on etiology not yet completed** • **Prevent hypothermia, Acidemia** **Conservative or Definitive Surgery:** • Uterine Artery Ligation • Hysterectomy **For Resuscitation: Aggressively Transfuse** **<u>Based on Vital Signs, Blood Loss</u>** **KEY: HIGH RATIO of FFP to RBC** **Either: 6:4:1 PRBCs: FFP: Platelets Or: 4:4:1 PRBCs: FFP: Platelets** **Unresponsive Coagulopathy:** • After 8-10 units PRBCs and coagulation factor replacement may consider risk/benefit of rFactor VIIa **Once Stabilized:** Modified Postpartum Management; consider ICU

BLOOD PRODUCTS

Packed Red Blood Cells (PRBC) *(approx. 35-40 min. for crossmatch—assuming no sample is in the lab and assuming no antibodies are present)* Transfuse O Negative blood if you cannot wait	Best first-line product for blood loss 1 unit = 450ml volume. If antibody positive, may take 1-24 hrs. for crossmatch 1 unit=450 ml volume and typically increases Hct by 3%.
Fresh Frozen Plasma (FFP) *(approx. 35-45 min. to thaw for release)*	Highly desired if >2 units PRBCs given, or for prolonged PT, aPTT >1.5x control 1 unit = 180ml volume and typically increases Fibrinogen by 10mg/dL

Platelets (PLTS) *Local variation in time to release (may need to come from regional blood bank)*	Priority for women with Platelets <50,000 Single-donor Apheresis unit (= 6 units of platelet concentrates) provides 40-50k transient increase in platelets
Cryoprecipitate (CRYO) *(approx. 35-45 min. to thaw for release)*	Priority for women with Fibrinogen levels <80 10 unit pack typically raises Fibrinogen 80-100mg/dL Best for DIC with low fibrinogen and don't need volume replacement Caution: 10 units come from 10 different donors, so infection risk is proportionate.

SELF- CONTROL

1. **What is the most important cause of maternal mortality worldwide?**
   a) Infection.
   b) Hemorrhage
   c) Pulmonary embolism
   d) None of the above
   e) All of the above
2. **For a woman measuring 50 and 120 lb, what is her expected pregravid blood volume?**
   a) 3000 mL
   b) 3250 mL
   c) 3500 ml.
   d) 3800 mL
   e) 3900 mL
3. **Assuming a 50% increase in the blood volume of a woman during pregnancy, what would the blood volume of a 5'2" woman who weighed 140 lb pregravid be at term?**
   a) 4000 ml.
   b) 4340 ml.
   c) 4700 ml.
   d) 4930 mL
   e) 4850 mL
4. **Which of the following statements is accurate concerning postpartum hemorrhage**
   a) The blood loss at delivery approaches the volume of blood added during pregnancy.
   b) Studies show that estimated blood loss reported is often less than the actual blood loss.

c) The American College of Obstetricians and Gynecologists defines postpartum hemorrhage as cumulative blood loss of 100 mL accompanied by symptoms and signs of hypovolemia.
d) None of the above
e) All of the above

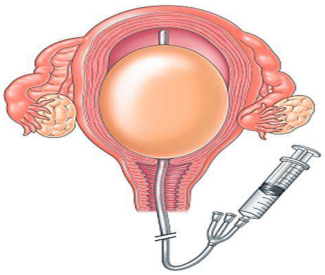
5. **Causes of uterine atony include which of the following?**
   a) Obesity
   b) Placenta previa
   c) Multiple fetuses
   d) Placental abruption
   e) None of the above
6. **A 33-year-old G413 at 35 weeks gestation presents to labor and delivery with a small amount of vaginal bleeding. When you place her on the fetal monitor there is a category III fetal heart rate tracing. An emergent cesarean delivery is performed. The 1-minute and 5-minute Apgars are 0 and 3, respectively. Which of the following is the etiology?**
   a) Vasa previa
   b) Placenta previa
   c) Placental abruption
   d) All of the above
   e) None of the above
7. **Which of the following maneuvers should be performed in the setting of postpartum hemorrhage following a vaginal delivery?**
   a) Evaluate birth canal for lacerations
   b) Evaluate the placenta for possible retained fragments
   c) The uterus should be manually explored, and placental fragments removed
   d) All of the above
   e) None of the above
8. **During evaluation of postpartum bemorrhage following a vaginal delivery, which of the following maneuvers or medications might be used?**
   a) Bimanual uterine compression

b) Ergot alkaloids for patients with hypertension
c) Carboprost tromethamine in patients with mild asthma
d) All of the above.
e) None of the above

9. **A 34-year-old G3P3 begins having brisk bright red bleeding following completion of a vaginal delivery. You give her carboprost tromethamine and perform the maneuver pictured below. What else should be immediately considered?**
   a) Call for help
   b) Ask for urgent help from anesthesia
   c) C. Place large-bore intravenous lines, order blood, and begin volume resuscitation
   d) All of the above
   e) None of the above
10. **The patient continues hireding after the interventions mentioned above. Which of the following maneuvers might be employed?**
   a) Hysterectomy
   b) Bakri balloon placement
   c) Uterine compression sutures
   d) All of the above
   e) None of the above
11. **The patient undergoes a hysterectomy and 5 units of packed red blood cells are given, but bleeding continues. What is the most likely etiology of the bleeding?**
   a) Vaginal cuff bleeding
   b) Dilutional coagulopathy
   c) Lacerated internal iliac artery
   d) Placental implantation on the omentum
   e) None of the above
12. **Regarding the patient in Question 41-10, which of the following interventions might have avoided or ameliorated this condition?**
   a) Transfusion of platelets
   b) Transfusion of whole blood
   c) Infusion of 5% albumin for initial resuscitation

d) All of the above
e) None of the above

13. What is represented in the following image!



a) Bakri balloon
b) Foley catheter
c) Blakemore tube
d) Jackson-Pratt drain
e) None of the above

14. What percentage of women have lacerations at the time of vaginal delivery?

a) 50%
b) 90%
c) 80%
d) 65%
e) 77%

15. Which maneuvers below should be performed when repairing a cervical laceration?

a) Operator grasps lips of cervix with ring forceps.
b) Second assistant can provide better exposure with vaginal wall retractors.
c) Assistant place downward pressure on the uterus to expose the cervix better for the operator
d) All of the above
e) None of the above

16. What is the appropriate management of vulvovaginal hematomas?

a) Surgical exploration in all cases
b) To prevent infection they should all undergo ultrasound guided drainage.
c) In a small hematoma, if pain is severe then ice packs and analgesia are appropriate.

d) If bleeding ceases, small to moderate-sized hematomas can be treated expectantly.
e) None of the above

17. Which of the following are risk factors for recurrent abruption?

a) Prior abruption
b) Low birth weight
c) Preterm rupture of membranes
d) None of the above
e) All of the above

18. Reason for shock in uterine inversion

a) Septic
b) Hypovolumic
c) Neurogenic
d) Cardiogenic
e) Iatrogenic

19. What is the approved dose of Misoprostol in emergency management of PPH

a) 200mcg
b) 400 mcg
c) 600mcg
d) 1000mcg
e) 1500mcg

20. Role of ergometrine to stop PPH is due to

a) Increase uterine muscle tone
b) Vasoconstriction
c) Increased platelet aggregation
d) Increased coagulation
e) Decreased coagulation

21. A female presents with significant blood loss due to PPH, what would be the shock index

a) 0.9-1.1
b) 0,9-1.0
c) 09-05
d) 0.5-0.7
e) 0.2-0.1

22. Amount of blood passed through placenta on delayed cord clamping

a) 50-100ml
b) 100-200ml
c) 120-150ml
d) 150-180ml
e) 100-120ml

23. Most common cause of postpartum haemorrhage

a) Trauma
b) Uterine atony.
c) Retained products of conception
d) Coagulopathy
e) Idiopathic

24. The main indicator of consumption coagulopathy is

a) Decrease in the concentration of fibrinogen;
b) Decrease in the concentration of prothrombin;
c) Decrease in the number of platelets;
d) All of the above;
e) None of the above.

25. Manual removal of the placenta should be performed in case of blood loss

a) Up to 100 ml;
b) Up to 200 ml;
c) Up to 400 ml;
d) Up to 600 ml;
e) Up to 700 ml.

26. The shock index is

a) Quotient from dividing the pulse rate by the systolic blood pressure indicator;
b) Quotient from dividing the pulse rate by the indicator of diastolic blood pressure;
c) Quotient from dividing the sum of systolic and diastolic blood pressure by the pulse rate;
d) SBP + 2 DBP / 3;
e) None of the above.

27. Hemorrhagic shock is

a) Disruption of protective and adaptive mechanisms in response to blood loss;
b) Discrepancy between the capacity of the vascular bed and the volume of circulating blood as a result of blood loss;
c) The extreme state of the organism;
d) Crisis of hemodynamics and microcirculation;
e) All of the above.

28. The most common cause of bleeding in the third period childbirth is:

a) Violation in the hemostasis system;
b) Partial dense attachment of the placenta;
c) Partial placenta accreta;
d) Rupture of the cervix;
e) Defect of the placenta.

29. The most common cause of late PPH is

a) Violation of the contractility of the uterine muscle;
b) Disturbances in the hemostasis system;
c) Retention in the uterus of the remnants of placental tissue;
d) Trophoblastic disease;
e) None of the above.

30. In case of massive bleeding in the third stage of labor or the postpartum period, the infusion of plasma substitutes is started

a) Intravenous drip (up to 50 ml / min) after stopping bleeding;
b) Intravenous jet (100–150 ml / min) after stopping bleeding;
c) Intravenous stream (100-150 ml / min) simultaneously with stopping bleeding;
d) Intravenous drip (up to 50 ml / min) simultaneously with stopping bleeding;

e) In this clinical situation, infusion therapy is not performed.

Answers

1. B	**2. A**	**3. B**	**4. B**	**5. C**
6. D	**7. D**	**8. A**	**9. D**	**10. D**
11. B	**12. B**	**13. A**	**14. C**	**15. D**
16. D	**17. A**	**18. C**	**19. C**	**20. A**
21. A	**22. A**	**23. B**	**24. D**	**25. C**
26. A	**27. E**	**28. B**	**29. C**	**30. C**

APPENDIX № 4

CRITERIA FOR ASSESSING THE QUALITY OF MEDICAL CARE OF OBSTETRICIAN-GYNECOLOGIST

№	Criteria	Performed
1.	Additional medical personnel called	Yes/ No
2.	Risk stratification and prevention in accordance with the degree of risk	Yes/ No
3.	Anesthesiologist-resuscitator summoned	Yes/ No
4.	Assessment of the volume of blood loss	Yes/ No
5.	Bimanual uterine compression performed	Yes/ No
6.	Performed manual examination of the uterine cavity and removal of the remnants of placental tissue and clots (in the presence of remnants of placental tissue and clots)	Yes/ No
7.	Performed suturing of ruptures of the soft birth canal (in the presence of ruptures of the soft birth canal).	Yes/ No
8.	Laboratory diagnostics was carried out according to the protocol (blood group / Rh factor, OAC, coagulogram).	Yes/ No
9.	Performed the introduction of uterotonic drugs (in the absence of medical contraindications).	Yes/ No
10.	Introduced two intravenous catheters> 16 G.	Yes/ No
11.	Bladder catheterization was performed.	Yes/ No
12.	Monitoring of vital functions (blood pressure, pulse, respiration, oxygen saturation in the blood, urine output) was performed.	Yes/ No
13.	Surgical intervention was performed within 20 minutes with massive blood loss exceeding 25-30% of the circulating blood volume, with continued bleeding.	Yes/ No

CRITERIA FOR ASSESSING THE QUALITY OF MEDICAL CARE OF ANESTHESIOLOGIST-REANIMATOLOGIST

№	Criteria	Performed
1.	Risk stratification and prevention were carried out in accordance with the degree of risk.	Yes/ No
2.	Oxygen was administered by inhalation.	Yes/ No
3.	Performed the introduction of uterotonic drugs (in the absence of medical contraindications).	Yes/ No
4.	Introduced two intravenous catheters> 16 G.	Yes/ No
5.	Monitoring of vital functions (blood pressure, pulse, respiration, oxygen saturation in the blood, urine output) was performed.	Yes/ No
6.	Bladder catheterization was performed.	Yes/ No
7.	The study of hemostasis was performed.	Yes/ No
8.	Correction of disturbances in the hemostasis system (in the presence of disturbances in the hemostasis system) was performed.	Yes/ No
9.	Infusion-transfusion therapy was performed.	Yes/ No
10.	Conducting anesthesia.	Yes/ No

CRITERIA FOR THE EFFECTIVENESS OF THERAPY FOR POSTPARTUM HEMORRHAGE

№	Criteria	Performed
1.	Stop / absence of bleeding.	Yes/ No
2.	Normalization of hemodynamic parameters (blood pressure, heart rate).	Yes/ No
3.	Stabilization of hemostasis indicators: international normalized ratio (INR) less than 1.3; APTT does not exceed the norm by more than 1.5 times; fibrinogen more than 2.0 g / l, platelets more than 50x109 / l.	Yes/ No
4.	Diuresis more than 0.5 ml / kg / min.	Yes/ No
5.	Recovery of consciousness.	Yes/ No
6.	No signs of ARDS and / or pneumonia.	Yes/ No
7.	Termination of mechanical ventilation.	Yes/ No

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FOR NOTES: