AN OBSERVATIONAL STUDY OF MANAGEMENT PRACTICES AND MATERNAL OUTCOME OF POSTPARTUM HEMORRHAGE AT A TERTIARY CARE CENTERIN BELAGAVI

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Sir/Madam,

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LIST OF ABBREVIATIONS USED

PPH : Post Partum Haemorrhage

LSCS : Lower segment caesarean section

ITP : Idiopathic thrombocytopenic purpura

HELLP : Hemolysis elevated liver enzymes low platelet count

CBC : Complete blood count

Hb : Hemoglobin

PCV : Packed cell volume

FFP : Fresh frozen plasma

MOH : Maternal obstetric haemorrhage

AMTSL : Active management of third stage of labor

PT : Prothrombin time

aPTT : activated partial thromboplastin time

DIC : Disseminated intravascular coagulation

ICU : Intensive care unit

IIAL : Internal iliac artery ligation

MAP : Mean arterial pressure

ABSTRACT

Title:An observational study of management practices and maternal outcome of postpartum hemorrhage at a tertiary care center in Belagavi

Introduction:

Postpartum hemorrhage is an important cause of maternal mortality and morbidity. These postpartum hemorrhage need to be prevented to decrease overall maternal morbidities and death. Therefore, it is important to understand the risk factors and plan the preventive strategies. Prompt and sequential implementation of management practices including uterotonics, surgical compression sutures and vascular ligation and timely blood product transfusion can prevent maternal deaths and morbidities.

Aim and objectives:

To study the management practices and maternal outcome of postpartum hemorrhage

To determine the risk factors of postpartum hemorrhage

Material and methods:

The study population constituted postnatal patients referred to or getting admitted to labor room of KAHERs Dr. Prabhakar Kore Hospital, Belagavi and were diagnosed with postpartum hemorrhage was defined as blood loss >500 ml from the genital tract within 24 hours of deliver. Study period was from 1stJanuary 2018 to 31st December 2018. Data was collected with the help of proforma, it included details of the patient, details of previous and present pregnancy, vitals at the time of admission and after delivery, risk factors, amount of blood loss, investigations like CBC,DIC

Profile, LFT,RFT. Management practices done according to the hospital protocol to arrest bleeding such as medical measures, surgical measures or a combination of both were recorded .Maternal outcomes in the form of morbidity indicators like DIC,ARDS,ARF,ICU admission, massive blood transfusion and maternal death were noted. Perinatal outcome like LBW,IUD,NICU admission and stillbirth were recorded. Appropriate statistical analysis was done.

Results:

Incidence of PPH in the present study was 1.86%.most common risk factor for PPH was induction of labor(33.3%) followed by anemia (23.9%) and hypertensive disorders of pregnancy(23.9%).Majority of patients (64.6 %.) had atonic PPH, 11.45% cases hadboth atonic & traumatic PPH.97.9% cases were managed successfully with conservative methods either medical or surgical or a combination of both procedures.7 cases required peripartum hysterectomy. With 2 maternal deaths, outcome of management practices can be considered successful.

Conclusion:

Postpartum hemorrhage is the major cause of maternal morbidity and maternal death. Most common risk factor for PPH was induction of labor, followed by anemia and hypertensive disorders of pregnancy. To prevent PPH, AMTSL should be practiced for all delivering women. Medical management proved as effective as surgical management of PPH but a combination of both medical and surgical procedure prevents the delay and helps to give appropriate care in short time and thus reduces the morbidity and mortality of PPH.

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INTRODUCTION

Postpartum hemorrhage is not only a life threatening situation but also an obstetrician's nightmare. It is defined as bleeding in excess of 500 ml within first 24 hours after birth.[7]Approximately 830 women die all over the world per day from pregnancy or child birth-related complications. Out of this 52 percent of maternal deaths are attributed to 3 major preventable causes – sepsis, hemorrhage and hypertensive disorders. According to World health organization, 25% of maternal mortality attributes to postpartum hemorrhage. It is a rapid maternal killer and can even kill a healthy female within 2 hours of PPH, without its proper treatment. Incidence of Postpartum hemorrhage is reported as 6% after LSCS and 2-4% after vaginal delivery, with uterine atony as the major cause in approximately 50 % cases. Approximately 14 million pregnant women every year in world suffer from PPH[1]. Postpartum hemorrhage occur in 5% of all deliveries, majority of death occur within 4 hrs of delivery indicating that it is a sequel of 3rd stage of labor [2]

Maternal mortality is less in high income group and urban areas as compared to low income group and rural areas.[1]World health organization estimates that of the 5.29 lac maternal mortality that occurs annually, 1.36 lac 25.7%) of death takes place in India and 2/3rd of these maternal death occur after delivery, Postpartum hemorrhage is most commonly reported complication[6]. The unacceptably high maternal mortality of 540 per 100,000 live births in India is a major challenge to obstetricians in last few decades[6] According to district health and family welfare office in India, 35% of the total 137 maternal deaths in Belgaum district in 2005 were the result of PPH[3]

As we know it is multifactorial [125] the various risk factors included are retained placenta, failure of progression during second stage of labor, placenta

accreta,lacerations, instrumental delivery, large for gestational age, hypertensive disorders, induction of labor and augmentation of labor[127]but still in 75% patients it occurs without any risk factor therefore PPH is unpredictable and unpreventable .As it is correctly said that prevention is always better than cure thus active management of third stage of labour is implemented universally as a package to prevent postpartum hemorrhage, it includes administration ofuterotonic therapy with delivery of the anterior shoulder, delayed cord clamping and placental delivery by controlled cord traction following signs of placental separation. In established PPH, death is preventable if delay in seeking care and treatment is avoided [7] In case of PPH, uterine atony stands as the most common cause.

A number of drugs and various surgical techniques are used for prevention and control of PPH. 5 to 10 IU IV oxytocin administered immediately after anterior shoulder delivery as compared to IV methergin is the drug of choice to prevent PPH[1]. A randomized controlled trialconducted by using data from Cochrane Pregnancy and Childbirth Group's Trials Register to compare interventions used for the management of primary postpartum hemorrhage and to assess their safety and effectiveness, showed that, oxytocin infusion gives better result than misoprost and causes fewer side effects, suggesting oxytocin to be used as first line drug in prevention of PPH. It also suggested, that there were no additional benefit from additional use of misoprost in women, who received oxytocin for the management of PPH.[3]

Bakri ballooncan be used as first line surgical management and should be made the part of existing treatment protocols for PPH[8,9] at low resource places as results of Hayman sutures and bakri balloon tamponade are identical in treatment of postpartum hemorrhage due to uterine atony[17].Massive transfusion protocol enable early arrangement of blood and its product in anticipation of severe

PPH.[126]Itisestablished that uterine massage was comparatively less effective for reduction of blood loss as compared to administration of oxytocin. Prophylactic Tranexamic acid given prior to caesarean incision can decrease PPH[30]. Stepwise uterine devascularization can also be used to control PPH resistant to routine treatment. Newer treatment modalities like uterine artery embolization can be considered as second line treatment modality for women refractory tofirst line management[22]. The acute maternal morbidity or Obstetric near-miss is an indicator for assessment of obstetric care quality. The maternal near-miss ratio was 8.4/1000 live births, and maternal near-miss to mortality ratio was 5.3:1. It helps in assessment and improvement in the quality of healthcare and locating the spectrum of severe maternal mortality and morbidity.Hysterectomy is treatment of choice, when medical and surgical treatment fails to arrest bleeding for refractory cases of Postpartum hemorrhage, but with advances insurgical techniques and interventional radiology techniques, new safe and effective alternatives to hysterectomy have evolved.

The aim of present study was to review the maternal parameters with respect to age, parity, socio-demographic factors, risk factors, etiological factors, methods of treatment adopted at our institute and maternal outcome. At the level of a tertiary care center, PPH has always been the focus of maternity care, present study was intended to incorporate safety initiatives to improve maternal outcome by incorporating a variety of strategies, such as practice guidelines or protocols, drills and teamwork training to influence the outcome of PPH. Correction of preventable risk factors and using combination of medical and surgical procedures rather than applying a single intervention approach can prevent PPH and also can shorten the time period from diagnosis to treatment of PPH and thus can reduce the morbidity and mortality due to PPH in low resource countries.

AIMS AND OBJECTIVES

Primary objective

1. To study the management practices in postpartum hemorrhage
2. To study the maternal outcome in postpartum hemorrhage

Secondary objective

1. To determine the risk factors of postpartum hemorrhage.

REVIEW OF LITERATURE

Primary Postpartum hemorrhage is defined as loss of blood>=500 ml from the genital tract within 24 hours of child birth vaginally or >=1000 ml after a cesarean section[4]. PPH can be minor (500 -1000 ml) or major (more than 1000 ml), major can be divided into moderate (1000 -2000 ml) and severe (more than 2000 ml) [8]. A small blood loss that makes the woman hemodynamically unstable is also termed as PPH[1].

The classical presentation of postpartum hemorrhage is of heavy bleeding per vaginum that can quickly develop symptoms and signs of hypovolemic shock.[1]

1. If placenta is delivered fully, blood loss seen at the introitus, if placenta remained inside, significant blood may be retained inside uterus.
2. Bleeding from uterovaginal trauma can be concealed in form of hematoma of retroperitoneum, broad ligament, lower genital tract or abdominal cavity.
3. If uterine atony is not cause of bleeding, loss of blood may be slow and clinical symptoms and signs may develop over longer duration of time.
4. Blood may collect in Atonic uterus even after placental delivery - making monitoring Uterine size & tone mandatory after delivery

Signs and Symptoms and of hemorrhagic shock are:

1. Fall in BP
2. Palpitations, Tachycardia, dizziness
3. Restlessness, pallor
4. Oliguria, Weakness, Sweating

The four important causes of PPH are atony, trauma, retained placenta or adherent placenta and coagulation abnormalities. Commonest cause of postpartum

hemorrhage is atonic uterus, which is unpredictable and episodic. Women having risk factors for postpartum hemorrhage, preventive steps should be taken during antenatal and intra partum period to reduce the risk. Postpartum hemorrhage can occur without any risk factor[9].

TABLE A9

The 4 "Ts" for Causes of PPH are

FOUR 'T'S	CAUSE	APPROXIMATE INCIDENCE (%)
Tone	Atonic uterus	70
Trauma	Lacerations, hematomas, inversion, rupture	20
Tissue	Retained tissue, invasive placenta	10
Thrombin	Coagulopathies	1

Causes of primary PPH:

1. **Uterine Atony**: Defined as failure of uterus to contract following delivery. it is commonest cause of PPH worldwide leads to maternal death. Atonic bleeding occurs from site of placental attachment, when the myometrial muscles do not contract and retract effectively, therefore blood vessels are not compressed and bleeding continued.

- Conditions which hampers the uterine contraction such as, remnants of placental tissue, membranes, retained placenta and blood clots. Full bladder, hemorrhage due to placenta praevia or placenta abruption may also cause postpartum hemorrhage..
- Overstretched uterus as seen in multipara, multiple gestation, polyhydramnios, large baby and fibroid results in uterine atony.
- Poor myometrial contractions can results from fatigue of muscles due to rapid forceful labor or prolonged labor.
- Inhibition of contractions from drugs such as halogenated anaesthetic agents, nitrates, non steroidal anti-inflammatory drugs, magnesium sulphate, beta-sympathomimmetics and nifedipine.
- Anemia, Intrauterine death with retained fetus, preeclampsia and Eclampsia are other causes of uterine atony.

2. **Genital trauma**: spontaneously or iatrogenic during process of childbirth

- Injuries during labor to uterus, cervix, vaginal walls and perineum, episiotomy, and caesarean section.

    - Following prolonged and vigorous labor.
    - Cervical laceration with forceps delivery.
    - Extra uterine and intrauterine manipulation of fetus.
    - Uterine rupture with previous cesarean delivery scars

3. **Tissue:** Complete separation and removal of placenta leads to continued retraction and optimal occlusion of blood vessels whereas Retention of pieces of placenta and membranes or incomplete separation of the placenta, placenta praevia may result in PPH.

4. **Coagulation problems:**

    - Pre-existing bleeding disorder and therapeutic Anticoagulants
    - Thrombocytopenia
        a. Pre-existing condition as ITP
        b. Acquired secondary to HELLP syndrome (hemolysis, elevated liver enzymes and low platelet count)

Management of Postpartum Haemorrhage

Investigation:

1. CBC to diagnose anemia
2. Blood grouping & antibody screening
3. Blood cross matching for high risk patients of postpartum hemorrhage
4. Coagulation studies to rule out coagulopathies
5. Ultrasound for detecting high-risk patients and placental abnormalities
6. Women with previous LSCS must determine their placental site by ultrasound scan.

Evaluation during III stage of labor:

1. Assessment of uterine size and tone
2. Inspection of placenta (for integrity of cotyledons) if delivered
3. Manual exploration of placenta and membranes
4. Palpation and inspection of hematomas
5. Inspection of vagina and cervix for any injury

Assessments of Blood Loss

The important steps in management of postpartum hemorrhage are early prediction of PPH and assessment of blood loss during 3rd stage of labor. Visual estimation is inaccurate analysis of loss of blood after delivery. After vaginal delivery, with 300 ml blood loss, there is 16% underestimation, which increased to 41% at 2000 ml blood loss[10]. MOH is defined as loss of blood from genital tract or uterus >1500 ml or a fall in Hb by >4 gm/dl or acute loss of blood requiring transfusion of > 4 units of PCV, or any loss of loss responsible hemodynamic instability[11]. Accurate methods such as blood collection drapes for vaginal delivery, periodic estimation of blood loss, weighing of blood soaked swabs, can increase efficiency of estimation of blood loss[12].

AMTSL is a low cost & efficient measure which can help to prevent 60-70% of atonic postpartum haemorrhage[9]. Monitoring of blood pressure, pulse, bleeding per vaginum during 4th stage of labour help in early prediction and management of PPH.It a crucial step to decrease morbidity and mortality.

Protocol for Management of PPH

It involves 4 components:

1. Communication

2. Resuscitation

3. Monitoring investigation

4. Arrest of bleeding

The therapeutic goals of active management of massive PPH is to maintain Hb>8 mg/dl, platelet count >75 x 10^3/cu mm, PT<1.5 x mean control, aPTT<1.5 x mean control, fibrinogen >1.0 gm/l [12].

Restoration of oxygen saturation and blood volume forms the basis of management of PPH. It includes securing two intravenous lines with 14 gauge cannula, blood sample of 20 ml for diagnostic test. It includes complete blood count, coagulation profile including fibrinogen, renal function test, serum electrolytes and blood cross match and arrangement of at least 4 blood units.

Therapeutically consider administering a high concentration of oxygen (15 L/minute). Monitor the vitals such as Pulse rate, B.P, oxygen saturation (SpO_2), ECG and if needed consider invasive blood pressure recording through arterial and central lines. Catheterization to asses urine output hourly, charting of fluid intake, blood, blood product and other procedures. Patient should be kept warm in a flat position. Start transfusion of blood as soon as arranged, in the mean while, 3.5 liters of warmed crystalloid Hartmann's solution (2 liters) and/or colloid (1-2 liters) should be infused. Recombinant factor VII can be used, based on the results of coagulation profile. The best fluid to replace lost blood volume is the compatible blood & should be transfused, if fully cross matched blood unavailable then uncrossmatched group specific blood or 'O' Rh-negative blood may be considered as the safest option to give in acute emergencies [9].In case of PPH, use of blood collection bag or drape is recommended. The entire concerned professional team must be informed immediately. If retained placenta is there, manual removal should be considered immediately, following which manual exploration of uterine cavity is recommended. concurrently, a dose of 5 or 10 IU of oxytocin must be administrated IV over at least 1minute or directly by an IM injection followed by an infusion of 5 to 10 IU/h over a

periodof 2 hrs. In deliveries at risk of cervical and high vaginal laceration, detailed examination of urogenital tract should be done. Concerned professional treating the case of PPH should have acquaintance with correct method of management and retrospective analysis of each case of postpartum hemorrhage should be done.[13]

Arrest of Bleeding

There can be more than one cause for PPH related to four Ts 'namely Tone, Tissue, Trauma and Thrombin. The commonest etiology of postpartum hemorrhage is uterine atony, but still clinical examination should be done to exclude other or additional causes of PPH. Irrespective of the cause of maternal obstetric hemorrhage, bimanual uterine compression should be started, uterine massage given and uterotonic drugs should be instituted, till the bleeding stops.

If the medical methods fail to control ongoing blood loss in atonic postpartum hemorrhage, it becomes mandatory to do clinical examination in operation theatre and the other less radical method of interventions like mechanical intrauterine compression by balloon catheter tamponade should be started before considering more radical surgical management[9].

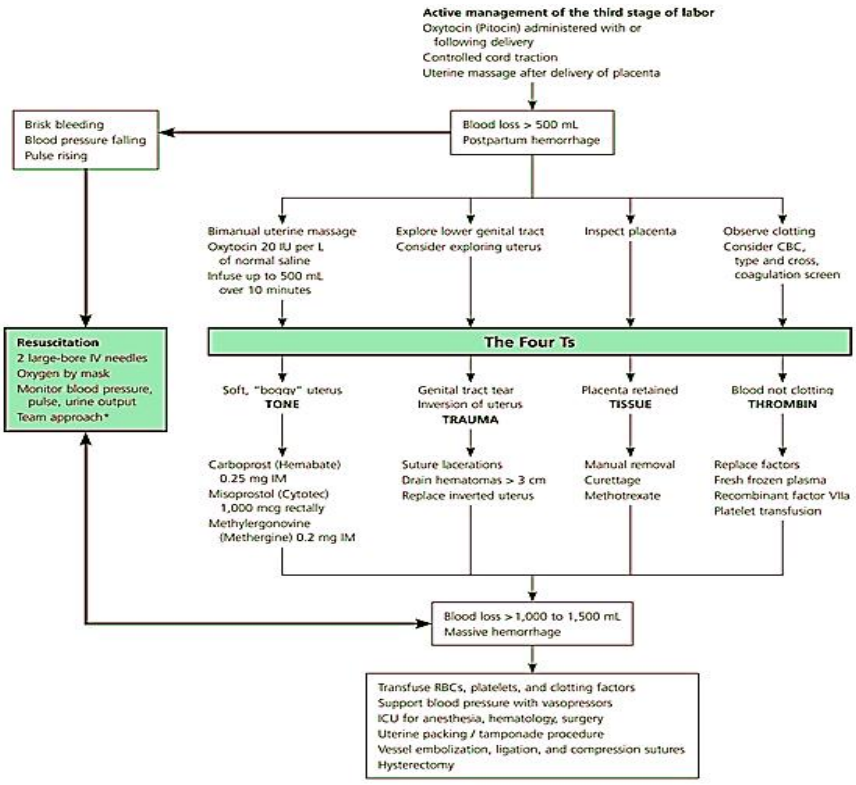


Figure 1: AMTSL

TONE

Atonic uterus is the commonest cause of PPH[14].After placental separation, hemostasis depends on contraction of myometrium. Atony is initially treated by uterine massage & bimanual uterine compression, followed by uterotonics to enhance uterine contraction.

Uterine Massage

Excessive blood flow after placenta delivery should alert to conduct bimanual examination of uterus. If it is soft, bimanual uterine compression is done. one hand in vagina pushes against the body of uterus and other hand compress the fundus from above through the abdominal wall & other(Figure 2).[15]

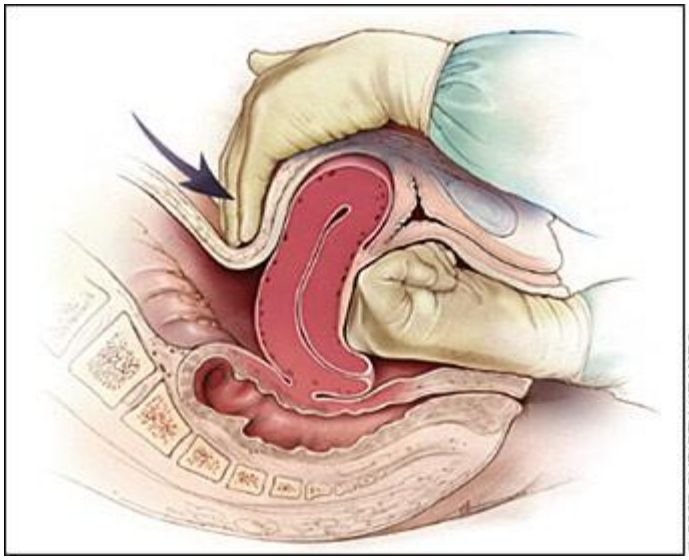


Figure 2: Bimanual Uterine compression

Uterotonic Agents

The various Uterotonic agent are Oxytocin, Methergin and prostaglandins.

Oxytocin: it stimulates the contraction of myometrium rhythmically, to enhance constriction of spiral arteries and reduction in blood flow to the uterus.[16] Oxytocin is a highly effective first-line treatment for PPH[17]; 10 IU should be injected IM, or 20 IU in 1 liter of Normal saline may be infused at 250 ml/ hour rate. 500 ml is maximum dose over 10 minutes without complications.[18]

Methylergometrine (Methergin) and ergometrine: These are ergot alkaloids which causes smooth muscle contraction of both the lower & upper uterine segments to contract tetanically.[19]Methergin dose is 0.2 mg IM, which can be repeated at 2-4 hours interval. These agents raise blood pressure, and therefore contraindicated in hypertension or pre-eclampsia.[20] Other adverse effects are nausea and vomiting.[20]

Prostaglandins increases uterine contractility and vasoconstriction[21]. The most commonly used prostaglandin is 15-methyl $PGF_{2\alpha}$, available as carboprost.

Carboprost: it can be given intramuscularly or intramyometrially with 0.25 mg dose; which can be repeated in every 15 minutes up to cumulative dose of 2 mg. It has been proved to control hemorrhage in up to 87% of patients.[22] In resistant cases, chorioamnionitis is often present.[22] The only absolute contraindication to carboprost is known hypersensitivity, but asthma & hypertensive patients, it should be used with caution. Side effects include nausea, vomiting, diarrhea, hypertension, headache, flushing, and pyrexia.[21]

Misoprost: it increases tone of uterus and decreases postpartum bleeding.[64] Misoprost is effective in management of PPH. Route of administration is oral, sublingual, per vaginum, and per rectum. Dosage ranges from 200-1,000 µg; Recommended dosage is 1,000 µg per rectum by FIGO[14,24,25] Higher doses causes side effects, like chills, fever, diarrhea and limit its use.[14,24,27]

Uterine tamponade

Uterine packing is one among the earliest method to achieve a uterine tamponade to control postpartum haemorrhage[27].

The possibilities of infection, trauma and inadequate packing result in concealed hemorrhage along with increased and more effective usage of uterotonic agent ergometrine and syntocinon to treat atonic uterus gradually resulted in its decline[28]. It was an effective method to control bleeding in spite of decreasing popularity[29,30]. In a study of 163 cases, immediate control of bleeding seen in 97% cases.[31]

Previously sterile gauze were used for uterine tamponade, but now a days, different balloon tamponade is used to control the uterine bleeding during hemorrhage. The balloons in sequence of decreasing cost include the Sengstaken–Blakemore tube, the Bakri balloon, the Rusch balloon, Foley catheters and the condom catheter balloon.

Basically, the intrauterine balloon exert an inward-to-outward pressure higher than the systemic arterial pressure' to prevent continuous bleeding[32]. An alternative mechanism of action involves the hydrostatic pressure effect of the balloon on the uterine arteries.[33]

Bakri balloon

Bakri introduced the principle of intrauterine balloon technique in the management of hemorrhage due to adherent placenta (praevia–accreta) during LSCS with or without B/L hypogastric artery ligation[35]. The present Bakri balloon can be filled with 500 ml of saline to control bleeding from uterus. An article described the result of Bakri balloon in 4 women with Postpartum hemorrhage due to a placenta praevia successfully[34].

Foley catheters

Both multiple & single Foley catheters were used in the management of PPH[35]. In a case study, after failed uterine curettage and packing of uterine cavity with sterile gauze, 5 Foley catheters were inserted and their balloon filled with 80 ml normal saline in the uterine cavity to stop bleeding.[36]Later they were removed without further bleeding in 36 hours.

Sengstaken–Blakemore tube

Foley catheter with 30 ml volume may be ineffective for tamponade effect due to large volume of a postpartum uterus.[37]Therefore, the Sengstaken–Blakemore two balloon tube was used, which was initially designed for the treatment of bleeding esophageal varices[38]**.** Initially distal gastric balloon filled with 300 ml of normal saline used to control bleeding from atonic uterus[39]. Later proximal esophageal balloon was used[40].

Rusch balloon

Large volume of postpartum uterine cavity motivates the use of urological Rusch balloon[41]. It had an insufflation capacity of 1500 ml.[42] It was initially used for adherent placenta to control bleeding after removal and secondarily for an adherent succenturiate lobe. It was inflated with 400–500 ml of saline and after 24 hours, gradually deflated at rate of 20 ml/hour and removed[43].

Condom catheters

It act like fluid-filled structure to stop bleeding by exerting a tamponade effect in uterine cavity[44].A latex condom attached with 16 F rubber catheter inserted in uterine cavity and filled with 250–300 ml of normal saline. It was removed gradually after 24–48 hours.

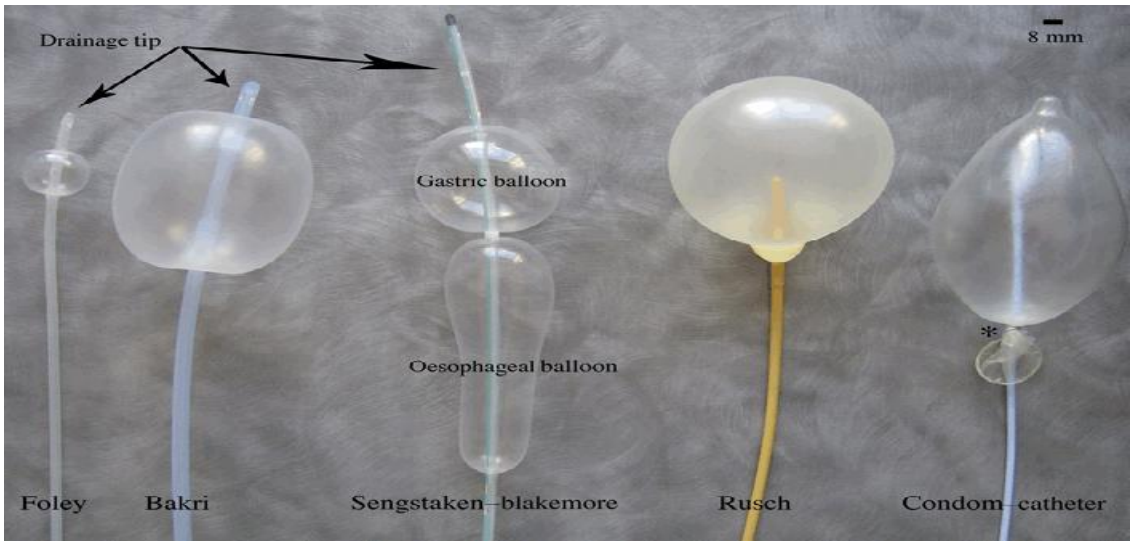


Figure 3: Distal component of tamponade balloons

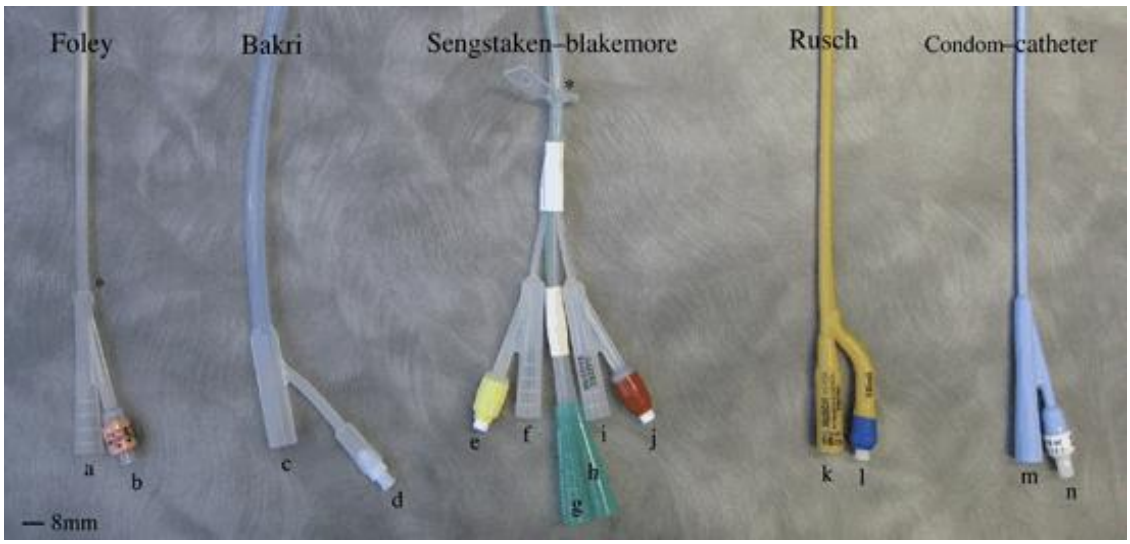


Figure 4: Proximal component of tamponade balloons

Radiological management

Uterine artery embolization is useful in controlling both traumatic and atonic postpartum hemorrhage in situation, when surgical options are exhausted and fertility is desired. Major limitation is 24 hrs availability of interventional radiologist and hemodynamic stability of patient. Complications include infection, local hematoma at site of injection, rarely uterine necrosis. It can be done as elective or emergency intervention[45].

Emergency indications are atonic postpartum hemorrhage and surgical complications, uterine tear during LSCS, persistent bleeding after hysterectomy. Internal iliac artery (anterior division) is approached via a femoral artery and gelatin particles or polyvinyl alcohol injected. It has high success rate of 75 -100%.

Elective indications are abnormal placentation such as Placenta praevia, adherant Placenta, or previous caesarean scar diagnosed by MRI scan or Ultrasonography. It minimizes blood loss, requirement of blood transfusion and ICU admission. It incorporates balloon catheters placement in internal iliac artery or uterine artery, for vascular occlusion by balloon inflation and on failure, it can be used as route for arterial embolisation[46]. Intravascular Aortic Balloon Occlusion is minimally invasive method of treatment of postpartum hemorrhage and conservative approach for abnormal placentation[46]. Hysterectomy was prevented in (10/14) cases, by arterial embolization, Penney et al [47].

TRAUMA

Vaginal lacerations and cervical tear from birth trauma causes significant loss of blood which can be reduced by timely repair of tear &hemostasis. Sutures should be placed if required. Episiotomy is a risk factor for anal sphincter tears, and

increased blood loss[48,49,50]**.** Indications are to expedite urgent delivery or perineum is a limiting factor.

Hematomas usually present as severe pain or drastic alteration in vital signs in comparison to the loss of blood volume. Small hematomas require close observation**.**[51] Patients with large hematomas require incision and clot evacuation along with fluid replacement.[51] Bleeding vessels should be ligated. A layer wise closure can secure hemostasis with diffuse oozing and eliminates dead space.

Uterine Inversion

It occurs in 0.05% of deliveries.[52] AMTSL can lower the incidence of uterine inversion.[53] Fundal attachment of the placenta may lead to inversion; the significance of fundal pressure and undue cord traction are uncertain.[52] The inverted uterus appear as a gray-blue protruded mass from the vagina. Altered vital sign as compared to blood volume loss is due to vasovagal effect of uterine inversion. The placenta still attached to uterus, should be left in place until reduction[54]. Uterus should be quickly repositioned by every possible attempt. The Johnson method used to replace protruding uterus[55] (**Figure 5**). Once repositioned, uterotonics should be started to increase tone of uterus and to prevent chances of recurrence. If manipulation fails to replace uterus or a cervical constriction ring develops, administration of relaxant or GA helps in uterine muscle relaxation for manipulation. If these methods further failed, surgical replacement of uterus will be needed.[53]

Uterine Rupture

The risk is high with previous surgeries on lower uterine segment, and short interval between subsequent pregnancies or multiple LSCS with no previous vaginal deliveries.[56-60]**.** Misoprost should be avoided for ripening of cervix or induction of

labour to attempt vaginal birth after earlier cesarean delivery.[60] Before delivery, fetal bradycardia is the earlier sign of uterine rupture.[57] Increased fetal heart rate or late decelerations, bleeding per vaginum, tender lower abdomen.[59] An asymptomatic small defect can be managed expectantly.[99]

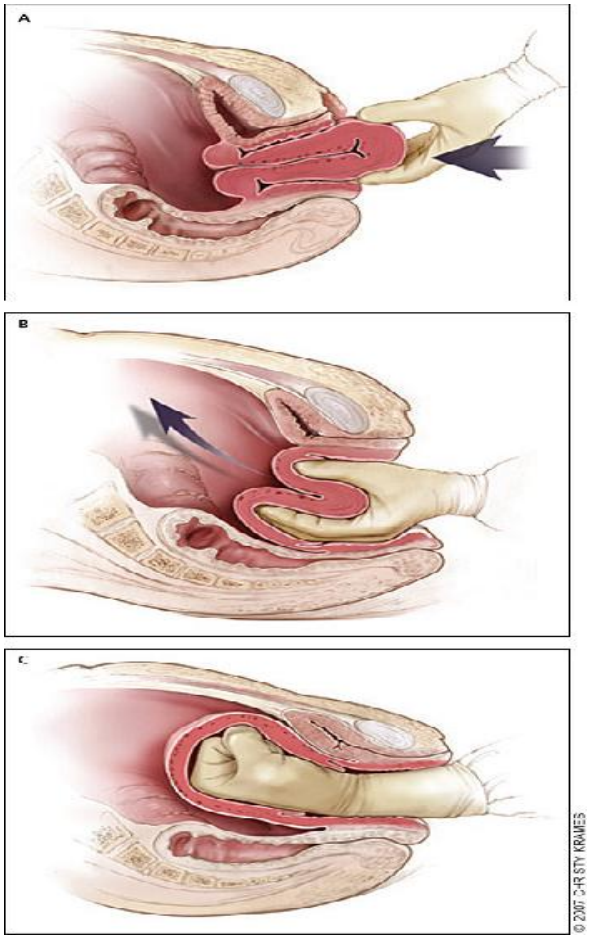


Figure 5: Johnson method for reduction of uterine inversion

Tissue

The average time from fetal delivery to placental expulsion is 8-9 minutes. Longer interval increases risk of PPH, with rates increased to two times after 10 minutes[61].

Retained placenta (failure to deliver placenta within 30 min. after birth) occurs in < 3% of vaginal deliveries.[62] One option is to inject20 units of oxytocin with 20ml of 0.9 % normal saline in the umbilical vein.[63]Alternatively, removal of placenta manually, can be done using appropriate analgesia. If still placenta cannot be separated, adherent (invasive) placenta should be anticipated.

Invasive placenta Incidence has increased from 0.003% to 0.04% of deliveries since 1950s due to increase in rates of cesarean section[61].It can be life threatening[62].On the basis of depth of invasion in uterus, it can be classified as: placenta ***accreta*** , placenta ***increta*** , and placenta ***percreta*** .[61] Risk factors include increased maternal age, high parity, previous invasive placenta or cesarean delivery, and placenta praevia (increased to 67% with >= 4 previous LSCS)[61]. The most common treatment for invasive placenta is hysterectomy.[1] However, conservative management (leaving placenta in place or giving weekly oral methotrexate[61] until Hcg levels are 0) is sometimes successful.[65] Late sequel, include infection and late PPH.[64,65]

Surgical management

Uterine compression sutures: In severe postpartum hemorrhage refractory to uterotonics and uterine compression, earlier the treatment modality was hysterectomy even in primigravida and in young women. Introduction of compression sutures reduce the incidence of hysterectomy for severe PPH[66]. Several modifications of this

technique aimed at simplicity and better applicability with equivalent efficacy developed like Hayman sutures, Cho sutures, Periera suture, etc[67]. Complications related to compression sutures are uterine suture erosion, ischemic uterine necrosis, uterine inflammation leading to chronic endometritis, pyometra, systemic sepsis, and uterine synechiae[68,69]. Vast majority of case studies shows no rise in infertility rates or complications in future pregnancies. Ovahba et al., reported eight pregnancies among 20 women with successful term delivery (four cesarean and 2 vaginal) among those underwent uterine compression sutures[70]. The risks of complication are higher with non absorbable sutures. Uterine compression sutures should not prevent the drainage of blood from uterine cavity and uterine vascularity should not be affected. Hysteroscopy to be done on follow up to asses uterine cavity [71].

B-Lynch suture (brace suture)

B-Lynch used compression suture in uterus from 1989 to 1995, among 5 women with postpartum hemorrhage, and achieved complete hemostasis. It was later described in the *BJOG* in 1997 [66]. An incision in lower segment of uterus is made or caesarean suture removed. It include two longitudinal sutures in uterus which looks like a “brace-suspender,” and therefore these B-Lynch suture referred to as the “brace suture.”. Of the 5 women, 2 became pregnant after B Lynch suture: one delivered per vaginally and another through LSCS without any complications. Disadvantage: (i) Incision in lower uterine segment (like an LSCS incision) even after vaginal delivery; (ii) It does not transfix the complete thickness of posterior and anterior uterine walls. Although these sutures has been the performed most widely during last 15 years [72], it may have certain drawbacks.

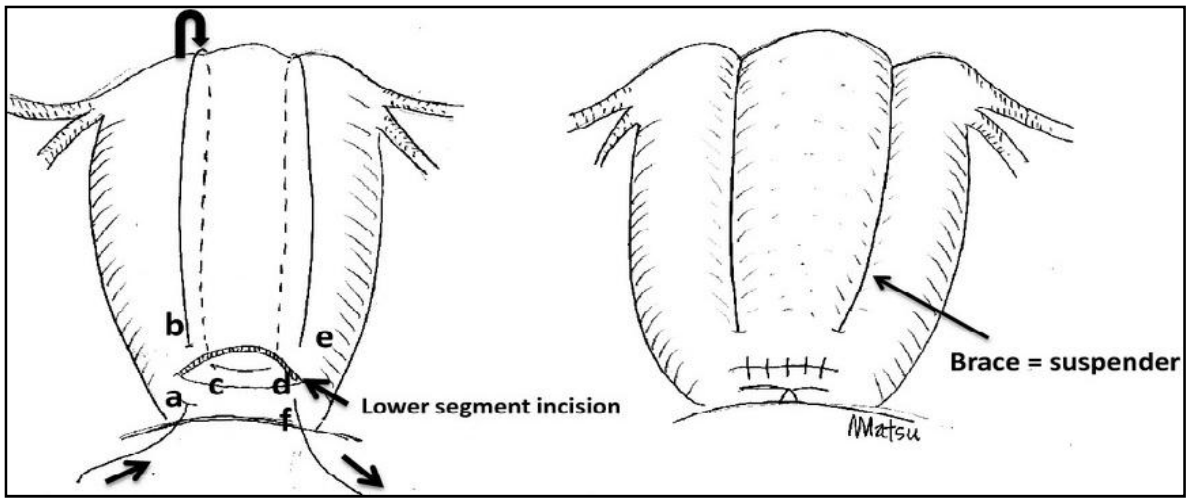
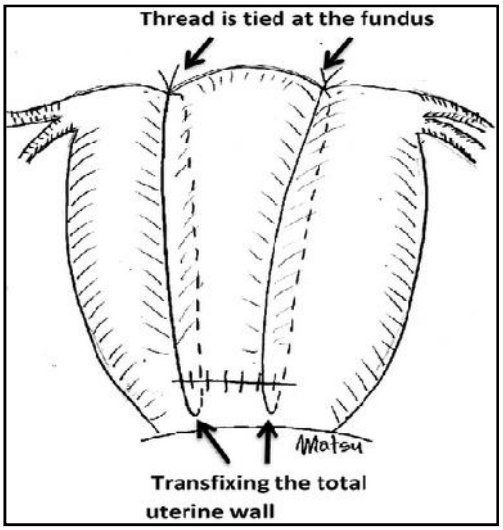


Figure 6: B-Lynch suture.

Hayman suture (simple brace)

In 2002, Hayman et al[73] reported a new suture employed in 3 patients, with slight differences. According to Hayman et al.[73],there are two drawbacks of B-Lynch suture: (i) hysterotomy is mandatory (ii) technically difficult. This suture transfixes the complete thickness of both walls of uterus at the lower segment of uterus. If there is bleeding from lower segment of uterus 2 transverse cervico-isthmic sutures to be applied, transfixing both the posterior and anterior cervico-isthmic walls. The basic Hayman suture uses using two vertical threads and transfixing the entire uterine wall. Hayman suture also known as “simple brace”, since it is comparatively simple than B-Lynch



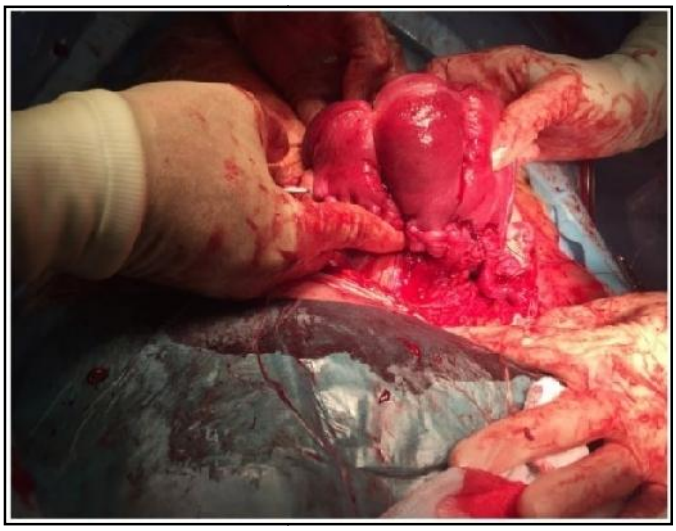


Figure 7: Hayman suture

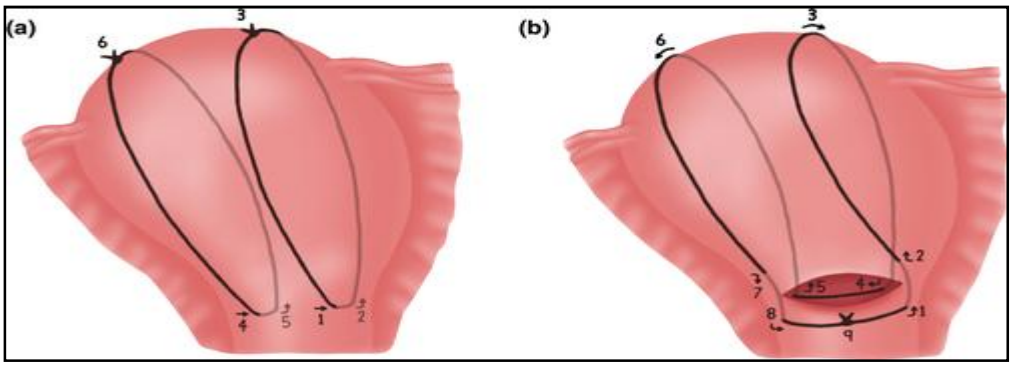


Figure 8: (a) Hayman suture (b) B–Lynch

Cho suture

It opposes the posterior and anterior walls of uterus in a “square” shaped manner. 4-5 square sutures to be applied in atonic uterus walls until no dead space in the cavity of uterus. At bleeding point, suturing needed to compress the bleeding site. Cho et al. [74] performed it in 23 women, with complete hemostasis and continuity of normal menstrual blood flow in all. Out of 10 women desirous of pregnancy, 4 delivered infants within 1 year after having this procedure. The compression achieved is highand technically easier to applyin comparison with B-Lynch suture.

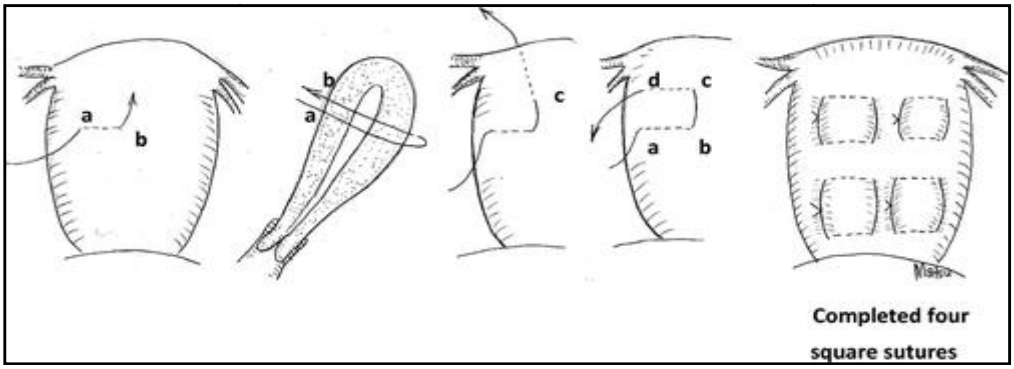


Figure 9: **Cho suture**

Pereira suture

The unique feature is that needle does not enter the uterine cavity [75]. The uterus is encircled by multiple longitudinal and transverse continuous sutures. Two or three longitudinal sutures are necessary. It was performed among 7 women with postpartum hemorrhage, all achieved complete hemostasis.

Vascular ligations [76]: The blood vessels are ligated to decrease blood supply of uterus to control hemorrhage.

1. Bilateral uterine artery ligation: If it fails to control hemorrhage, ovarian artery is ligated.

2. Bilateral ovarian artery ligation: Ovarian artery ligated through a vascular area in mesovarium. If it fails to control hemorrhage internal iliac artery is ligated.

3. Internal Iliac artery ligation: It decreases pulse pressure in arteries distal to point of ligation by 85% therefore, provides hemostasis via clot formation[77,79].

Surgical ligation of the uterine artery, ovarian artery, and internal iliac artery can be useful to control maternal bleeding after failure of other methods. Bilateral uterine vessels ligation is a better than internal iliac artery ligation because of easy accessibility and the field of dissection is away from the ureters and iliac veins, with higher success rate[78.]Vascular ligation is time-consuming required both surgical expertise and a hemodynamically stable patient. Risks include lower limbs ischemia, neuropathy, occlusion of intestine, and peripheral nerve ischaemia.[80.] Fertility is usually preserved when ligation is successful.[77]

Stepwise uterine devascularization has been described whereby uterine arteries, tubal branches of the ovarian arteries, and finally internal iliac arteries are ligated in a sequential manner.[81]In a study of 103 patients, uterine devascularization was 100% effective and hysterectomy was avoided.[81]

Hysterectomy: Peripartum hysterectomy can be a total or subtotal, it is done when all other methods failed to control postpartum hemorrhage, as a last option. The common indications are adherent placenta, irreparable uterus rupture, persistent atonic

postpartum hemorrhage. Incidence of hysterectomy varies from 1 in 331 to 1 in 6978 deliveries [82]. It should not be delayed too long. Subtotal hysterectomy is treatment of choice except cervical tear or lower uterine segment injury. The aortic compression is useful at times for control of bleeding in surgical area for severe cases.

THROMBIN

Coagulation disorders, though rare cause of PPH, don't respond to above described measures.[52]These disorders include ITP, TTP, von Willebrand's disease, and hemophilia. Patients can develop disseminated intravascular coagulation or HELLP syndrome. Risk factors for DIC include amniotic fluid embolism severe pre-eclampsia, placenta abruptio, sepsis, and retention of dead fetus[83,84]. .

Evaluation include a platelet count, PT, aPTT, fibrinogen level, and D-dimer (fibrin split products). Management consists of intravascular volume replacement, serial coagulation studies, and replacement of essential blood components.

Administration of recombinant factor VIIa or clot-promoting medications (e.g., tranexamic acid may be considered[83,84]

Transfusion Protocols

It should be recommended in uncontrolled hemorrhage or when >10 unit PCV is anticipated [86]. Early usage of blood products for prevention of dilutional coagulopathy is required in MOH.

Research in transfusion medicine suggest usage of PCV and FFP in a ratio of 1:1 and 1:2 , restoration of platelets to avoid dilution of clotting factors, with regular assessment of Hb and clotting factors by conventional tests [87]. Transfusion protocols

decreases mortality, multiple organ failure and increase ventilator free days. Disadvantages are circulatory overload, transfusion associated lung injury, immunomodulation and iron overload. Regular measurements of clotting factors and hemoglobin can avoid this situation and guide transfusion.

Fibrinogen levels is best marker for developing coagulopathy and blood loss whereas, PT and aPTT are not very useful, as revealed by a survey. It predicts severity of postpartum hemorrhage early, and a level of < 2 gm/l had 100% Positive Predictive Value (PPV) for severe postpartum haemorrhage[88].

Cryoprecipitate: It contains approx. 10 times the conc. of fibrinogen as compared to FFP. 30 ml/kg of FFP is comparable with 3 ml/kg of cryoprecipitate, to increase fibrinogen level by 1 gm/l. So, FFP is not the product of choice to restore fibrinogen levels. During active bleeding, up to 1 liter of FFP and 10 units of cryoprecipitate can be given until coagulation study results arrive[89].

Fibrinogen: It is a lyophilized powder, virally inactivated which is stable at room temperature. Blood typing is not required before transfusion and it restores fibrinogen levels rapidly. For severe PPH in patients with normofibrinogenemia pre-emptive treatment with fibrinogen concentrate is not justified but the effect of fibrinogen substitution in severe postpartum hemorrhage with hypofibrinogenemia is yet to be studied[90].

Recombinant Activated Factor VII

. Current recommendations for its use are after failure of conventional methods. Major concern is it causes thrombin burst, resulting in clot formation in open vessels which in turn increase the potential for thrombotic complications. Factor

VIIa is considered in women with severe postpartum hemorrhage and susceptible to severe hypofibrinogenemia.

It is required when platelet count is $>50x10^9/l$ hematocrit is adequate, fibrinogen >1 gm/l, temperature $>34^0C$ and pH > 7.2. Dose is 90µg/Kg IV over 3-5 minutes, repeated only if necessary. Franchiniet et al., reported study on 65 women treated with rFVIIa for postpartum hemorrhage and found decreased blood loss. Only 30 women needed peripartum hysterectomy[91].

Tranexamic Acid

It is being used successfully for both prophylaxis and treatment of PPH in cases of continuous blood loss due to atonic uterus[92].

Non Pneumatic Anti Shock Garment (NASG): Main use of antishock garment for management of hypovolemic shock and transfer of patient to higher center. It reverses the shock by pressing the lower body vessels and thus redistributing the circulating blood to the vital organs such as lungs, heart, brain, adrenals. Its pneumatic action reduces obstetric blood loss, morbidity & mortality by vascular compression and decreasing the blood supply to the uterus[93].

It is a low-cost device to help women survive obstetrical hemorrhage without adverse effects.[94]The foam compression ball of abdominal segment applies direct pressure to the uterus. After being applied, it reverses shock by diverting blood from abdomen & lower extremities to the brain, heart, and lungs, through circumferential counter pressure and reduces flow of blood through uterine vessels, which further decreases blood loss. Its effectiveness in decreasing blood volume loss and fast time to recover from hemorrhagic shock shown in studies from Egypt.[95,96] Larger studies in

Nigeria and Egypt shown its effective usage in reducing maternal death and morbidity.

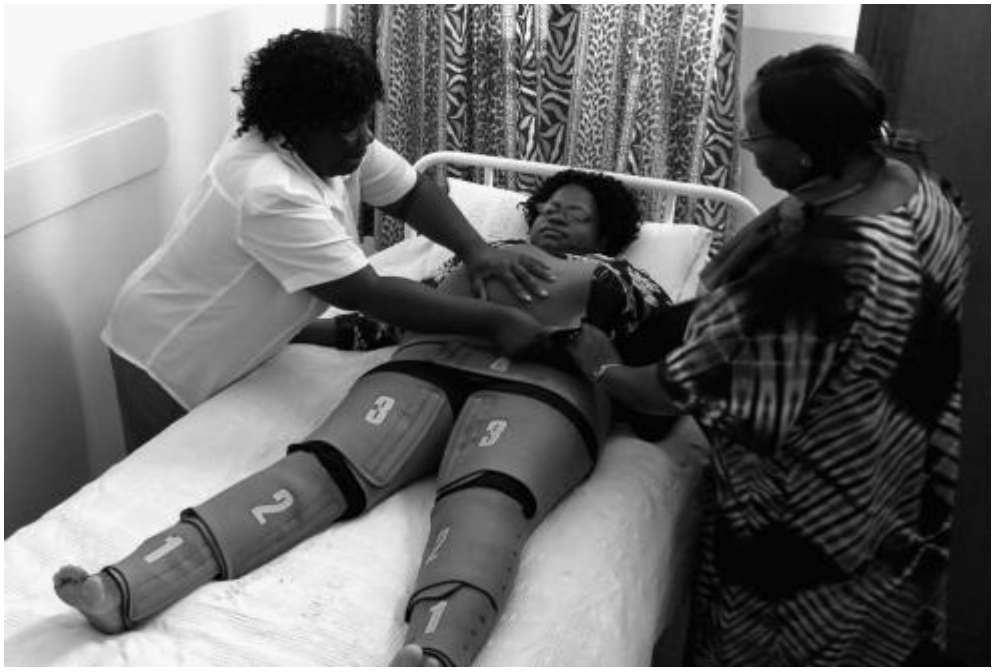


Figure 10: The non-pneumatic anti-shock garment

Prevention and Treatment in low resource Settings

PPH being the major cause of direct maternal death in low resource settings, where either lack of birth attendants or inadequate skills or lack of equipment to manage postpartum hemorrhage and shock.

Even with advancement in prevention of PPH, women are still succumbing. What is needed in these women is community based emergency care. Community workers should be taught about uterine massage technique and emergency preparedness, since as the best treatment for PPH depends on early identification and prompt action[96].

1. Uterine massage: process involves massaging the uterus through abdomen after placental delivery until it is contracted and retracted. It should be repeated in every 15 minutes during first two hours to ensure that the contracted stage of uterus.

2. Misoprost: although, oxytocin is ideal because of rapid onset of action & effects with minimal side effects, refrigeration and injectable route limited its use. If oxytocin is not available or difficulty in administration, single dose of 800 μg of misoprost, sublingually, can be given safely. If bleeding persists after the administration of uterotonics the immediate life saving measure is bimanual compression.

3. Aortic Compression: It is a critical measure in heavy PPH and does not interfere in any steps in management of PPH. It redistributes circulating blood to the upper parts of the body and thereby the vital organs. It prevents blood to reach bleeding area in pelvis and therefore, blood volume is conserved. By shifting blood supply away from pelvis via compression thus buying the time for patient to be shifted to higher center, simultaneously doing other measures.

4. Non Pneumatic Anti Shock Garment (NASG): Main Use of antishock garment for the treatment of hypovolemic shock is for transfer of patient to higher center. NASG reverses the shock state by compressing the lower body vessels, and diverting blood to the core organs.

Uterotonics

A study done to ascertain the benefit of oxytocin over methergin in prevention of PPH revealed that risk was substantially reduced with 5 IU IV oxytocin administered immediately after anterior shoulder delivery as compared to IV methergin and thus is the drug of choice to prevent PPH[98].

In an analysis with study population of 1335 women delivered through LSCS, cases with refractory uterine atony were identified receiving either methergin or carboprost. Outcome studied were blood transfusion (intraop or postop), surgical interventions asvascular ligation or peripartum hysterectomy, although most of the PPH cases responded to first line uterotonics. Study population received methergin 870(65.2%) compared with 465(34.8%)women received carboprost. In a score matched propensity methergin was concluded as more effective second line uterotonic[99].

A randomized controlled trial was conducted by using data from Cochrane Pregnancy and Childbirth Group's Trials Register (31 August 2013). It compared any interventions used for the management of primary postpartum hemorrhage to assess their safety and effectiveness. It shows that, oxytocin infusion gives better result than misoprost and causes fewer side effects comparatively ,after using it as first-line of treatment for primary postpartum hemorrhage. It also suggests, no additional benefit from additional use of misoprost in women, who received oxytocin for the management of PPH.[98]

Uterine Massage:

In a multicentre randomized trial, study populations of 2340 eligible women delivered vaginally were randomized among 2 groups, 1170 each. one group receiving only oxytocin and the other group receiving sustained abdominal pressure for 30 minutes in addition to oxytocin. Blood loss of >400 ml in 2 hours in both the groups, came to a conclusion that uterine massage does not reduce the blood loss when it was given along with oxytocin[99].

In other study to ascertain the efficiency of uterine massage before the delivery of placenta to reduce blood loss, RCT was conducted in Egypt and South Africa between September 2006 to February 2009. 1964 women were indulged in the study and were allocated to 3 groups namely groups 1,2 and 3,receiving IM oxytocin, uterine massage and both respectively. Blood loss of >= 300 ml in 30 minutes was the study criteria. It was established that uterine massage was comparatively less effective for reduction of blood loss than oxytocin and no added benefits seen in addition to oxytocin[100].

Bakri Balloon

In a study conducted to analyze insufficiency among 47 women having severe PPH due to failed treatment from pharmacological agents.43 out of 47(91.4%) patients bleeding was successfully controlled while in remaining 4 cases 2 underwent subtotal hysterectomy and the last 2 underwent total hysterectomy[101].

In a study to analyze the use of bakri balloon in 45 women with PPH. Bleeding was stopped in 34(75.7%) women with bakri balloon alone, 6 women required additional b/l internal iliac artery ligation, thus bakri balloon with additional procedures proved more effective 40/45(88.8%). It can be concluded that bakriballoon can be used on priority for management of postpartum hemorrhage

resistant to uterotonics both in tertiary care centers and centers with limited resources[102].

A prospective study with a study population of 152 cases to test the success of balloon tamponade effects proved that 23/152 in which condom catheter was inserted for 24-48 hours(mean 36 hrs), effective in 91.5% cases. Thus this study suggested that it may be used as first line surgical management and should be made the part of existing treatment protocols for PPH[103,104].

B Lynch Suture

A study where 22 patients were applied B lynch suture between March 1997 to March 2005,in order to control the PPH refractory to uterotonic agents. In 12/22 instances only B-Lynch suture was applied, whereas in 10/22 vascular ligation also done simultaneously. In 77% cases the suture achieved the hemostasis and uterus was preserved. Also 85% cases of uterine atony B lynch were sufficient enough to control the bleeding. And thus Hysterectomy was prevented in 17/22 cases[105].

A retrospective study was done in 36 women suffering from postpartum atonic uterus who were managed with b lynch suture, their success and possible complications.16/36 were managed primarily with b lynch sutures. Uterine artery ligation and B Lynch sutures were applied 4/11 women and 7/11 had received B-Lynch suture and uterine artery with ovarian artery ligation. Failure of B-Lynch suture occurred in 8 women in which hemostasis were achieved by BILAL. Only 2 women underwent post-caesarean hysterectomy. The efficacy of B-Lynch suture alone was 75%(27/36) and B-Lynch with BILAL was 94.4%(34/36)[106].

. The success of B-Lynch sutures to avoid hysterectomy was 23/35(66%), while in addition with other surgical techniques was 23/35(74%), during a retrospective study involving 35 patient who had massive hemorrhage over a 5 year period from January 2008 to December 2012.This reported success rate was comparatively less than reported in literature[107].

.In a systematic done in 2007 review the success of uterine compression sutures(B-Lynch and others) was 91.7%[108].Other prospective population based study conducted between 2007-2009 in UK among 211 women demonstrated success rate of 75. It also showed, delay of 2 to 6 hrs is associated with 4 times increase in risk of hysterectomy, and if applied within 1 hour yielded 84% success rate and there was no difference in the result between various compression sutures.[109]

Hayman Suture

In a comparative study to highlight the difference of success rates between Hayman sutures and bakri balloon tamponade among study population of 82 women diagnosed of uterine atony and refractory to uterotonic agents during their LSCS, the study yielded that success rates of both the methods are comparable (76.7% in Hayman suture and 74.4% in BBT). Success rate increased in both the groups in addition to artery ligation (93% Hayman and 87.2% in BBT) and thus concluded that both are identical in treatment of postpartum hemorrhage due to uterine atony[110].

Another study done in a tertiary care center to ascertain the efficiency of Hayman suture, among 48 women with atonic PPH refractory to uterotonics. Hayman stitch avoided hysterectomy in 45/48 cases (93.75%). Six women conceived within a period

of 12 months after Hayman sutures and the cavity of uterus was absolutely normal in the 2 females who underwent c section[111].

Hayman suture was applied in a prospective study conducted in 11 women with severe PPH. Out of these 10 were treated successfully with the use of Hayman suture only and one required hysterectomy, .mean follow up time postoperatively was 11 month, out of 10 one conceived spontaneously. It shows Hayman suture is effective in management of PPH[112].

A Retrospective study conducted among 12 cases of intractable postpartum hemorrhage between 2007 to 2012. Average duration to apply the suture was 4 minutes (range2-7 min), successful outcome was seen in 11/12 (91.66%). Hysterectomy was not required in any patient, and only one patient(8.33%) required additional b/l IIAL and during 2 years follow up there was no report of infertility[113].

Pelvic artery embolization

A Retrospective study conducted among 117 patients who underwent pelvic artery embolization between January 2006 to June 2013 for postpartum hemorrhage, to evaluate its efficacy, and associated complications. It includes women refractory to uterotonics, uterine massage, surgical repair of cervical tear and vaginal lacerations, and manual removal of placenta. Among 117 patients, 48 had LSCS and 69 had vaginal delivery. The main indication was atonic uterus (54.7%). Remaining causes were lower genital tract trauma (21.4%) and placentation abnormalities (14.5%). It showed a success among 103(88.0%) cases and failure of 14(12%) cases; which required 4 hysterectomies and 10 re-embolizations[114].

Internal Iliac artery ligation

Multi-center retrospective study was conducted between 2005 to 2010, in Turkey. Life-threatening cases of severe postpartum hemorrhage, which were not controlled with uterotonics and surgical treatment were finally treated with IIAL. Totally 53 patients underwent IIAL. All cases were unstable hemodynamically. The mean shock index was 1.17 +/- 0.46and unit of blood transfused were 5.49 +/- 3.04. Coagulopathy occurs in 26 (49.1%) patients. Hysterectomy was prevented in 17(32.0%) cases. 3 patients died of morbidity associated with hemorrhage and complications[115].

A Prospective study conducted among 53 patients of IIAL from 2007 to 2010 to ascertain their efficacy in obstetrical hemorrhage. Main etiology of hemorrhage were: atonic uterus (62.2%) and placenta abruption (15.1%). and Hypovolemic shock and coagulation disorders were found in 37.7% and 20.7 %respectively Transfusion of Blood was done in all 53 cases. It controlled hemorrhage in 48(90.5%) cases. 5(9.5%) cases need hysterectomy to control bleeding. It is a treatment of severe PPH and an alternative to arterial embolization[116].

A retrospective study among 52 women to evaluate the efficiency and fertility outcomes after IIAL in postpartum hemorrhage. Among 26 atonic uterus cases, 12 (91%) and 14(71.4%)were treated successfully with primary and secondary IIAL. Retroperitoneal hematoma and placental abnormalities were treated in 83% (10/12) and 75% (9/12) cases successfully. Hysterectomies performed in 9(17%) cases after failure of IIAL. There were 2 mortalities in this study. IIAL may decrease requirement of Hysterectomy. Fertility is not affected and it is helpful in retroperitoneal hematoma from obstetric causes[117].

A study among 103 patients to analyze the efficiency of Stepwise uterine devascularization to control PPH resistant to routine treatment. It includes 5 successive steps of unilateral uterine artery ligation, bilateral uterine artery ligation, lower uterine artery ligation, unilateral ovarian artery ligation and bilateral ovarian artery ligation. Its efficiency was 100%, and hysterectomy avoided in all cases. Survival is 100% with no complications. On follow ups menstruation function are normal and pregnancy occurred. It is an alternative to hysterectomy which is safe and effective for treatment of uncontrollable PPH[118].

A study to analyze the indications, technique, results of vascular ligation in the management of severe PPH. Uterine artery ligation shows good results. A stepwise technique with ligation of the uterine arteries followed by ovarian arteries (if needed) is an alternative solution with 100% success rate. Bilateral hypogastric artery ligation can be successful in 66% of cases. Ligation of the bleeding vessels decrease need of hysterectomy and improved maternal outcomes. Greater than 50 pregnancies successfully seen after vascular ligation.[119]

Hysterectomy

A retrospective study to identify risk factors during labour and 48 hrs postpartum leading to postpartum hysterectomy due to uncontrolled PPH and its outcomes. It includes 24 articles with 981 cases of postpartum hysterectomy. The morbidity was549 (56.0%), mortality rate 26(2.6%) and blood transfusion was required in 428 (44.0%). Total numbers of hysterectomies required were 601 (61.2%). Multipara women with LSCS in present or previous pregnancy are at very high risk of hysterectomy, or abnormal placentation.[120]

Tranexamic acid

In a meta analysis of 9 trials with the study population of 2365 women to assess the efficacy of TXA in decreasing the blood loss when it is given prophylactically before the c section. In all the RCT, comparison between TXA and placebo concluded that the amount of blood loss, decrease in Hemoglobin, severity of postpartum hemorrhage, need for additional uterotonic agents were less in cases who received TXA in comparison to controls. Prophylactic Tranexamic acid given prior to caesarean incision can decrease PPH[121].

Massive blood transfusion

To study the effectiveness of massive transfusion a review was done from the medical records where massive transfusion protocol was initiated in 31 patients(0.26%). 10(32%)had vaginal deliveries,19 patients(61%) had caesarean delivery, and 2 patients(7%) had D&E out of these 31. Blood products transfusion given in 26(84%) patients.In 17(58%) the protocol was initiated within 2 hrs. The median blood loss was 2842 ml. Median units transfused were 3,3,1 of RBC, FFP and platelets.61%had ICU admission and 19% had peripartum hysterectomy. It is concluded that massive transfusion protocol enable early arrangement of blood and its product in anticipation of severe PPH. the post resuscitation indices were Hb (10.3) and platelet count 126 and fibrinogen 125 mg/dl[122].

Morbidity

A retrospective study to analyze the sequence of obstetric morbidity by analyzing records of over 2,000 maternities over 6 month duration from a National Health Service Consultant Unit. The objective was to evaluate the frequency of life-threatening episodes. Morbidity associated with 1/4th total number of cases, and life-

threatening episodes also known as 'near miss' morbidity, were identified. Due to fall in maternal mortality rate, maternal morbidity can bea used as indicator of obstetric care. It suggests the need of exact definition for 'near miss' morbidity.[123]

A Case-control study conducted for 1 year from March 1997 to February 1998 for development of definition of obstetric morbidity by review of literature. 4 Pregnant women were randomly selected as control for every case. Disease specific morbidity per 1000 deliveries, were highest for severe hemorrhage i.e. 6.7 and 3.9 for severe pre-eclampsia. Age > 34 years, hypertension, non-white ethnic group, previous postpartum hemorrhage, emergency Caesarean section, multiple gestation, social exclusion, anti-depressants medication or iron tablets at antenatal booking were identified as risk factor for morbidity. Severe obstetric morbidity and its relationship to mortality is more sensitive assessment of outcomes of pregnancy than mortality alone. Majority of adverse outcomes related to PPH are due to pre-eclampsia and with LSCS up to 4 times. Measures are required to develop and evaluate methods for prediction and reducing risk factors, with increased importance on the management of hemorrhage and pre-eclampsia.[124]

A retrospective hospital based study was done using “The WHO Near-Miss Approach” to search details behind obstetric emergencies, near-miss cases, and maternal deaths. The acute maternal morbidity or Obstetric near-miss is an indicator for assessment of obstetric care quality. The maternal near-miss ratio was 8.4/1000 live births, and maternal near-miss to mortality ratio was 5.3:1. Major cause of morbidity in near-miss cases(43.7%) is hemorrhage whereas; hypertensive disorders were main cause of (66.6%) maternal mortality. Severe PE was the commonest life threatening complication (50.54%). It helps in assessment and improvement in the

quality of healthcare and locating the spectrum of severe maternal and mortality and morbidity, strengths and weakness (66.6%).[125]

Antishock garment

A study conducted among 6 women with postpartum hemorrhage and severe shock managed with the antishock garment. Restoration of blood pressure occurred within five minutes in two patients who had no pulse and three who were unconscious or confused. All patients showed improvement of MAP> 70 mmHg within five minutes. All 6 women had no further significant bleeding while the antishock garment was in place. There were no adverse effects, except fall in urine output transiently and the patients were comfortable with anti-shock garment [126].

Risk factor

A study was done to find out risk factors and outcome of pregnancy complicated by postpartum hemorrhage concluded that incidence of PPH is 0.4%,and risk factors included retained placenta(3.5%), failure of progression during second stage of labor(3.5%),placenta accrete (3.3%),lacerations(2.4%), instrumental delivery(2.3%),large for gestational age(1.9%),hypertensive disorders(1.7%),induction of labor(1.4%) and augmentation of labor(1.4%)[127].

A study done among 352 health facilities across 28 countries with n= 274985 to explore risk factor, clinical practices and maternal outcomes in relation with PPH. According to the results of study the incidence of postpartum hemorrhage was 1.2% among the women received uterotonic prophylaxis. The study also concluded that the risk factors associated with PPH are Age, Parity, Gestational age, Anemia, and uterotonics received for prophylaxis well as treatment and also referral from another facility[128].

METHODOLOGY

Study site:

The study was conducted at, KAHERs Dr. Prabhakar Kore Hospital & Medical Research Center, Belagavi Karnataka.

Study design: The study was an observational study.

Study population:

The study population constituted postnatal patients referred to or getting admitted to labor room, delivered and diagnosed as case of PPH at KAHERsDr. Prabhakar Kore Hospital & Medical Research Center, Belagavi Karnataka.

Inclusion criteria:

1. Women who had vaginal delivery or underwent LSCS at labour room of KAHERs Dr. Prabhakar Kore Hospital & Medical Research Center, Belagavi Karnataka and had blood loss >500ml during childbirth.
2. Women who had delivered outside and referred to KAHERs Dr. Prabhakar Kore Hospital & Medical Research Center, Belagavi Karnataka with the diagnosis of PPH.

Exclusion criteria:

Those with blood loss </=500 ml

Study duration: 1 year

Period of study:

This study was conducted from 1st January 2018 to31st December 2018

Sample size determination:

Sample size calculation for observational studies,

$n = 4pq/d^2$

n = the desired sample size,

p = proportion of population,

q = 1- p

d = the degree of accuracy level considered as 4.0 %, which assumes 0.04 (95% confidence interval)

The incidence of PPH is around 2-4 per cent (as per national health portal report, National Institute of Health & Family Welfare, New Delhi).[1]

So, the value of p = 0.04 and that of q = 1- 0.04 = 0.96

$n= 4x (0.04) x (0.96) / (0.04)^2$

=0.1536/0.0016

=1536/16

n = 96 (Estimated sample size).

Thus, in this study a total of 96 patients were included.

Sampling method

Patients fulfilling inclusion criteria (blood loss >500 ml) were enrolled for the study.

Methodology

All the women diagnosed with PPH including delivered at Dr. Prabhakar Kore hospital or referred from outside were included in the study. Data of the patients were noted in the proforma. Basic details like name, age, sex and Vitals at the time of admission and after delivery were noted. Details of previous pregnancies and present pregnancy regarding mode of delivery, place of delivery and any complication during previous pregnancies were also taken into account.Patients who came with shock they were assigned Grades of hypovolemic shock according to ATLS hypovolemic shock grading. Severities of anemia among PPH Cases were done to ICMR grading. Investigations like CBC, coagulation profile, LFT, RFT before delivery and after delivery repeat hemoglobin and platelets were recorded. Risk factors of PPH if present were also recorded. Blood loss was taken into account as mentioned in

The management of the patients with PPH was done as per hospital protocol. All patients received active management of third stage of labor (AMTSL) to prevent atonic PPH. Those with uterine atonywere given additional uterotonics. Traumatic postpartum hemorrhage cases were treated with repair of trauma. Patients with retained placenta were treated by manual removal of placenta and administration of additional uterotonics. Patients with disorders of coagulation and severe hypovolemic shock (grade III and grade IV) were treated by transfusion of blood and blood products.If medical management with uterotonics failed to control PPH, additional surgical interventions were done in the form of compression sutures (B Lynch/Hayman) and vascular ligation (unilateral or bilateral uterine or internal iliac artery). Hemorrhage cases unresponsive to other medical and surgical treatments were treated by hysterectomy. Maternal morbidity such as shock, disseminated intravascular coagulopathy,acute renal failure, acute respiratory distress syndrome,

massive transfusion and ICU admission were analyzed. Perinatal outcomes were also mentioned. Statistical analysis for the risk factors, management practices and maternal outcome were done accordingly.

Data collection method

Waiver of consent was obtained.Data regarding the age, parity, socioeconomic, demographic, etiological profile, risk factors, maternal treatment given, maternal outcome and Perinatal outcome wererecorded from the records.

Data Entry

All the data collected were entered in to a spread sheet on Micro Soft Office Excel Sheet and later transferred to SPSS IBM version 21.0 for analysis. The data collection sheet was checked before entering into the worksheet.

Data analysis

Data analysis was done with Statistical Package for Social Sciences (SPSS IBM) version 21.0. Required univariate and bivariate analysis was done. The qualitative variables are described in the form of proportions and quantitative variables are described in the terms of mean, median, range and standard deviation. Data was checked for normality before applying appropriate tests of significance. Significance of difference in means was calculated using independent t test. Difference in proportions was obtained using Chi square test. Significance of *p* value was taken as $p< 0.05$.

Ethical permission

Ethical permission was obtained fromethics committee for Post Graduate Studies, KAHERs Dr. Prabhakar Kore Hospital & Medical Research Center, Belagavi Karnataka vide letter.[129]

RESULTS

The present hospital based study was conducted at KAHERs Dr. Prabhakar Kore Hospital & Medical Research Center, Belagavi Karnatakaduring the period of January 2018 to December 2018

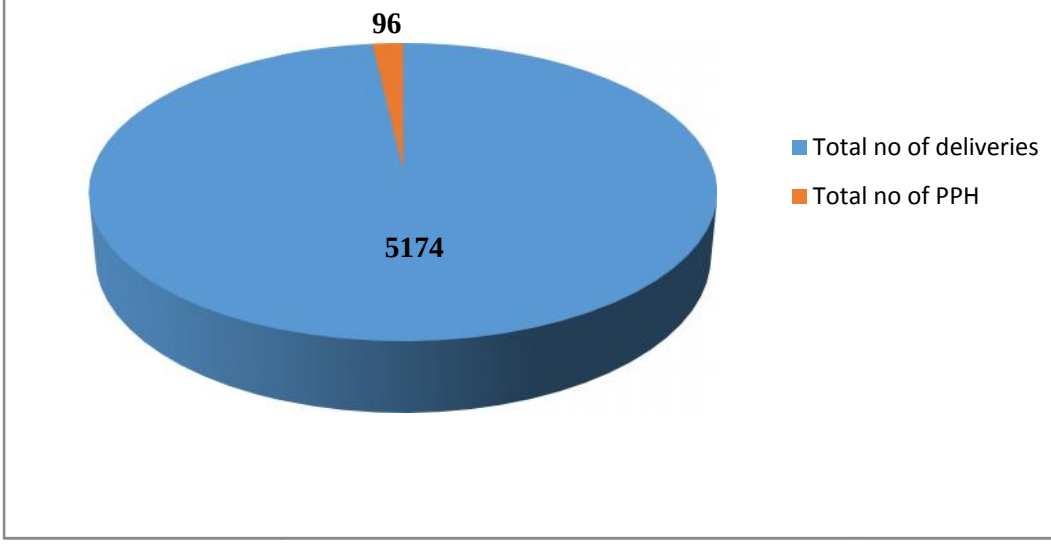
The data collected was entered into the Microsoft Excel spread sheet. The data was analyzed and the final results and observations were interpreted as follows.

Table 1: Incidence of Post partum hemorrhage:

Total number of deliveries	**5174**
Total No. of post partum hemorrhage	96
	1.86 %

Out of the 5174 deliveries, 96 women had postpartum hemorrhage. Incidence of PPH in the present study was 1.86%.

Graph 1: Incidence of PPH



Maternal characteristics:

Table 2: Age wise distribution

Age groups	Number	Percentage
<=20yrs	15	15.62%
21-30yrs	71	73.96%
>=30yrs	10	10.42%
Total	**96**	**100.00%**

Majority of the cases of Post partum hemorrhage were found age group of **21-30 years,** n=71 (74.0%). The mean maternal age in the study was 25.06

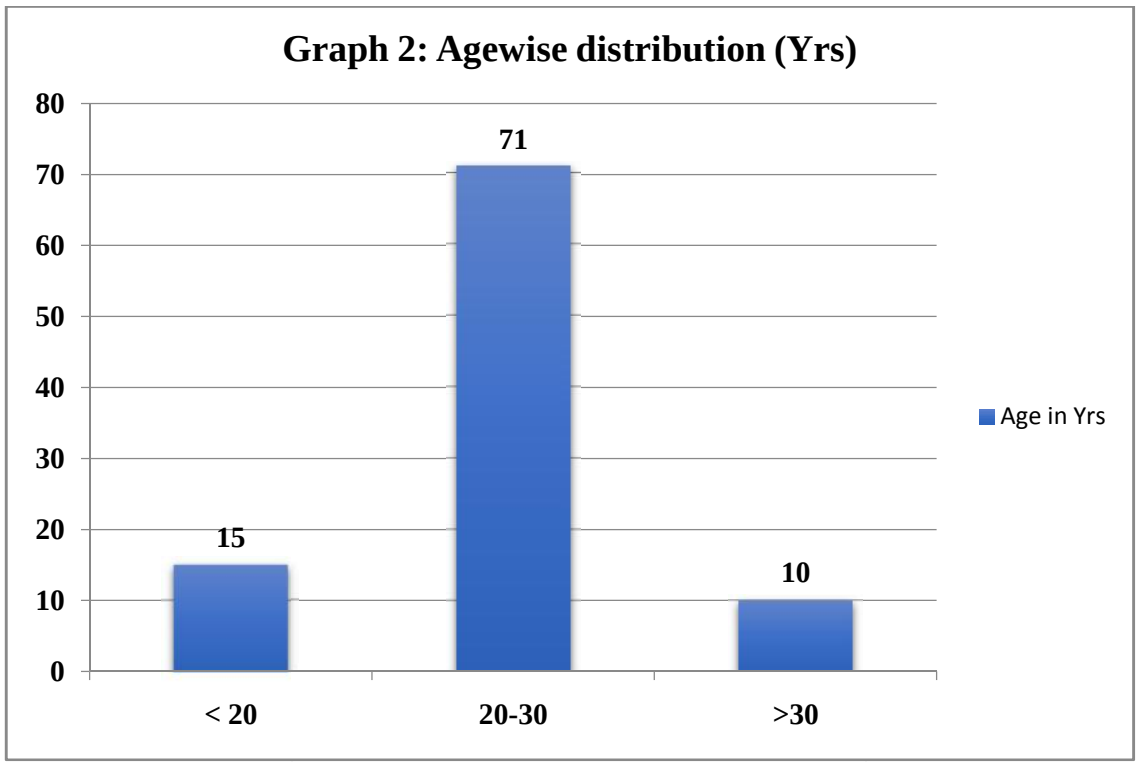


Table 3: Geographic distribution

Geographic	Number	Percentage
Rural	50	52.08%
Urban	46	47.92%
Total	96	100.00%

Out of 96 patients 50 cases were from rural areas and 46 cases were from urban areas.

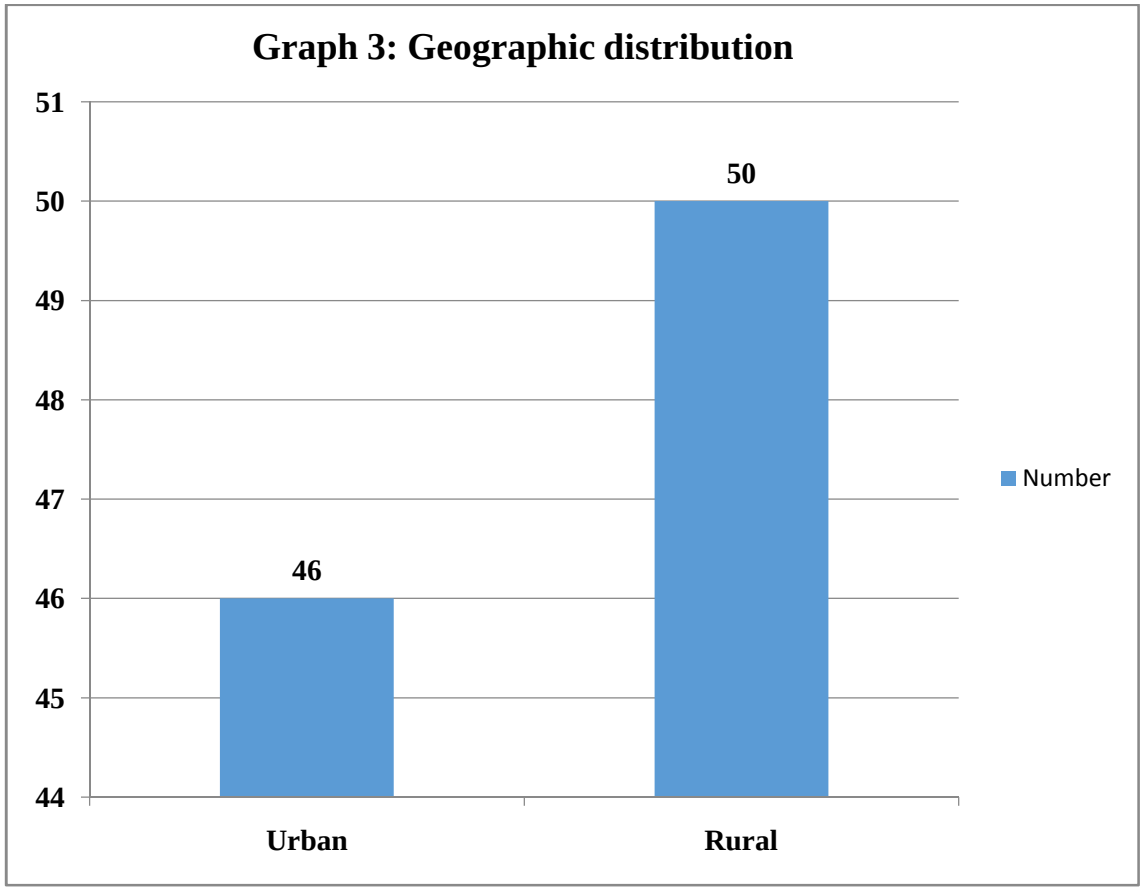


Table 4: Distribution on basis of referral

	Number	Percentage
Institutional	74	77%
Referred	22	23%
Total	96	100%

Majority of patients (77%), delivered at Dr. Prabhakar Kore hospital and remaining 23% patients had delivered elsewhere and were referred to KLE as cases of PPH.

Graph 4: Patient distribution (%wise)

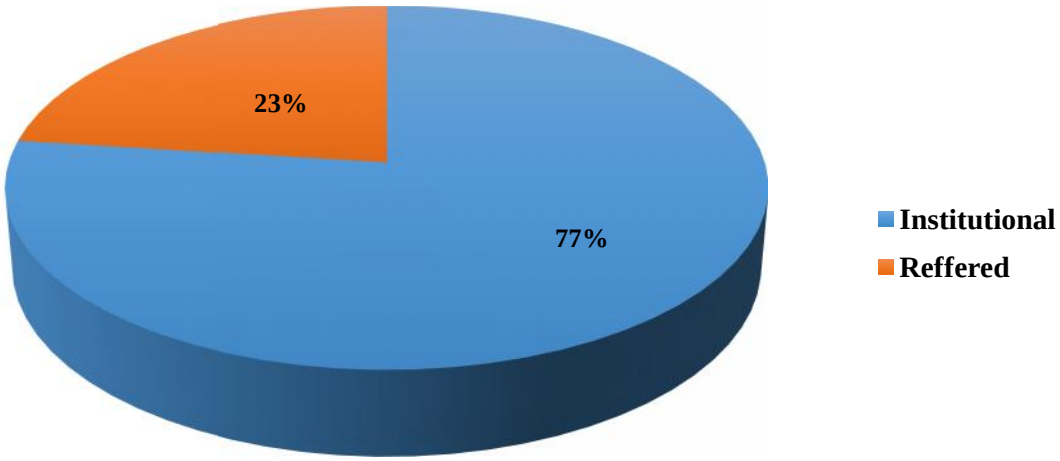


Table 5: Booking status

Type	No. of cases	Percentage
Booked	84	87.5%
Unbooked	12	12.5%
Total	96	100%

About 87.5% patients had atleast 3 antenatal checkups at KAHERs Dr.Prabhakar Kore Hospital,Belagavi,while only 12(12.5%) were booked with other institutes for antenatal visits and were referred to KAHERs Dr .Prabhakar Kore Hospital, Belagavi for the very first time as cases of PPH.

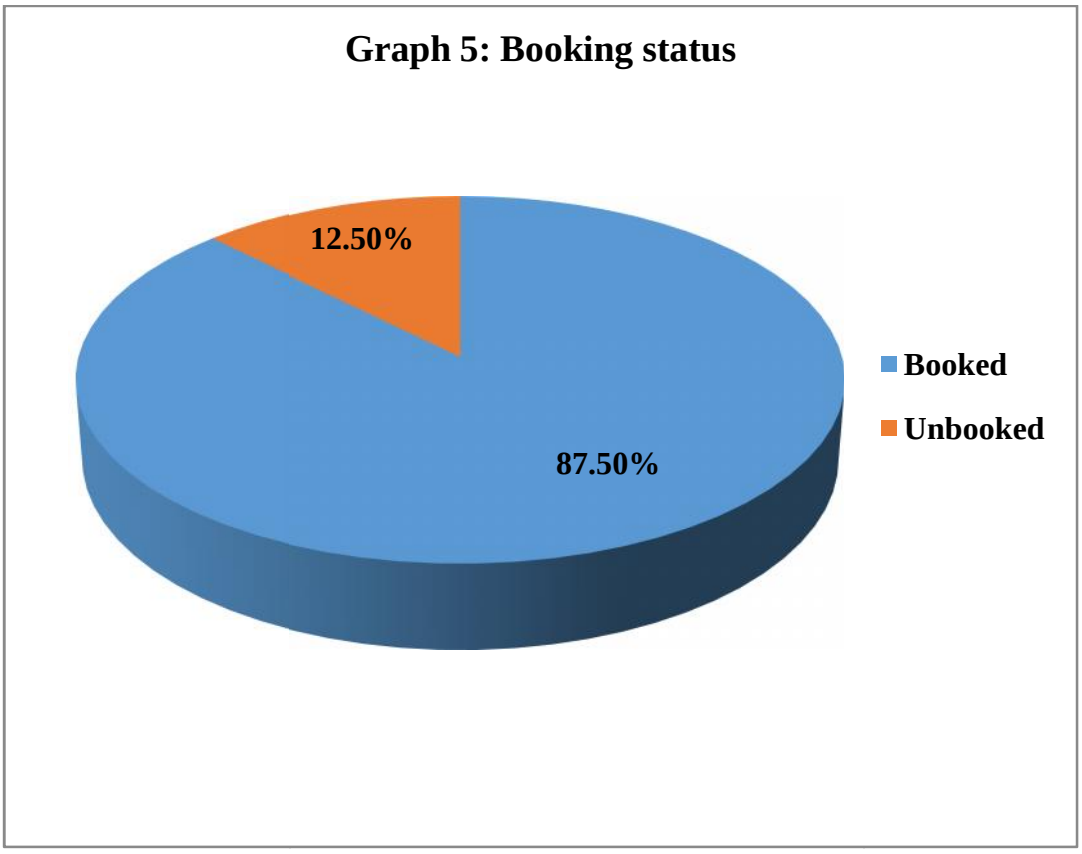


Table 6: Parity distribution

Parity	Number	Percentage
P1	45	46.87%
P2 And P3	43	44.80%
Multi (P4 and more)	8	8.33%
Total	**96**	100%

As we know multiparilty is a risk factor for PPH but according to present study a total of 45(47%) primiparous women and 43(45%) multiparous women suffered from PPH and only 8% of grand multipara(>/= P4) had PPH

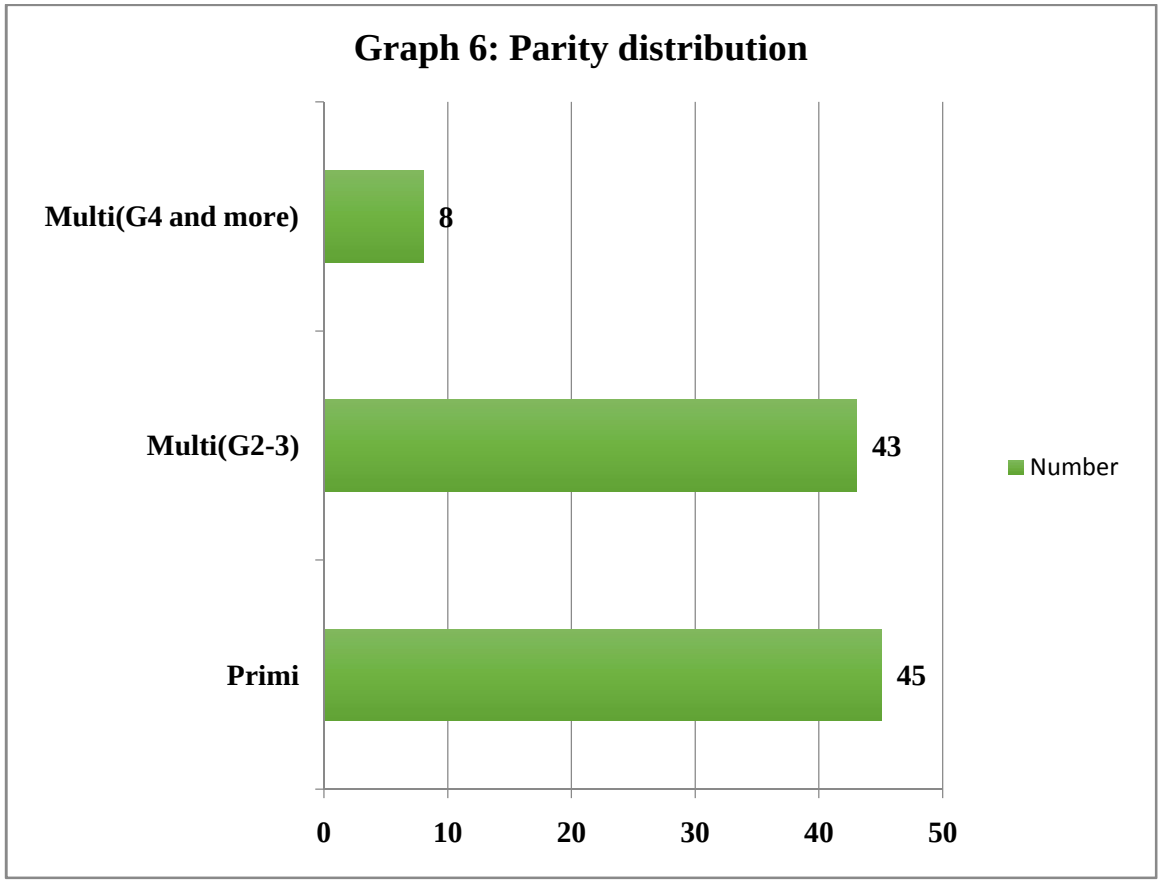


Table 7: Period of gestation

Gestation	Number	Percentage
< 32	8	8.34%
32-35wks 6days	17	17.70%
36-39wks 6days	51	53.12%
>=40	20	20.84%
Total	96	100.00%

Majority of patients, 53.12 % (n=51) who had Post partum hemorrhage delivered between 36-40 weeks, 20 patients (20.84%) delivered at >=40 weeks and 17 patients (17.70%) delivered between 32-36 weeks. Among the Women delivering at<32 weeks only 8 (9%) had Postpartum hemorrhage. The mean gestational age is 36.91

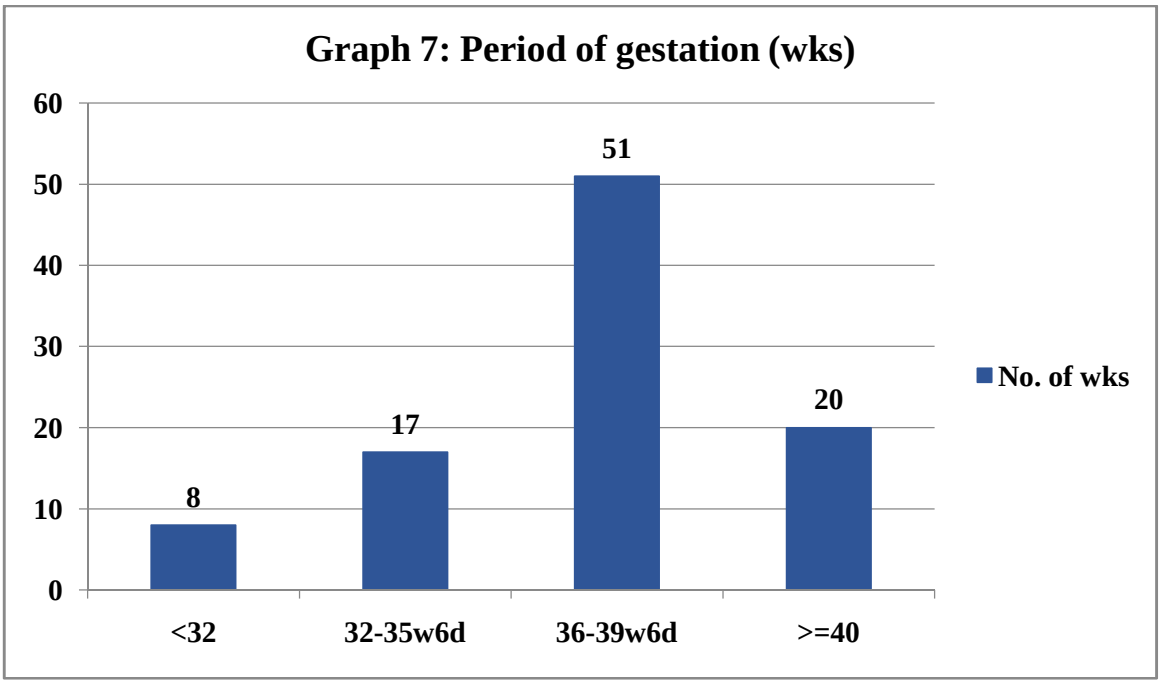


Table 8: platelet count (n=96)

S. No.	Platelets (lacs/microlitre)	Number
1.	<50,000	2
2.	50,000 - 1.0lac	12
3.	1.0 - 1.5 lac	6
4.	>1.5 lac	76

On admission 2 cases had platelet count of <50,000, 12 cases between 50,000 to 1.0 lac, 6 cases between 1-1.5 lac and 76 cases more than 1.5 lac

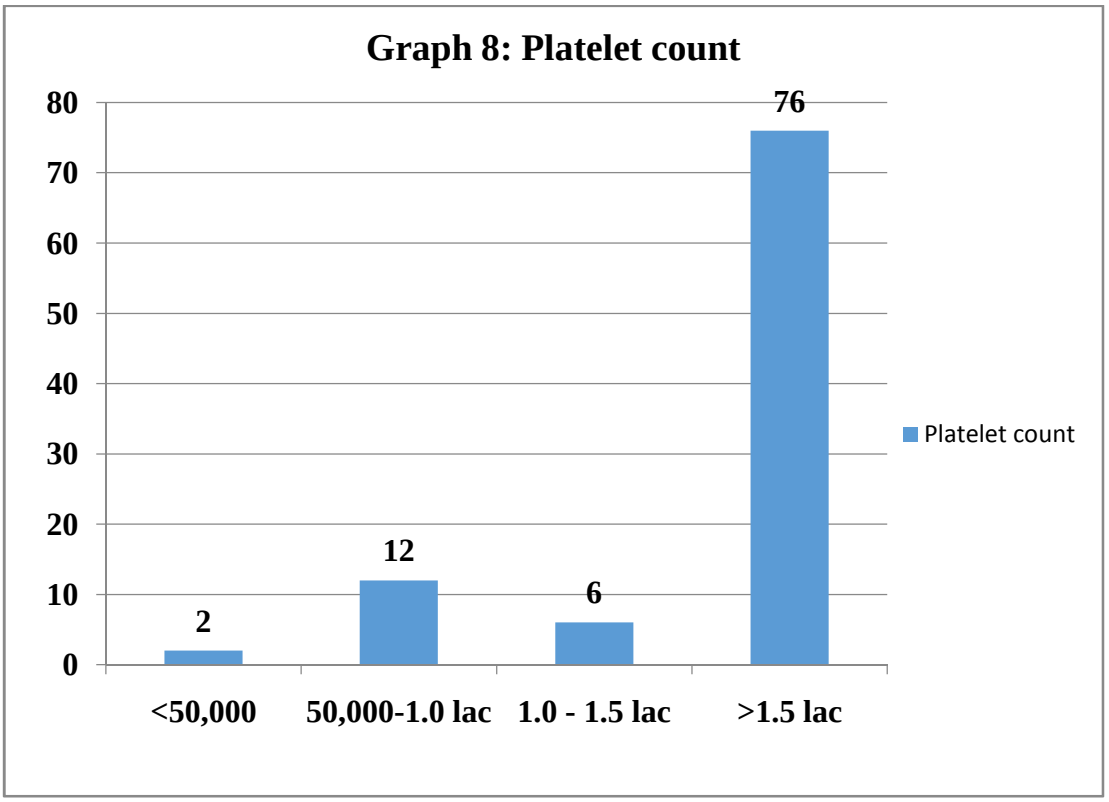


Table 9: Fibrinogen (n=47)

S.No	FIBRINOGEN(mg/dl)	NUMBER	PERCENTAGE
1.	<50	2	4.25
2.	50-150	13	27.65
3.	150-250	6	12.77
4.	250-350	8	17.03
5.	350-450	12	25.53
6.	≥ 450	6	12.77
	TOTAL	47	100.00

	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
FIBRINOGEN	273.70	± 157.59	48	611

Among 96 patients DIC profile for 47 patients were sent at the time of admission and were analyzed out of these 30 cases had serum fibrinogen level of < 50 mg/dl were 2, 13 cases had fibrinogen level between 50-150mg/dl. 6 cases had value between 150-250mg/dl, fibrinogen level of >250 mg/dl was present in 26 cases. Mean fibrinogen level of 47 cases was 273.70 with standard deviation of ± 157.59.

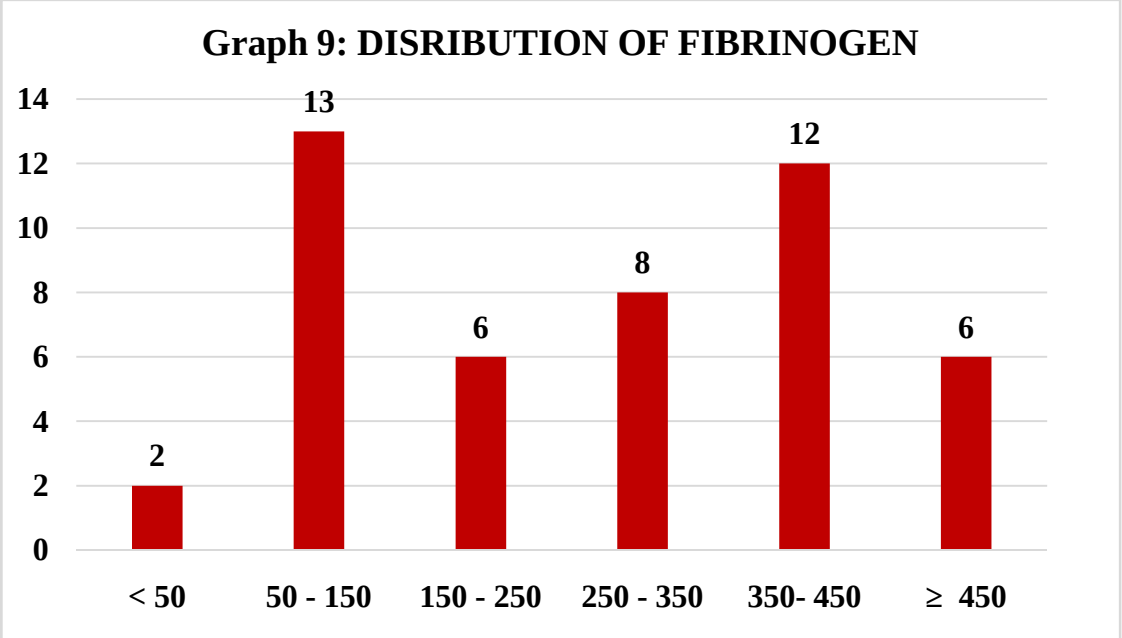


Table 10: Prothrombin time (n=47)

S.No	PROTHROMBIN TIME(sec)	NUMBER	PERCENTAGE
1.	<10	4	8.51
2.	10-12	27	57.45
3.	12-14	9	19.15
4.	14-16	0	0.00
5.	16-18	5	10.64
6.	≥18	2	4.26
	TOTAL	47	100.00

	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
PROTHROMBIN TIME	12.32	±2.75	9.1	22.4

27 cases out of 47 had PT between 10-12 seconds with mean value of 12.32±2.75 seconds.

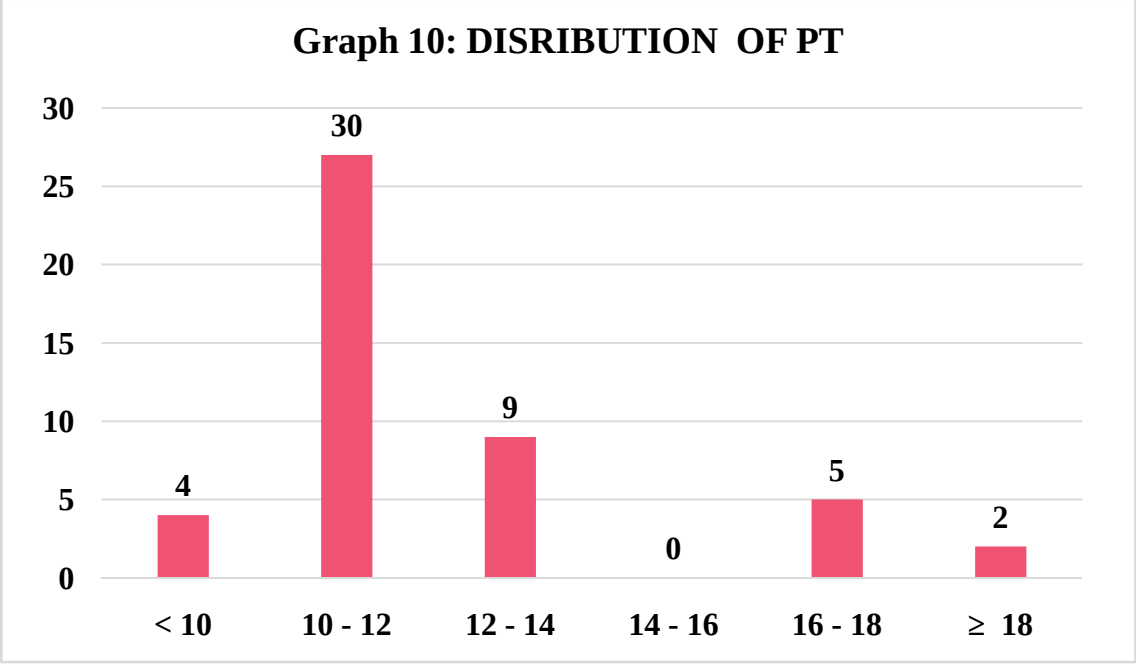


Table 11: PT-INR(n=47)

S.No	PT-INR	NUMBER	PERCENTAGE
1.	0.8-1.0	22	46.81
2.	1.0-1.2	16	34.04
3.	1.2-1.4	2	4.26
4.	1.4-1.6	5	10.64
5.	≥1.6	2	4.26
	TOTAL	47	100.00

	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
PT-INR	1.08	± 0.20	0.82	1.78

Mean value of PT-INR among 47 cases of PPH was 1.08± 0.20,with 22 patients having the value between 0.8-1.0 whereas 2 cases had PT-INR of ≥1.6.

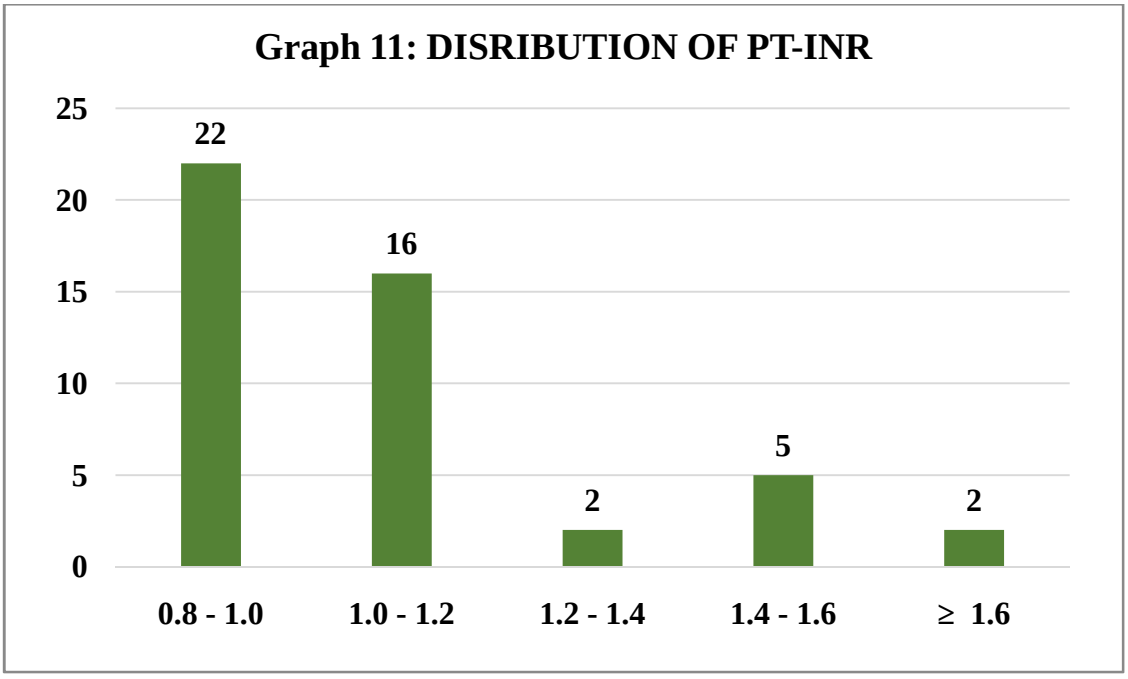


Table 12: aPTT (n=47)

S.No	aPTT(seconds)	NUMBER	PERCENTAGE
1.	15-20	4	8.51
2.	20-25	13	27.66
3.	25-30	18	38.30
4.	30-35	6	12.77
5.	≥ 35	6	12.77
	TOTAL	47	100.00

	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
aPTT	28.03	± 7.17	17.8	48.7

Mean value of aPTT was 28.03± 7.17 whereas value of >30 was found in 12 cases.

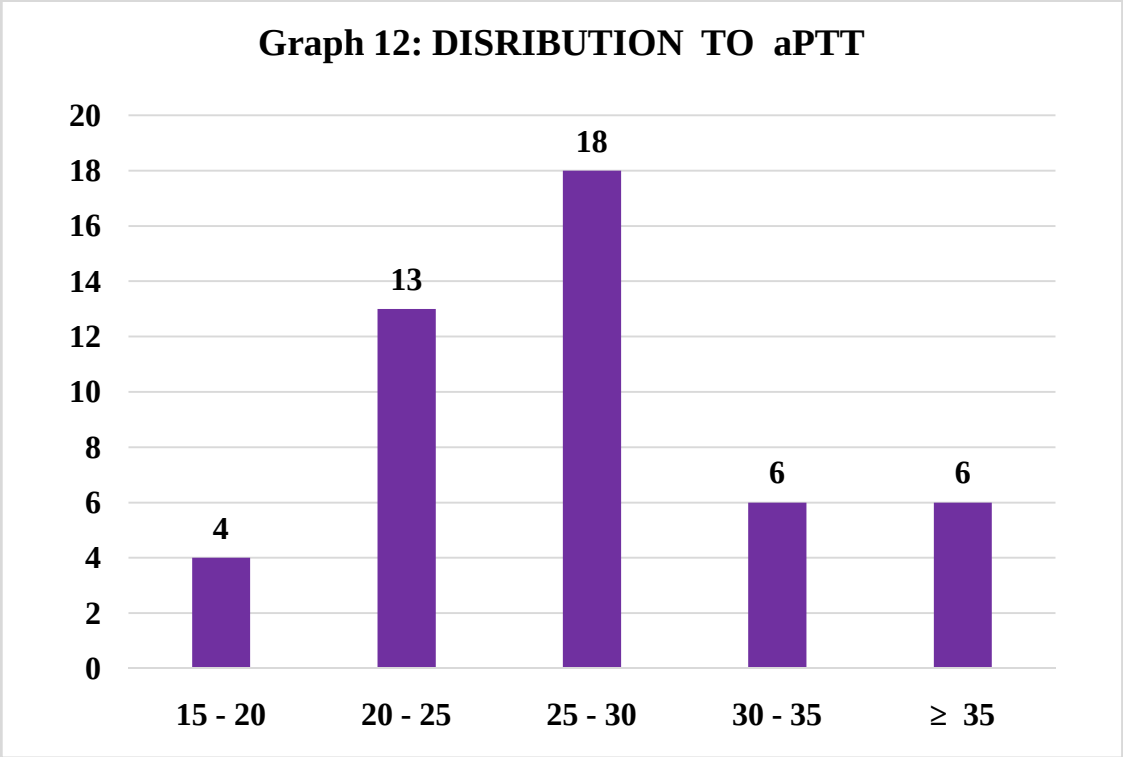


Table 13: D-dimer

S.No	aPTT(seconds)	NUMBER	PERCENTAGE
1.	<1000	4	8.51
2.	1000-2000	13	27.66
3.	2000-3000	21	44.68
4.	3000-4000	5	10.64
5.	≥ 4000	4	8.51
	TOTAL	47	100.00

	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
D-dimer	2266.72	± 2058.93	254	6596

Among 47 cases mean value of D-dimer was 2266.72 and standard deviation ± 2058.93

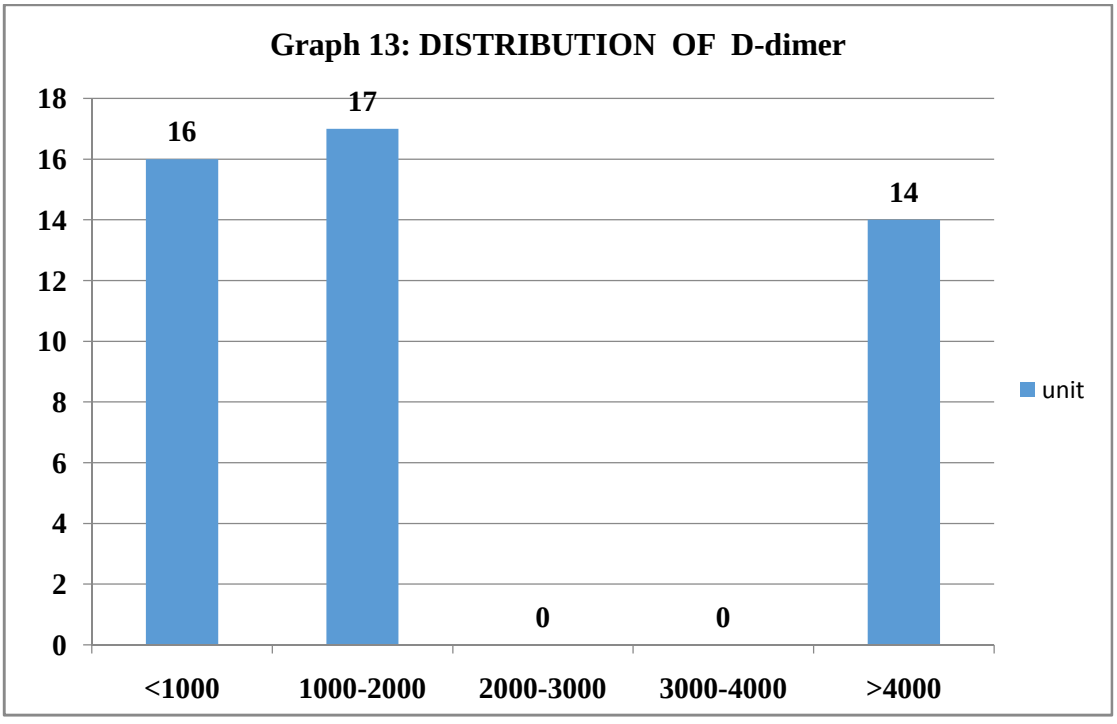


Table 14: DIC PROFILE (n=14)

	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
FIBRINOGEN(mg/dl)	95.92	± 34.81	48	167
PROTHROMBIN TIME(sec)	15.09	± 3.45	10.5	22.4
PT-INR	1.29	±0.23	0.99	1.78
aPTT(sec)	34.62	± 8.58	22.7	48.7
D-dimer	4430.64	± 1931.87	841	6730
Platelet(lac)	1.08	± 0.24	0.19	1.83

In the present study 14 patients out of 96 patients suffered from DIC. Incidence of DIC was 14.58% among postpartum cases. Mean value of fibrinogen among the patients of established DIC was 95.92± 34.81.Mean value of PT was 15.09± 3.45.Mean value of PT-INR was 1.29± 0.23.aPTT had a mean value of 34.62± 8.58.mean value of D-dimer was 4430.64± 1931.87 and mean value of platelet was 1.08± 0.24.

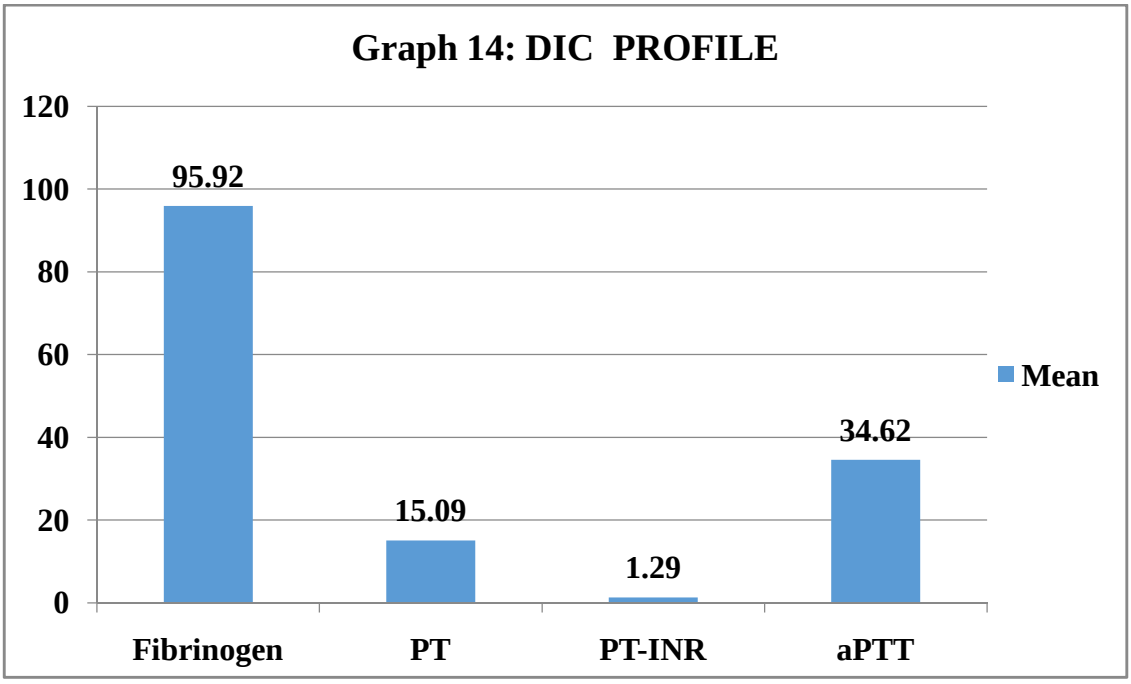


Table 15: Distribution of Hemorrhagic Shock- Amount of blood loss

Classification	Blood loss in ml	No. of cases	Percentage
I	>500-750	32	33.34%
II	750-1500	52	54.16%
III	1500-2000	07	7.30%
IV	>2000	05	5.20
		96	100.00%

In present study 33.4% had class I shock, 54.16% had class II shock and 7.30% had class III shock while only 5.20% suffered from class IV shock.

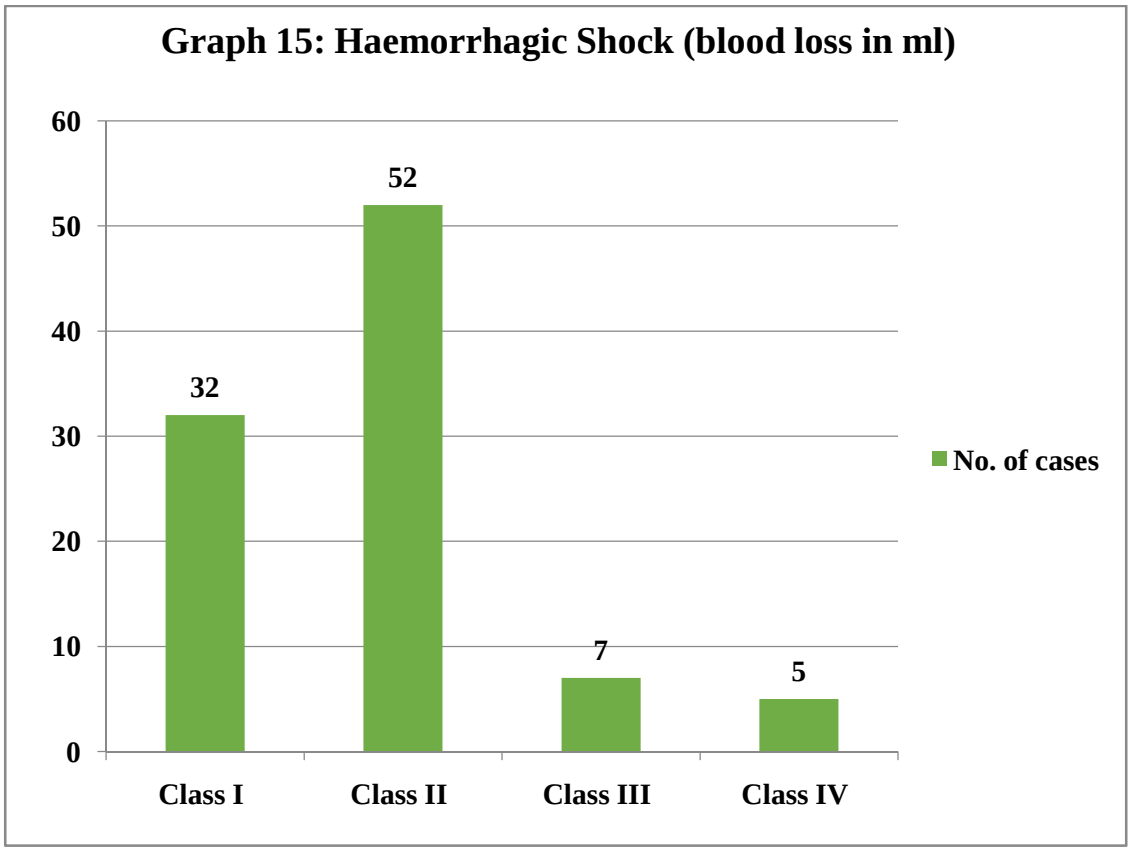


Table 16: Delivery details of study participants (n=96)

S No.	Delivery details	N=96 N(%)
1.	Vaginal delivery	31(32.3)
2.	Instrumental	12(12.5)
3.	Caesarean section	53(55.2)

Out of 96 there were 53 caesarean sections and 43 normal deliveries clearly suggesting incidence of postpartum hemorrhage to be more in cases of c-section as compared to vaginal deliveries and out of 43 vaginal deliveries, 12 had instrumental deliveries constituting 12.5% and showing that it can be assigned as a risk factor for postpartum hemorrhage.

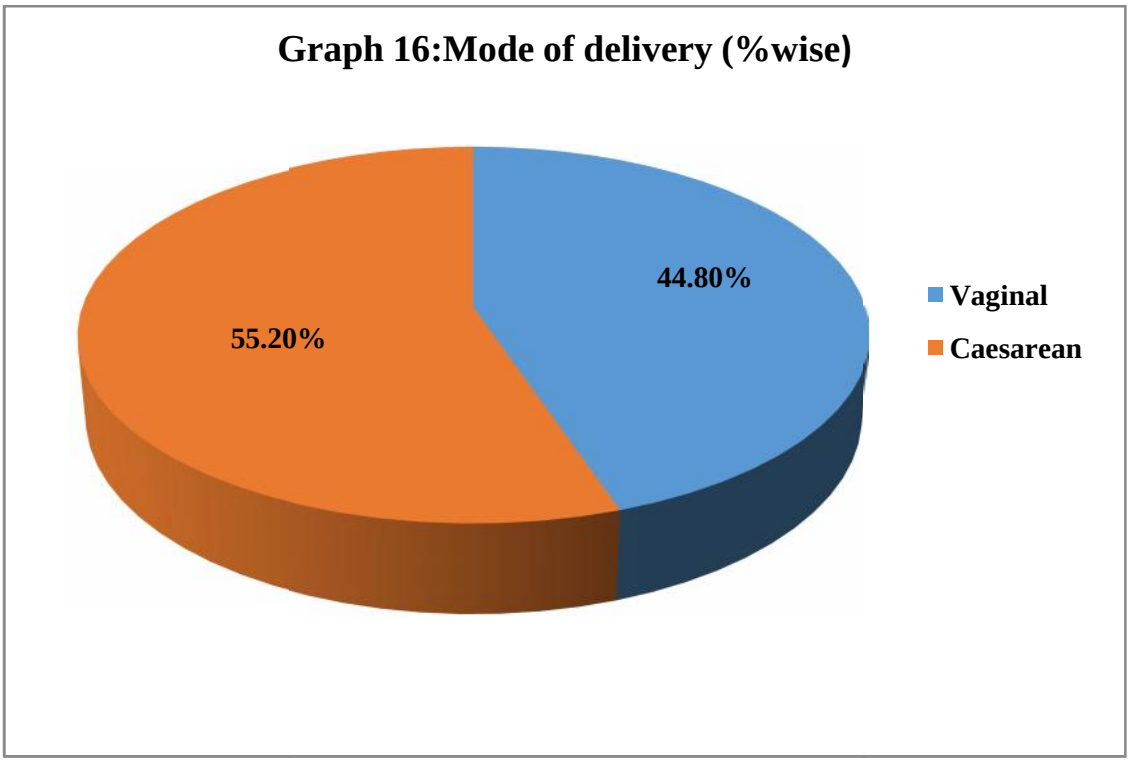


Table 17: Type of delivery – Vaginal

Vaginal	Number	Percentage
Spontaneous	29	30.20%
Induced	14	14.58 %
	43	44.78%

Out of 96 total number, Induction of labor done in 32 cases. Out of these 32, only 14(14.5%) delivered vaginally and 18 went into failed induction and required caesarean section. Out of 96 women delivered, spontaneous vaginal delivery occurs in 29(30.2%) and induced in 67(69.8%). Caesarean section rate was 53(55.2%) compared to vaginal delivery 43(44.8%).

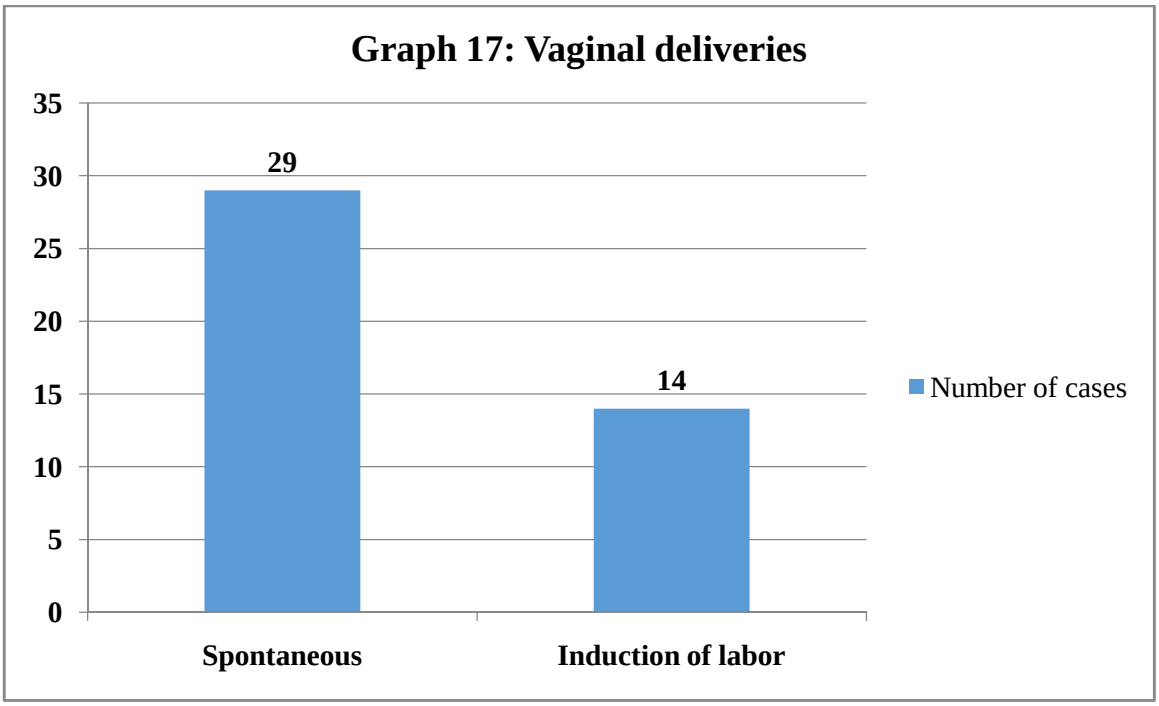
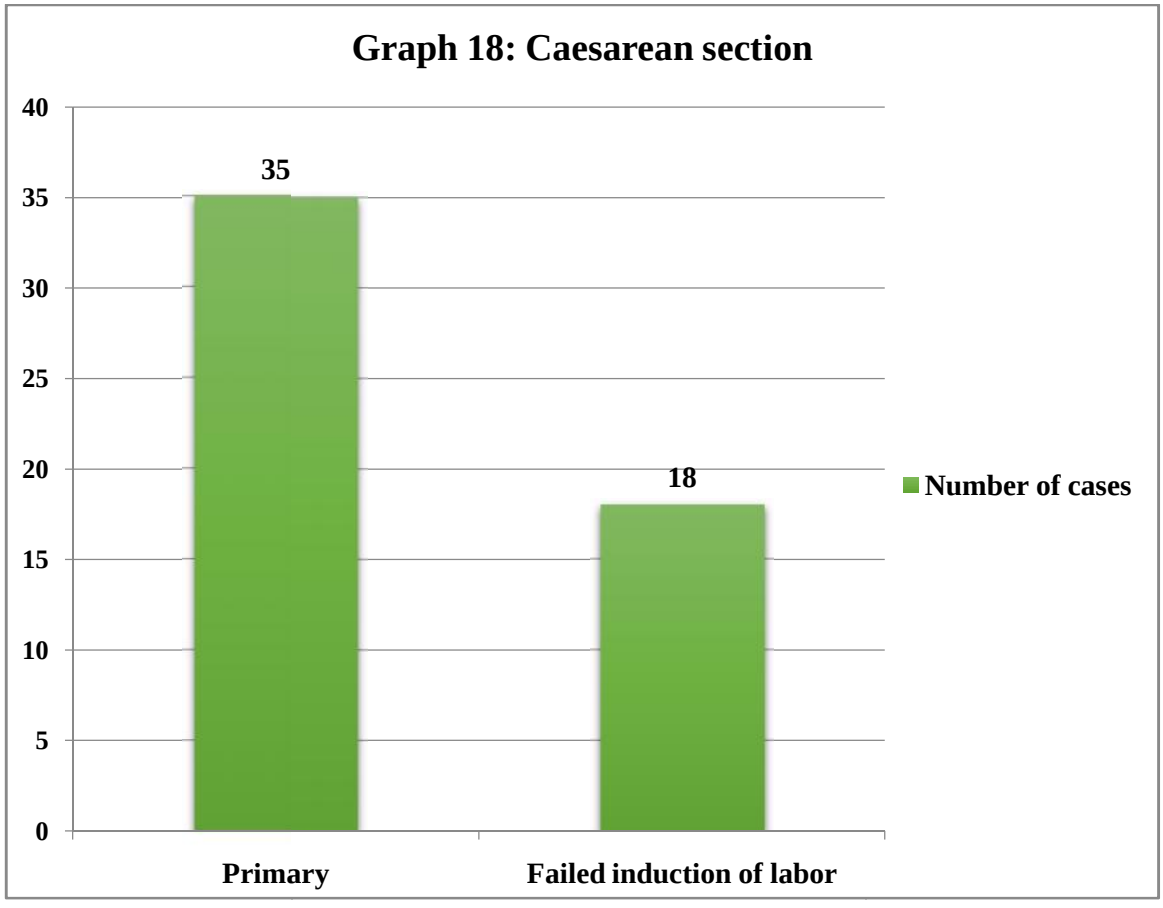


Table 18: Type of delivery-Caesarean

Caesarean	Number	Percentage
Primary	35	36.45%
Failed induction of labor	18	18.75%
	53	55.20%

Out of 53caesarean section which contributed 55.20% cases of PPH, 35(36.45%) were primary and 18(18.75%) were secondary to failed induction of labor.



RISK FACTORS OF PPH

Table 19: Risk factors of PPH among study participants (n=96)

S No.	Risk factors for PPH	N=96(%)
	Risk factors*	
1	Anemia	23(23.95)
2.	PIH/Pre-eclampsia/Eclampsia	23(23.95)
3.	Induction of labor	32(33.33)
4.	Placental Abruption	11(11.45)
5.	Multiple gestation	9(9.37)
6.	Instrumental delivery- forceps/ventouse	12(12.5)
7.	Placenta praevia	9(9.37)
8.	Multiparity	8(8.33)
9.	Macrosomia	7(7.29)
10.	HELLP	6(6.25)
11.	Adherent Placenta	5(5.20)
12.	DIC	2(2.08)
13	No risk factors	7(7.29)

*Multiple options

Among the study participants, no risk factors of PPH were found in 7(7.29%) cases. The biggest risk factors were Induction of labor 32(33.33%) followed by Anaemia and Pre-eclampsia/Eclampsia amounting to 23(23.95%) each cases.

Graph 19: Risk Factors

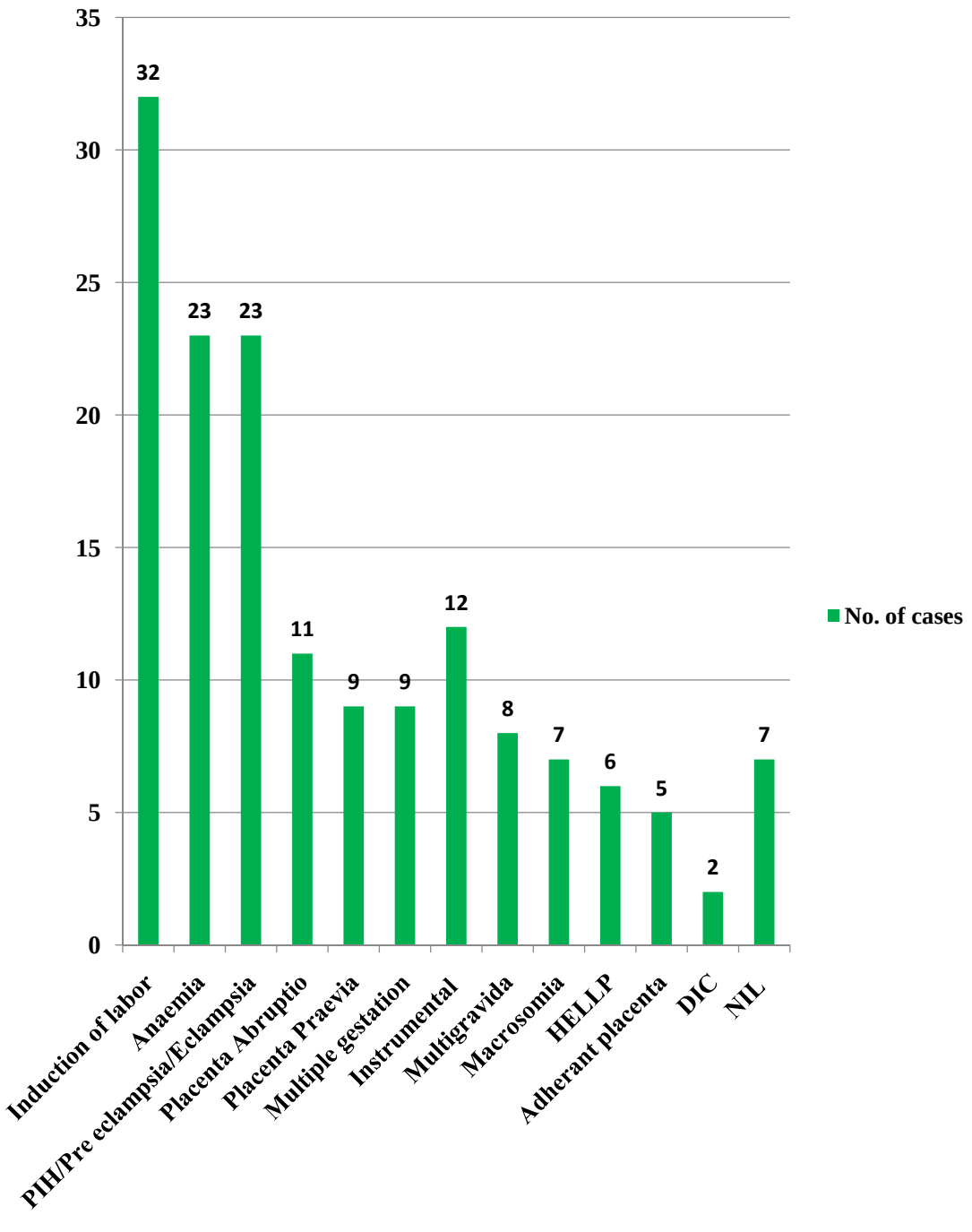


Table 20: Categorization of Anemia (at the time of admission)

Anemia (ICMR class.)	Hb(mg/dl)	No. of cases	Percentage
Normal	>=11	46	47.91%
Mild	10.9-10	19	19.79%
Moderate	9.9-7	21	21.87%
Severe	6.9-4	8	8.35%
Very severe	<4	2	2.08%
Total		96	100.00%

Approximately half patients 46(47.91%) had normal Hemoglobin levels at the time of admission. Only 10(10%) patients had severe or very severe anemia according to ICMR classification as a risk factor for postpartum hemorrhage.

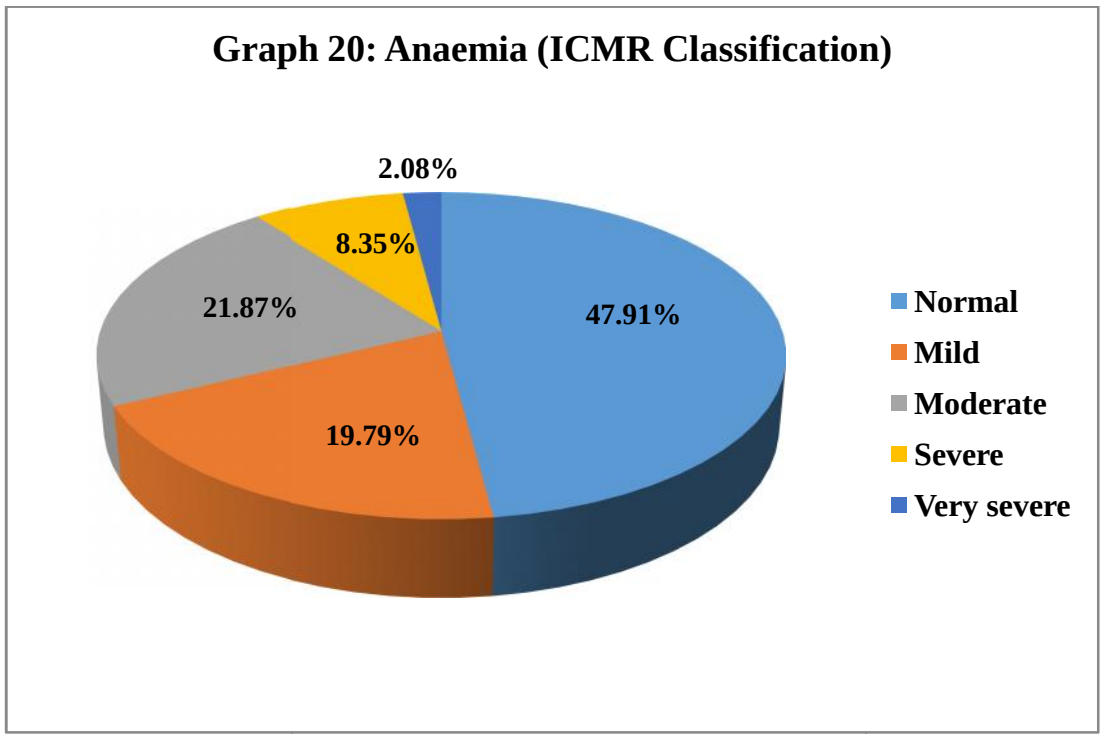


Table 21: Type of Postpartum hemorrhage

Types	No. of cases	Percentage
Atonic	62	64.60 %
Traumatic	23	23.95 %
Atonic+Traumatic	11	11.45 %
Total	96	100.00%

Majority of patients with postpartum hemorrhage had Atonic type(n=62) with incidence of 64.60%. Out of 96 , 11.45%(11 cases) had both atonic & traumatic PPH. Overall 73 cases had atonic PPH constituting its incidence to be 76% approximately suggesting it to be most common type of PPH.

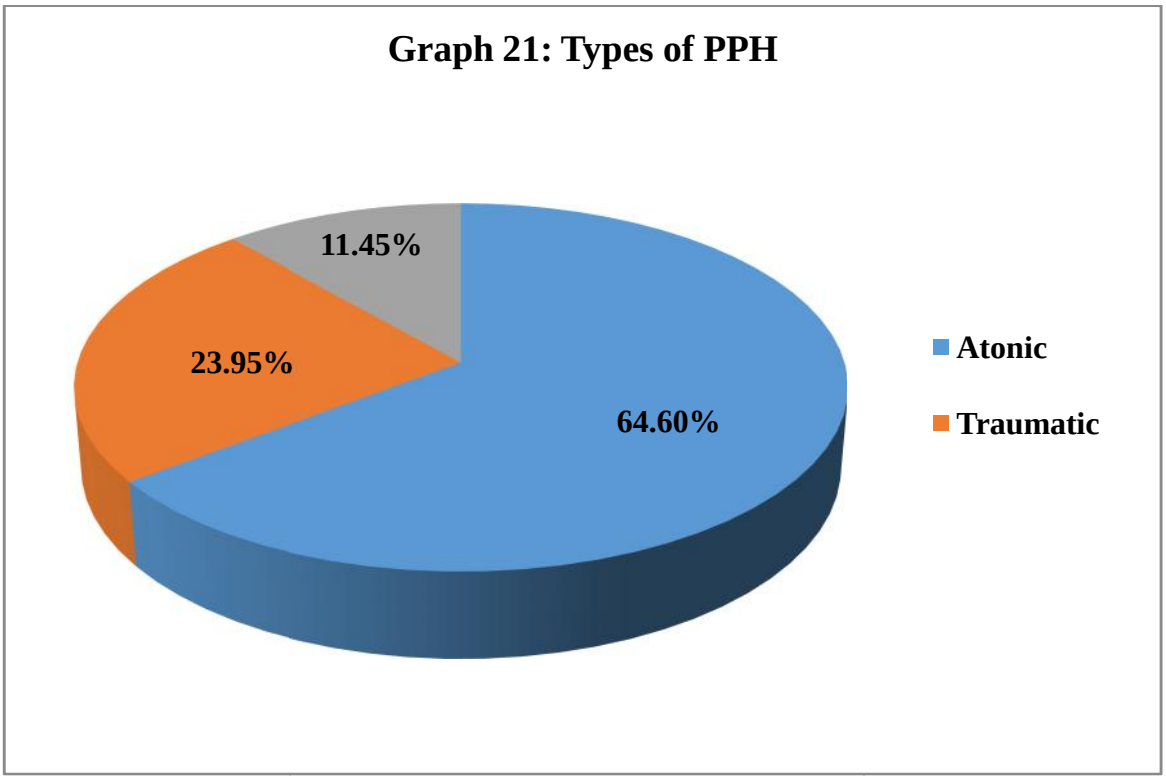
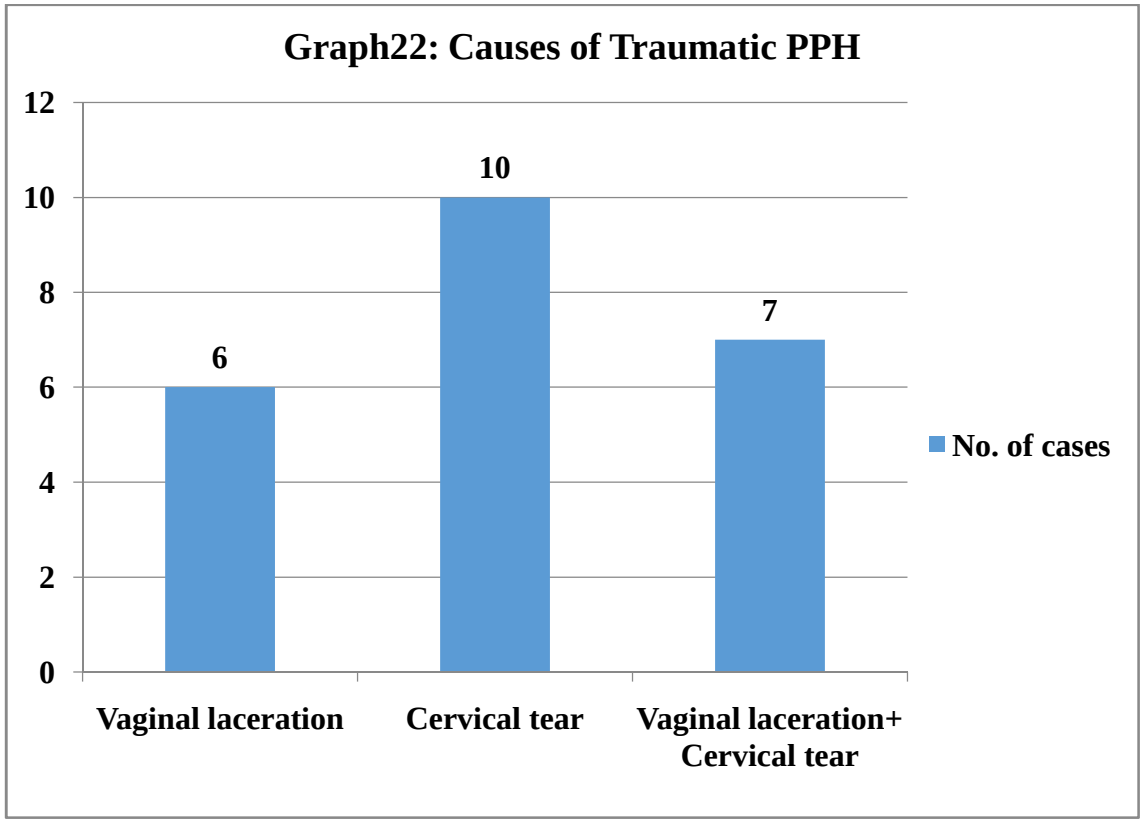


Table 22: Causes of Traumatic PPH

Traumatic	No. of cases	Percentage
Vaginal laceration	06	6.25%
Cervical tear	10	10.41%
Vaginal laceration + cervical tear	07	7.29%
Total	25	23.95%

Majority of traumatic PPH were either due to vaginal laceration 6(6.25%), cervical tear 10(10.41%), orcombined 7(7.29%), thus suggesting the most common cause of traumatic PPH was cervical laceration during our study.



MANAGEMENT OF PPH

Table 23: Medical management (Uterotonics) of PPH(n=96)

Uterotonics	No. of person	Percentage
Additional oxytocin	11	11.45%
Prostadin	40	41.66%
Misoprostol	33	34.37%
Methergin	27	28.12%

In addition to uterotonics given in AMTSL, additional oxytocin was given in 11 cases, Prostadin in 40(41.66%), Misoprostol in 33(34.37%), Methergine in 27(28.12%) cases.

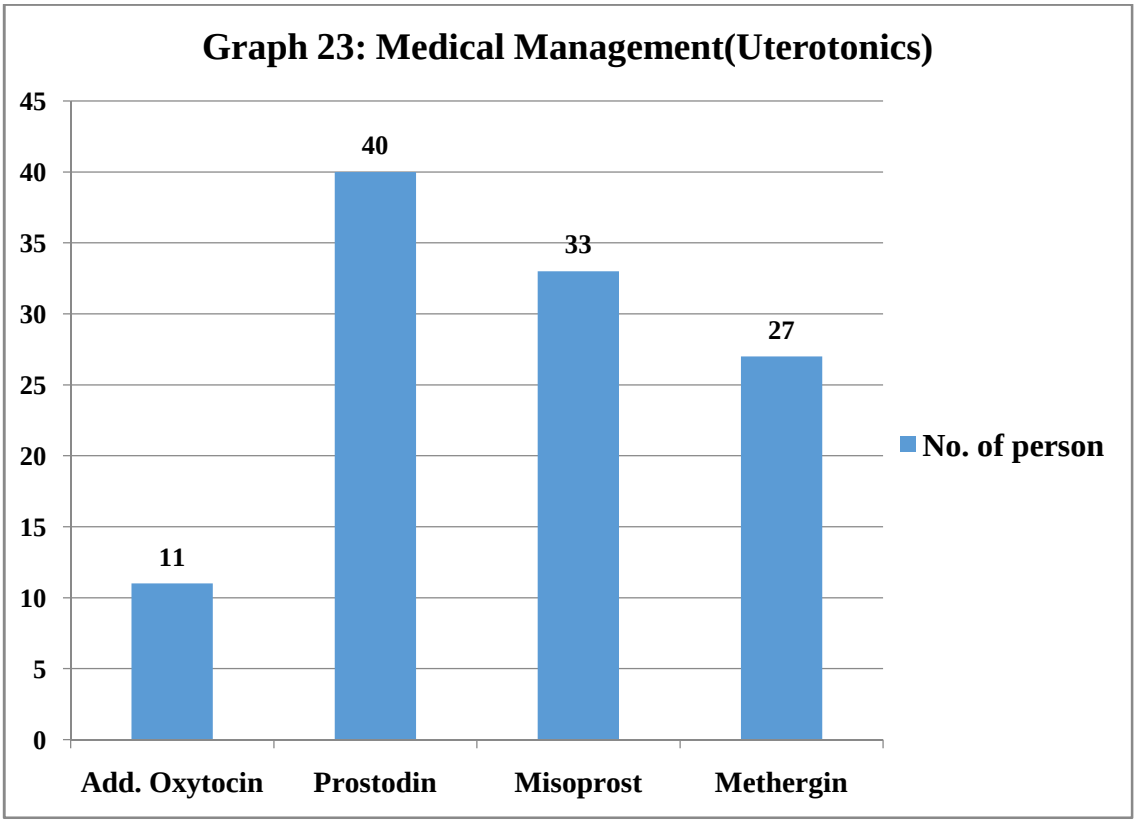


Table 24: Uterotonic Combination

Number of drugs combination	Percentage
Single drug	41
Two drugs	26
Three drugs	22
Four drugs	11

The above graph shows the usage of various uterotonics during the medical management of postpartum hemorrhage in 41% only 1 drug namely oxytocin was used (as used during AMTSL).26% hemorrhage cases received one more drug in addition to oxytocin.22.0% received 2 more drugs in addition to routine oxytocin and in 11 % additional oxytocin was used apart from routine oxytocin plus 2 more drugs.

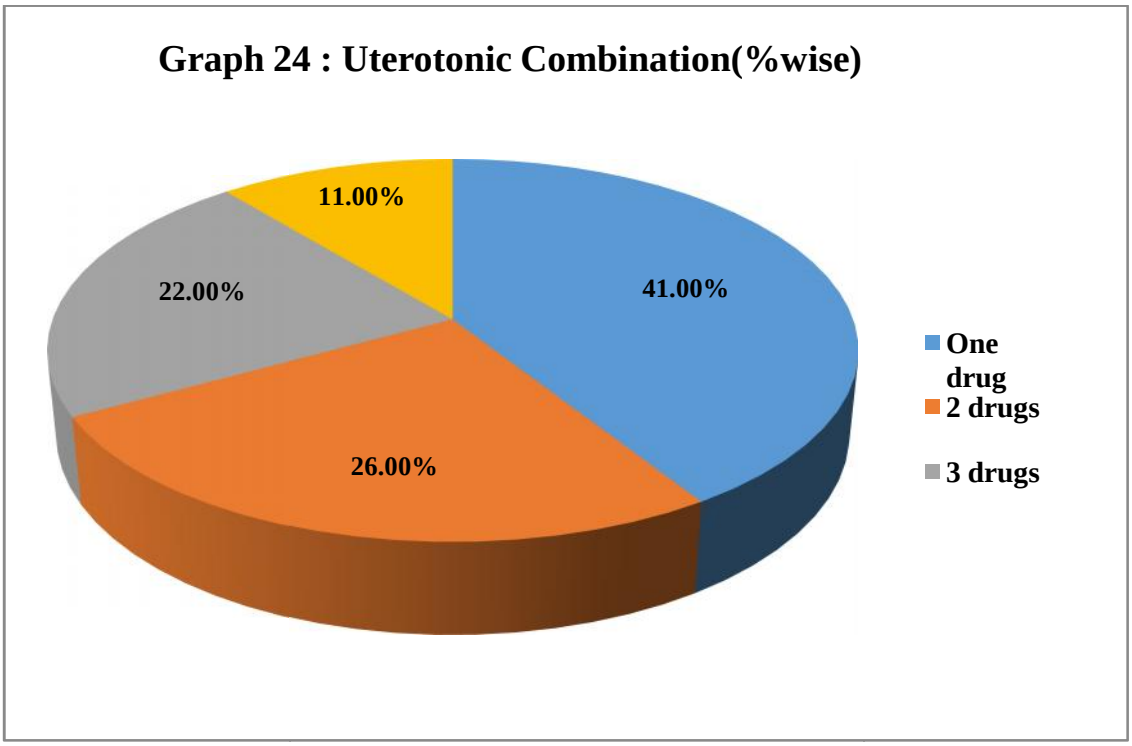
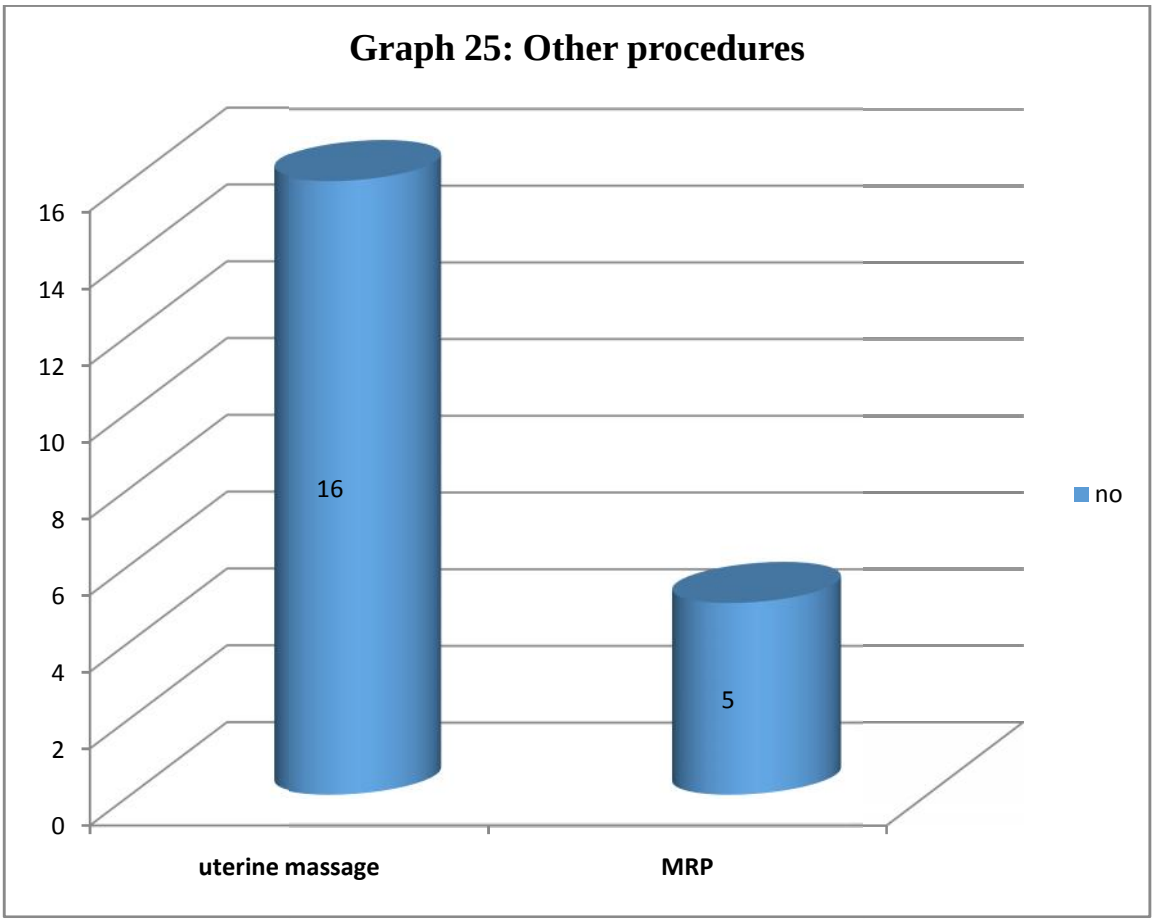


Table 25: Other procedures

S No.	Other procedures	N=96 (%)
1.	Uterine Massage	16(16.66%)
2.	Manual removal of placenta	5(5.20%)

Uterine Massage was done in 16(16.66%) patients only whereas Manual removal of placenta was required in 5(5.20%) cases.



Surgical Management

Table 26: Compression suture

S No.	Compression surgical suture	N=96,N(%)
1.	B Lynch	4(4.16%)
2.	Hayman	17(17.70%)
	Total	21(21.87%)

Compression sutures were chosen as a modality of treatment in 21 cases of postpartum hemorrhage. B Lynch sutures were applied in 4(4.16%) cases. Hayman suture were applied in only 17(17.70%) study participants.

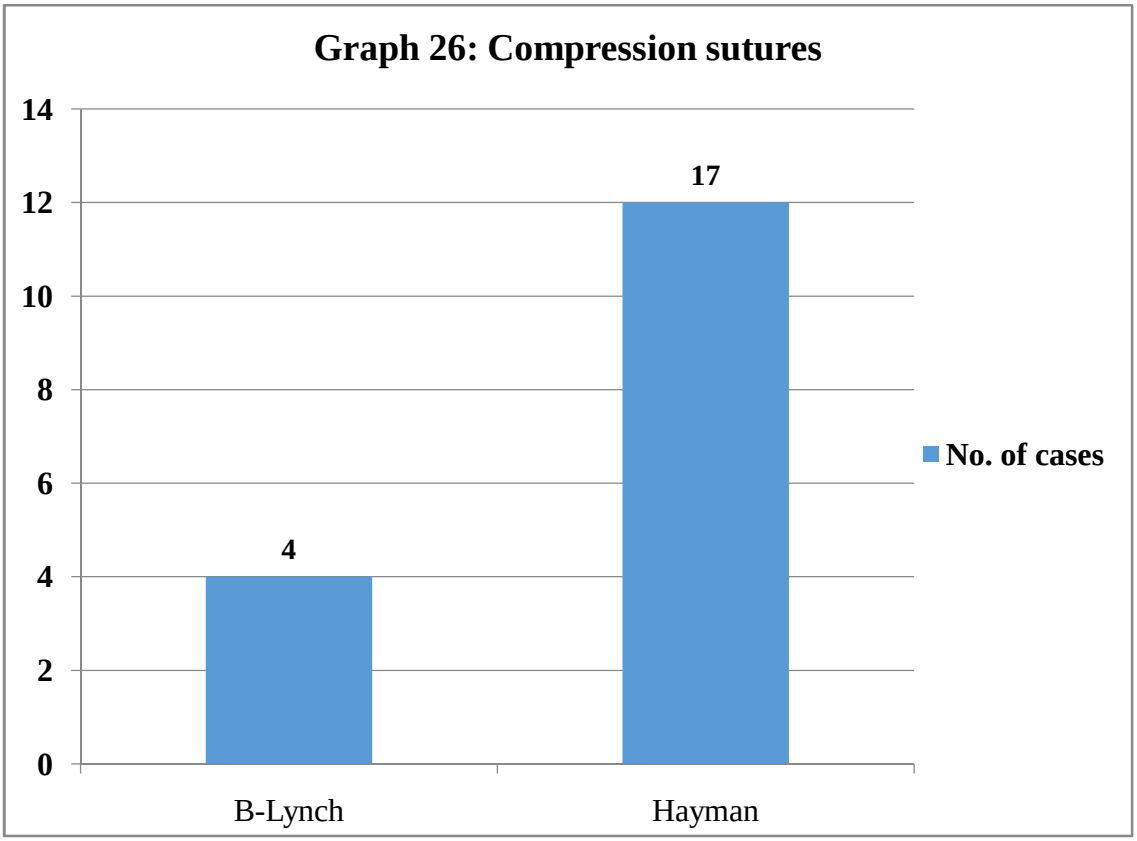


Table 27: Vascular Ligation

S No.	Arterial Ligation*	N=96, N(%)
1.	unilateral uterine artery ligation	11(11.45%)
3.	Bilateral uterine artery ligation	12(12.5%)
4.	unilateral internal iliac artery ligation	4 (41.66%)
6.	Bilateral internal iliac artery ligation	5(5.20%)
	Total	32

A total of 32 patients(33%) were managed with vascular ligation .Majority of patients were managed by either Right 2(2%) or Left 9(9.37%) uterine artery ligation summing up to 11.45% requiring unilateral uterine artery ligation whereas bilateral uterine artery ligation was done in 12 (12.5%)cases. In 4 cases in addition to bilateral uterine artery ligation either one or both internal iliac artery ligation was required.

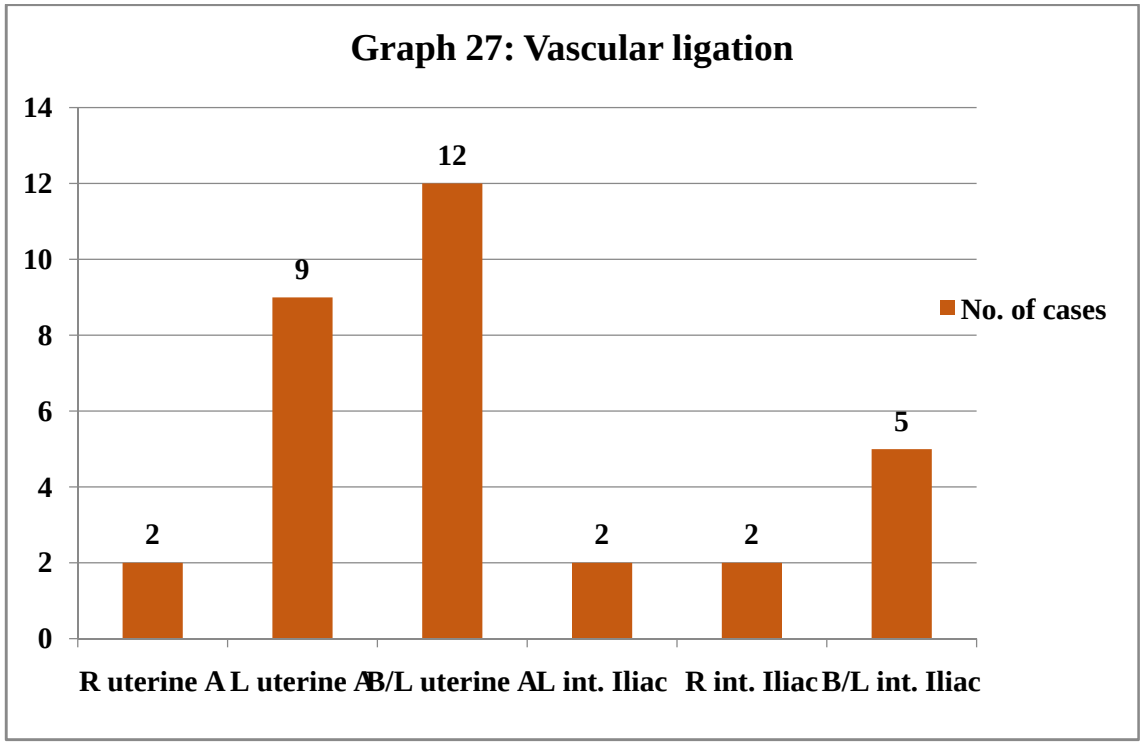


Table 28: Hysterectomy in post partum hemorrhage

S No.	Delivery	N=96,N(%)
1.	Vaginal	3(3.12%)
2.	Caesarean	4(4.16%)
	Total	7(7.28%)

3% cases required hysterectomy to control PPH after vaginal delivery,4 % cases required hysterectomy after caesarean section. 93% cases were managed either by medical management or a combination of surgical and medical management and there was no need for hysterectomy in those cases.

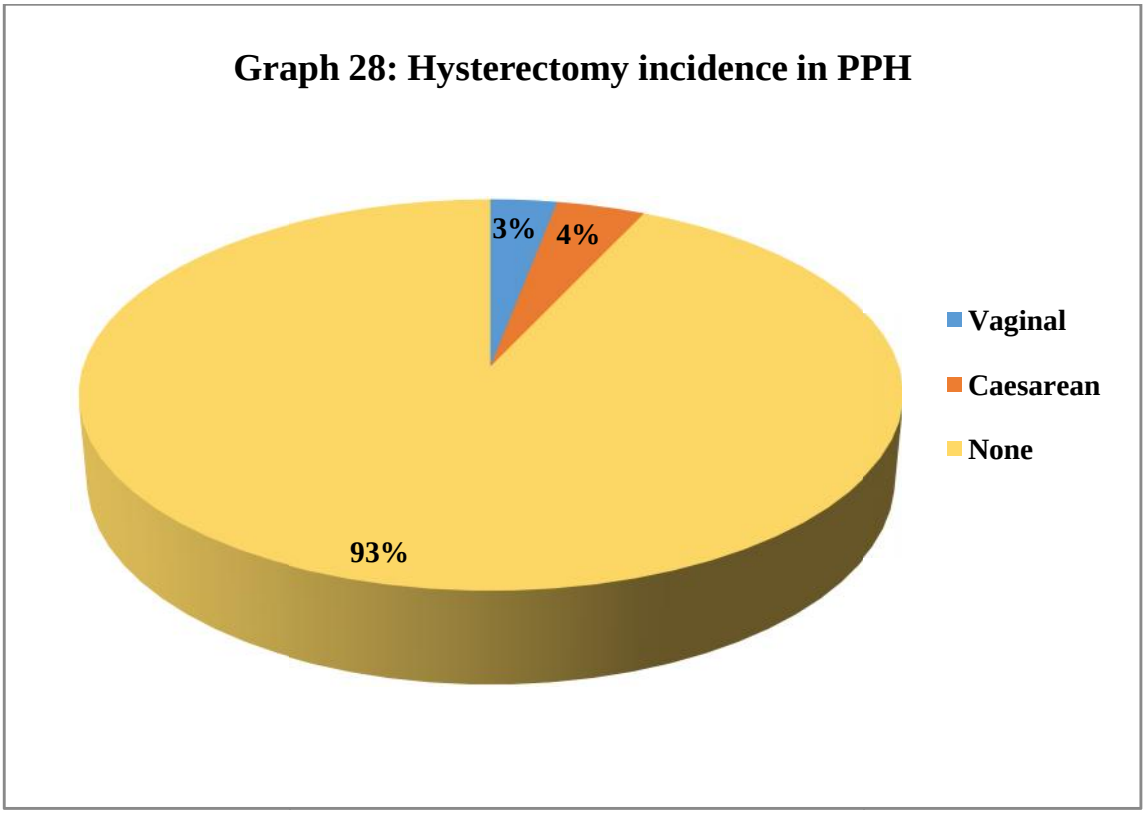


Table 29: Combination of surgical procedures

S.No	Procedure	Number
1.	Vascular ligation +hysterectomy	5
2.	Vascular ligation +B-lynch	1
3.	Hayman +hysterectomy	1
4.	Vascular ligation +Hayman+ hysterectomy	1

Out of 32 cases who required vascular ligation 5 cases needed hysterectomy as an additional procedure to arrest hemorrhage, 6 required Hayman's whereas 1 required all the three procedures including hysterectomy to control the bleeding .1 case required vascular ligation as well as b lynch to control bleeding.11 cases received Hayman sutures and bleeding was controlled in 10 cases whereas 1 required hysterectomy in order to control bleeding.

Graph 29: Combination of surgical procedures

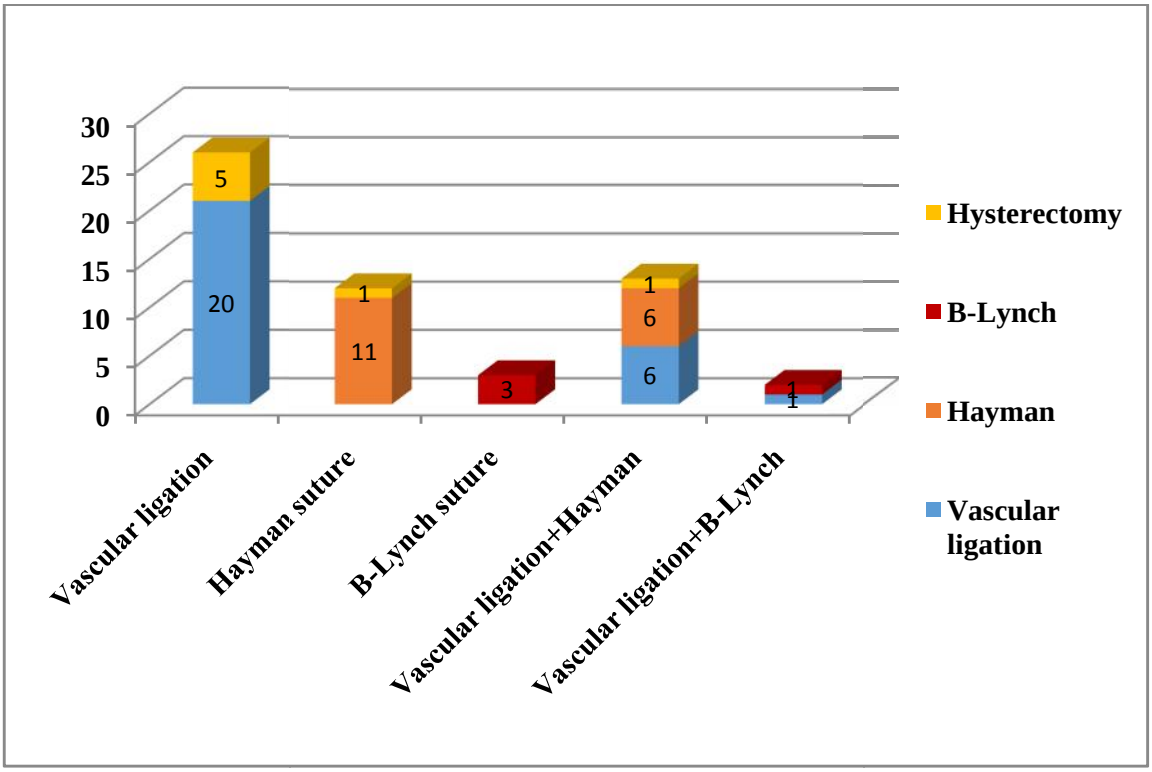


Table 30: Blood transfusion in the management of PPH*(n=96)

S No.	Blood component	N=96, N(%)
1.	PCV	62(64.58%)
2.	FFP	26(27.08%)
3.	Cryoprecipitate	8(8.33%)
4.	RDP	20(20.83%)
5.	SDP	3(3.12%)
6.	Whole blood	6(6.25%)
7.	None	34(35.41%)

Majority of patients were treated by PCV 62(65%), followed by FFP 26(27.08%) and RDP 20(20.83%) for the management of postpartum hemorrhage. Small numbers of patients were treated by cryoprecipitate, SDP and whole blood. A large number 34(35.41%) patients were treated without any transfusion.

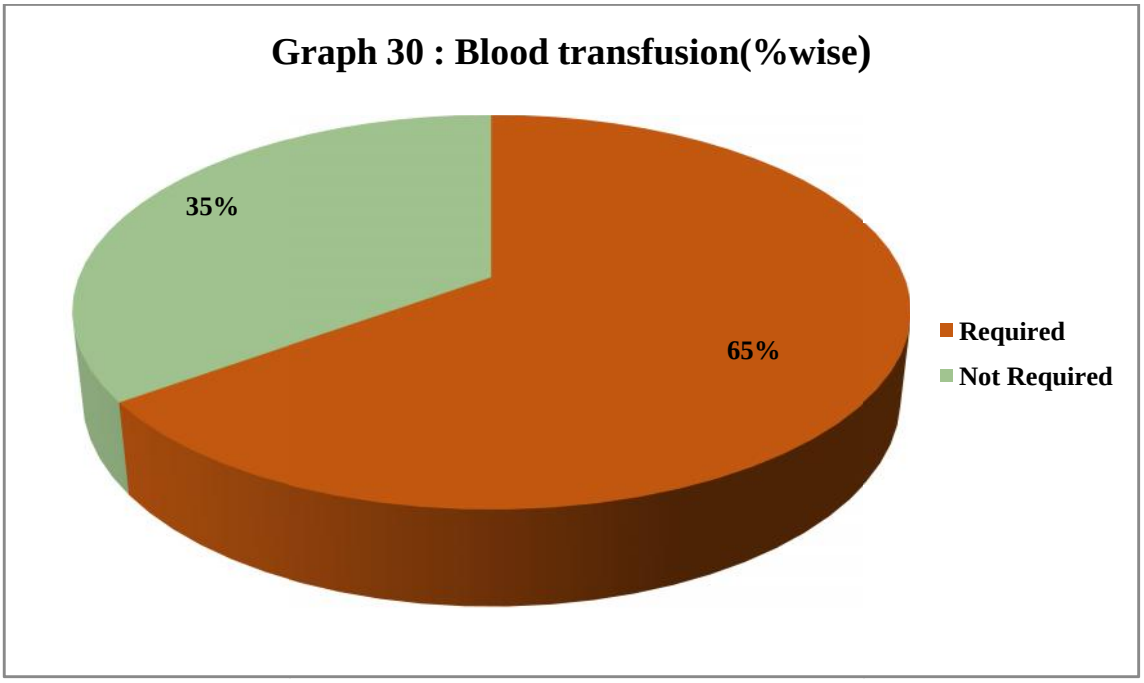


Table 31: Maternal outcomes *

S No.	Outcome	N=96, N(%)
1.	Disseminated intravascular coagulation	14(14.58%)
2.	Acute respiratory distress syndrome	8(8.33%)
3.	Acute renal failure	8(8.33%)
4.	Massive transfusion(>10 units /24 hrs)	21(21.87%)
5.	Intensive care unit(inotrope support)	9(9.37%)
6.	Death	2(2.08%)
7.	None	71(73.95%)

Major complications seen in postpartum hemorrhage were massive transfusion 21(21.87%), DIC 14(14.58%), ARF and ARDS in 8(8.33%) cases. ICU admission required in 9 cases. Death occurred in 2 cases with mortality rate 2.08%. No major complication seen in 71 (approx.74%) patients.

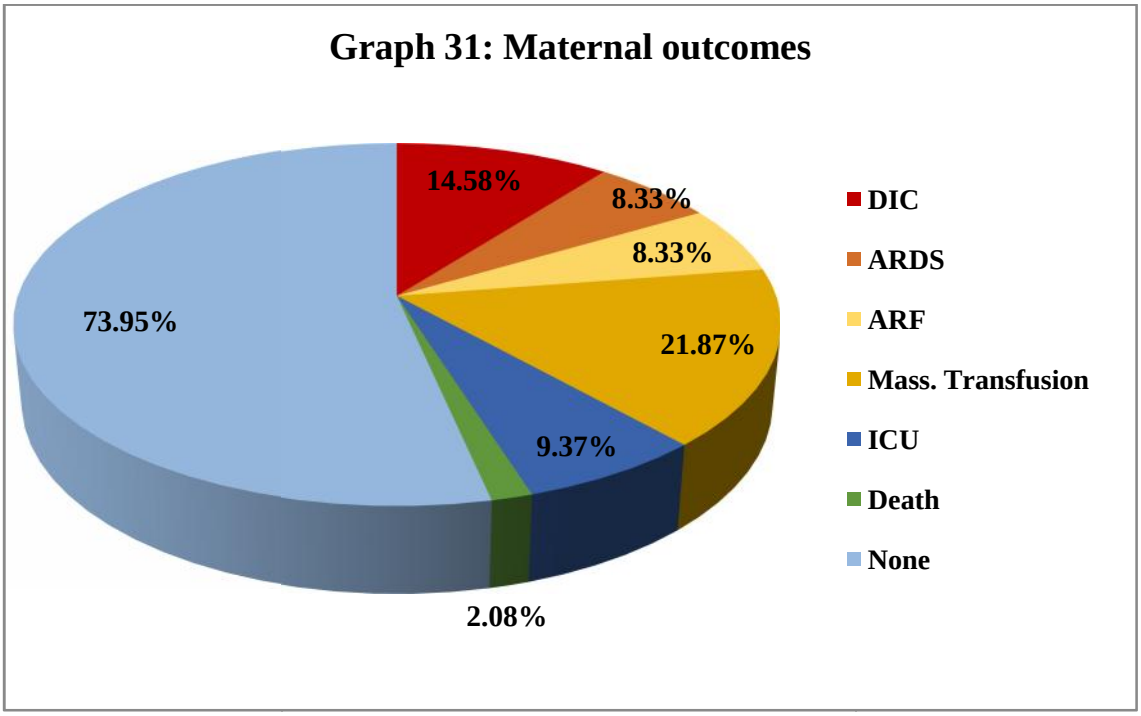
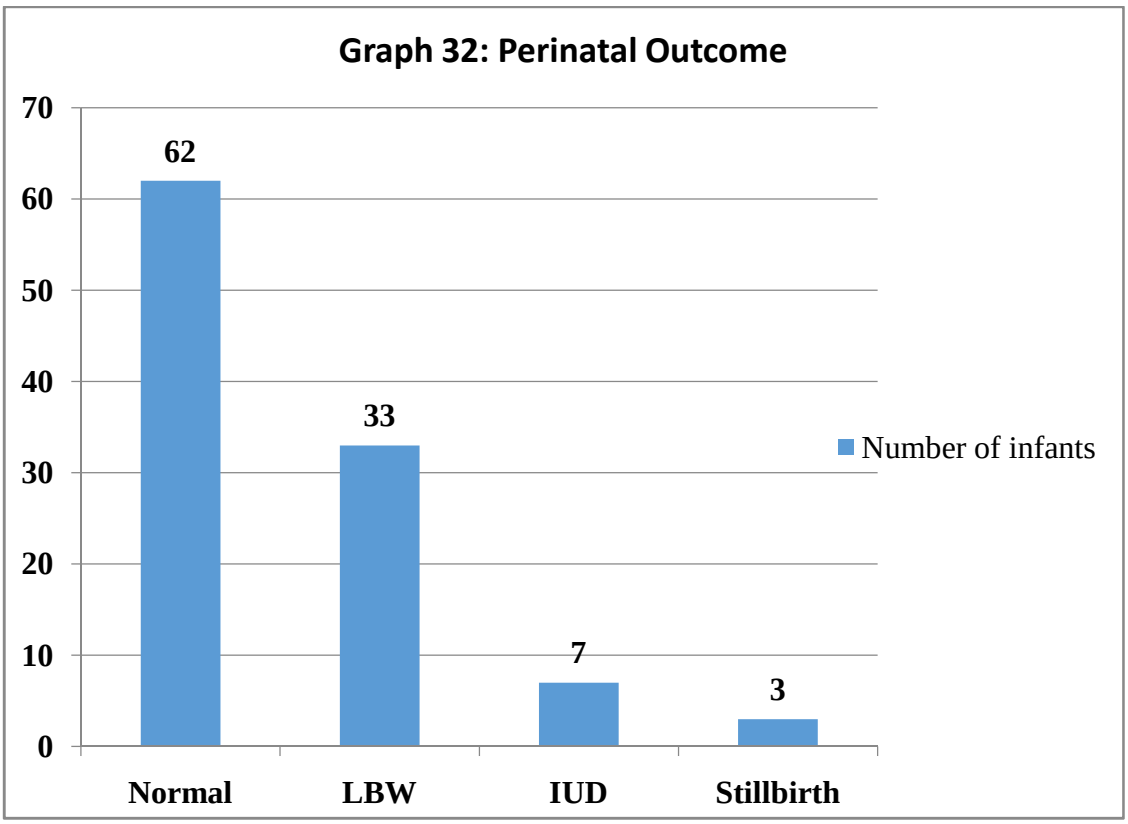


Table 32: Perinatal outcome

S No.	Perinatal outcome	Number of Infants
1.	Low birth weight	33
2.	Intra uterine death	7
3.	Stillbirth	3
4.	Normal	62
	Total	105

Out of 105 infants 62 were normal(wt>2.5 kg, no NICU admission), 33 were low birth weight, 7 were IUD and 3 were still birth.



DISCUSSION

The present study was sought to analyze various management practices for postpartum hemorrhage and maternal outcome in patients delivered and suffered from postpartum hemorrhage or referred from other centers as a case of postpartum hemorrhage at tertiary care center. It also intended for identification of risk factors of postpartum hemorrhage. This study was conducted between the period of January 2018 and December 2018 in the labour rooms of KAHERS Dr. Prabhakar Kore Hospital Belagavi. A total of 96 PPH cases were included in study. These cases were studied and analyzed.

Out of the total 5174 deliveries, total number of women who received treatment for control bleeding according to hospital protocol were 111 out of these only 96 cases met the inclusion criteria of blood loss more than 500 ml and thus were included and analyzed in the study. The incidence rate was 1.86% in our hospital during the study period which is slightly less than the global estimate of 2-4%.

Antenatal care

87.5% of the patients in the present study were booked at KAHERS Dr. Prabhakar Kore Hospital Belagavi. Presently antenatal care in our country is 51.2 %(2016)[130]. Compared to it antenatal care in our study was twice i.e.87.5%. This reflects the good standard of obstetric care of expectant mother in our catchment area.

Maternal Characteristics:

Age wise distribution of cases:

The significantly high incidence of hemorrhage with in maternal age group of 21-30 years, approximately 71(73.96%) cases, 15(15.62%)in < 20 years, 10(10.42%)>in 30 years. It corresponds to the maximum reproductive function of the women during the period of 21-30 years and the importance of not deferring pregnancy to older age[131]. The mean age was **25.06 ±4.14** , most common age group was 20 to 30 years which accounts to 73.96% which was higher than the study done by Al-Zirqi et al (49.72%).[132]it may be a risk factor owing to early marriage leading to increased gravidity and parity at younger ages. Multiparity particularly grand multiparity has been specified as a risk factor of PPH. 'At risk approach' limits the scarce resource utilization to pregnant females in emergency situation. Since it is not possible to predict maternal complications with reasonable accuracy. It should be available to all pregnant women at all times, since maternal complications and child birth can take place at any time[125]

Urban/Rural distribution

In present study, majority 52% cases belonged to rural area with lower socioeconomic group reflecting poor antenatal care[131] as compared to 47.92% cases belonged from urban area. Only marginal difference of approximately 4% cases of PPH between rural and urban areas so difference geographical region still serves additionally as a risk factor by increasing the delay for transportation to higher centre for further management of postpartum hemorrhage.

Distribution on basis of Referral

22(23%) cases of PPH were referred from outside and 74 (77%) cases were primarily registered cases at KAHERs Dr. Prabhakar Kore Hospital Belagavi. This high incidence of referral may be due to status of the only tertiary care centre available in this region

Parity wise distribution of cases

Majority of patients (53%) were multipara which were comparable to study by Al-Zirqiet al.[132] It appears as incidence of PPH rises with increase in parity. This was comparable with the other study of Limayeet al.[133]45 cases (46.87%) were Primiparous, 44.80% were multiparous (P2-P3), 8.33% were grand multipara (>= 4).

Distribution on basis of period of gestation

51(53.12 %) patients suffered from Postpartum hemorrhage delivered between 36-40 weeks period of gestation followed by 20 patients contributing 20.84% at >=40 weeks and 17(17.70%) between 32-36 weeks. Less than 8(9%) suffered from PPH in less than 32 weeks pregnancy. Cumulative incidence of PPH was found to be high in approximately 74% (2/3rd cases) in full term and post term pregnancies and suggest labor induction and augmentation of labor as potential risk factors of PPH.[134]

Blood and blood product related variables

The mean (SD) hemoglobin of the population studied was 10.45±2.0mg/dl(at the time of admission). The majority of study population 89(92%) was Rh positive, with blood group O+, A+,B+,AB in decreasing order in terms of number of cases as 30%,

27%, 27%, 5% respectively. The Rh negative cases were only 9(11%). In a study[135]blood group O was found to have lower levels of VWF and are associated with increased bleeding complications. This was found to be a positive factor in terms of patient management, as availability of Rh negative blood group was comparatively difficult than Rh positive group.

Delivery related variable

Out of total 96 cases of postpartum hemorrhage, 43(45%) cases delivered vaginally, rest 53(55%) cases had to undergo caesarean section. It was comparable to Al-Zirqiet al[132]which were 60% delivered by emergency LSCS and carries the highest risk for severe obstetric hemorrhage. The PPH rate in emergency caesarean section deliveries was greater than elective caesarean section because risk factors for emergency caesarean sections included blood disorders, retained placenta, antepartum/ intrapartum hemorrhage, placenta praevia and general anaesthesia.[135]

Among the vaginally delivered patients 29(30%) cases had spontaneous onset of labour, whereas 14(15%) needed induction of labour. Among 53(55%) caesarean delivery, 35(36.45%) underwent primary LSCS and 19(18.55%) had caesarean delivery after failed induction of labour. Hence caesarean section can be attributed as a risk factor for postpartum hemorrhage according to study .according to a study second stage of labor is characterized by the presence of frequent and prolonged contractions, which can contribute to fetal distress and the need for the Instrumental delivery[135]in the present study 12 cases, had instrumental deliveries and (12.5%).

Risk factors

Most common risk factor among medical disorders (cardiac diseases, hypertension, diabetes, sickle cell disease, & coagulopathy) was hypertension28(29.16%), while in a study by Mark Waterston, et al had 46.8% cases of the combined hypertensive conditions.[124]

According to the study by Al-Zirqi et al anemia was the most common risk factor in 50% cases followed by previous caesarean section in 5.4%, HELLP in 2.8% and multiple gestation in 2.1%. [132].In the present study commonest risk factors were Anemia 23.95%,hypertensive disorders of pregnancy in 23.95%, HELLP in 6.25% and multiple gestation in 8.33%.

According to Sosa et al [136] risk factors associated with severe postpartum hemorrhage were retained placenta(17.1%),multiple pregnancy(4.7%), macrosomia(4.9%),induction of labor(3.5%),need for perineal sutures(2.5%)as compared to present study Labour related risk factor for obstetric hemorrhage were found to be induction of labour 32(33.33%), Instrumental delivery 12(12.5%), Multigravida 7(7.29%), Macrosomia 7(7.29%).

According to another case control study done by lill trine et al[137] the most common etiology of severe PPH were uterine atony(60%)and placental complications(36%).the placental complications constituted abruption placenta(2.2%),retained placenta(19.8%),retained placental tissue(11.4%),abnormal placentation(4.4%).In the present study Placenta related risk factors were placental abruption 11.45% placenta praevia 9.37% retained placenta 5.20. There were no risk factors seen in 7.29% cases as postpartum hemorrhage can occur without any risk factors.

Etiology

According to another case control study done by Lill trine [137] the most common etiology of severe PPH were uterine atony (60%) and placental complications(36%).study by Edhi et al [138]commented that most common cause of post partum hemorrhage was uterine atony followed by cervical and vaginal tears comparable to present study atonicity was the major contributor in 64.60% whereas traumatic causes contributed to 23.95%. Both atonic & traumatic PPH were noted in 11.25%.

Anemia

As per ICMR classification, 46(47.90%) person were non anemic and had hemoglobin level >=11mg/dl, and 52.1% had anemia. Mild, moderate, severe and very severe anemia was present in 19.79%, 21.87%, 8.35%, 2.08% cases at the time of admission. This was comparable with NHFS data published by K. Kalaivani et al[139] in Indian journal of medical research 2018.

Blood transfusion

Total number of cases requiring transfusion in our study were 62(64.58%), whereas 34(35.42%) cases of PPH were managed without transfusion. Major component of transfusion were PCV in 62(64.58%), FFP in 26(27.08%) and RDP in 20(20.83%). Few cases were treated with cryoprecipitate in 8(8.33%), SDP in 3(3.12%) and whole blood in 6(6.25%). The percentage of transfusion was slightly higher in comparison with (44.0%) required blood transfusion in study by Rossi AC et al[120]. Most cases were treated with single component in 34.37% cases, whereas 2 and 3 components were required in 7.29% and14.58% cases respectively

Hypovolemic Shock

In a multicentric study done by Carlos et al[140] among the cases of severe postpartum hemorrhage due to uterine atony,49.5% had grade II shock,33.9% had grade III shock,16.5% had grade IV shock .In the present study 33.34% had grade II, 7.30%hadgrade III and 5.20% had grade IV shock. The mean (SD) of amount of blood loss was 962(±300) with a minimum and maximum value of 550 ml and 4500 ml respectively.

Medical management

The prevention of PPH during present study was done by practicing active management of third stage of labor for all cases. In the multicentric study done by Carlos et al .[140]additinal oxytocin was given in 88.5% cases, prostodin in 60% cases, methergin was given in 54% cases and Carbetocin in 18% patients as compared to the present study where additional Oxytocin was given to 11.45% cases. Additional drugs used were Prostodin in 41.66%, Misoprostol in 34.37%, Methergin in 28.12%.

Oxytocin alone was effective in 41%cases or in combination with blood products or surgical measures, whereas combination of uterotonics i.e. 2, 3 and 4 drugs were used in 26%, 22%, 11% cases respectively.

Other measured used during the present study wereUterine massage and manual removal of placenta in 16.66% and 5.20% cases respectively in addition to uterotonics.

Compression suture

The success rate of uterine compression sutures has been reported to be 77 to 82% in several case series. Price and B-Lynch presented a detailed review of 15 published reports, which included 46 cases with two failures. Baskett described the

largest series of 28 cases in which hysterectomy was avoided in 23 patients, Wohlmuth et al described 22 cases,11cases obtained hemostasis with B-Lynch suture alone and six cases with the uterine and/or ligation with the success rate of 77.3%[141]
In the present study B Lynch sutures were applied in 4.16% cases. Hayman suture were applied in 17.70 % study participants. All 4 B-Lynch sutures were applied in postpartum hemorrhage after caesarean delivery. Out of 17, 15 Hayman sutures were applied after LSCS, whereas in 2 cases it was applied after vaginal delivery.

Among 17 cases of Hayman sutures, 11 cases were treated with Hayman suture alone, with the success rate of 64% comparable to above studies whereas 6 cases required uterine vessel ligation for hemorrhage control. Uterus was preserved in 15 cases, with 11 successful Hayman and 4 B-Lynch with 88.2% success rate of compression sutures whereas 2 cases underwent hysterectomy. This was comparable with success rates ofCetin BA,[110] Nanda S,[111]Ghezzi F,[112]Ghosh SR,[113] with 76.7%, 93.75%, 90.9%, and 91.66% respectively.

Vascular ligation

In a Multi-center retrospective study conducted among Life-threatening cases of severe postpartum hemorrhage, which were not controlled with uterotonics and surgical treatments and were finally treated with IIAL. Totally 53 patients underwent IIAL. All cases were unstable hemodynamically. Coagulopathy occurs in 26 (49.1%) patients .Hysterectomy was prevented in 17(32.0%) cases. 3 patients died of morbidity associated with hemorrhage and complications[115.]Salvat J et al[119] in another study to analyze the indications, technique, results of vascular ligation in the management of severe PPH came to a conclusion that Uterine artery ligation shows good results. A stepwise technique with ligation of the uterine arteries followed by

ovarian arteries (if needed) is an alternative solution with 100% success rate. Bilateral hypo gastric artery ligation can be successful in 66% of cases. Ligation of the bleeding vessels decrease need of hysterectomy and improved maternal outcomes.

In the present study 32 cases needed vascular ligation. It included right uterine artery 2.08%, left uterine artery 9.37%, b/l uterine artery 12.5%, right internal iliac artery 2.08%, Left internal iliac artery 2.08%, b/l internal iliac artery 5.20%. Out of 4 cases of B/L uterine artery ligation 2 cases required unilateral iliac artery ligation for the arrest of bleeding and 2 cases needed ligation of b/l internal iliac artery. 7 out of 32 cases required additional sutures (6 Hayman + 1 B- Lynch).

Hysterectomy

Major blood loss in hemodynamically unstable postpartum patients with uncontrolled ongoing hemorrhage required hysterectomy, Hysterectomy rate in present study was 7.29% thus 92.71% cases were managed without hysterectomy thus it was found corresponding with the study of Drife J et al.[142]in which 89(92.71%) cases were successfully managed without hysterectomy

Morbidity Indicators

.A retrospective study done by shah et al to identify risk factors during labour and 48 hrs postpartum leading to postpartum hysterectomy due to uncontrolled PPH and its outcome .The morbidity 56.0%, mortality rate 2.6% and blood transfusion was required 44.0%. Total numbers of hysterectomies required were 61.2%.[120]

Morbidity indicators associated with severe PPH in present study were disseminated intravascular coagulation (DIC) 14.58%, acute respiratory distress

syndrome (ARDS) 8.33%, acute renal failure (ARF), 8.33%, massive transfusion 21.87% and intensive care unit (ICU) 9.37%, There was no significant morbidity seen in 71cases 73.95% and were managed conservatively and the outcome was good.

Maternal outcome

In India, according to the 2006 National Family Health Survey the commonest cause of maternal mortality is obstetric hemorrhage, generally occurring postpartum and accounting for 25 to 33% of all maternal deaths.[143]Mortality rate in our study was 2.08% and morbidity was 26.04% as compared to Neeru Gupta[144] in her series of obstetric hemorrhage with 30% of maternal mortality, mortality in our study was very less. Although results were similar with study by Rossi ACet al[120], where mortality rate was 2.6% and morbidity 56.0%.

Perinatal outcome

Out of 96 cases of obstetric hemorrhage, 62(59.04%) babies born were of normal weight, alive and healthy. 33(31.42%) babies were low birth weight (LBW). There were 7(6.66%) intrauterine deaths(IUD) and 3(2.85%) stillbirths. Overall Perinatal mortality was 10(9.52%)

CONCLUSION

Postpartum hemorrhage is defined as bleeding in excess of 500 ml within first 24 hours after birth. PPH can be associated with risk factors, most common risk factor being induction of labor followed by anemia and hypertensive disorders of pregnancy. Most of the cases of postpartum hemorrhage can be effectively managed with prompt usage of uterotonics. AMTSL should be given to all delivering women to prevent PPH. Most common cause of PPH is uterine atony thus making Oxytocin as the first line uterotonic among all the available drugs both for prevention and management of PPH. To treat PPH blood products can be effectively used along with uterotonics and can reduce the requirement of surgical management provided blood parameters and vitals are regularly monitored. Uterine massage can be used as adjunct measures but cannot be relied as a definitive measure .Surgical managements including compression sutures and vascular ligation are highly effective in cases of uncontrolled hemorrhage and are helpful to minimize the need of hysterectomy and thereby preserving fertility. The practice of AMTSL has reduced the incidence of PPH also the availability of effective uterotonics, blood and blood products and conservative surgical procedures have reduced the maternal morbidity and mortality to a greater extent in postpartum hemorrhage cases.

Medical management proved as effective as surgical management of PPH but a combination of both medical and surgical procedure prevents the unnecessary delay and as an adjunct measure to give the treatment in short time and thus reduces the morbidity and mortality of PPH.

SUMMARY

The present hospital based study was conducted in the study period of January 2018- December 2018 for a period of 1 year at KLE's Dr. Prabhakar Kore Hospital attached to KAHER's JNMC, Belagavi. The objective of the present study was to observe management practices and maternal outcome among patients of postpartum hemorrhage cases. Secondary objective was to determine the maternal risk factors of PPH.

During the one year period total 5174 pregnant women delivered. Out of this 111 hospital delivered as well as referred cases of PPH were given treatment to arrest bleeding. According to study protocols, among these only 96 cases fulfilled the inclusion criteria for the PPH and thus were enrolled in the study.

Severity of post partum hemorrhage was analyzed using amount of blood loss along with vital signs. All cases delivered at KAHERs Dr. Prabhakar Kore Hospital Belagavi were given AMTSL as a preventive measure for hemorrhage. Management of PPH was done using medical or conservative procedures such as uterotonic drugs, blood and blood products, certain mechanical procedures like uterine massage ,manual removal of placenta along with the administration of uterotonic drugs, surgical procedures compression suture ,vascular ligation, hysterectomy and combination of more than one or more procedures to a control the bleeding, according to the protocols of institution and according to individual blood parameters of patients. The data was collected and analyzed.

- The Incidence of Postpartum hemorrhage in the study was 1.86%.
- 77% cases of PPH were delivered at Dr. Prabhakar Kore hospital and remaining 23% cases delivered outside and were referred from other institutes.
- 33.4% cases had class I shock, 54.16% had class II shock and 7.30% had class III shock while 5.20% suffered from class IV shock.
- 44.8%women delivered by vaginal route and 55.2% underwent LSCS.
- The most common risk factor was Induction of labor in 32(33.33%) cases followed by anemia and Hypertensive disorders(PIH/Pre-eclampsia/Eclampsia) of pregnancy in 23 23.95% each. 7.29% cases were not associated with any risk factors.
- 64.60% cases had atonic PPH, 11.45% cases had both atonic and traumatic PPH. Thus atonic PPH was present in 76% cases and traumatic PPH was seen in 23.95% cases.
- 43.75% case along with medical management (uterotonics) required additional surgical managements like compression sutures and vascular ligation with success rate of 83.33% where uterus was preserved and 16.66% cases required hysterectomy
- Total 7(7.28%) cases of PPH required hysterectomy. It include 3(3.12%) vaginally delivered cases and 4(4.16%) cases of caesarean section.
- Blood transfusion required in 62(65%) cases, whereas transfusion was not required in 34(35.41%) cases.
- Maternal morbidity was seen in approximately 23(26%) cases in terms of DIC, ARDS, ARF, Massive transfusion and ICU admissions.
- Major maternal morbidity of PPH include DIC in 14(14.58%) and Massive transfusion in 21(21.87%) cases. ARF and ARDS seen in 8(8.33%) cases.

- Maternal mortality wasseen in 2(2.08%) cases.
- PPH was successfully managed in 21(21.87%) cases with no adverse maternal outcome.
- Perinatal outcome was satisfactory with 62 normal fetuses. 33 babies were LBW, 7 had IUD, and 3 were stillbirth.

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129. Waiver of consent

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ANNEXURE I

K.L.E.UNIVERSITY'S
JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)
(Accredited 'A' Grade by NAAC)

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Ref: MDC/DOME/31 **Date: 22/11/2017**

To,

Dr.
PG student in Obstetrics and Gynaecology,
J.N.Medical College,
BELAGAVI.

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"AN OBSERVATIONAL STUDY OF MANAGEMENT PRACTICES AND MATERNAL OUTCOME OF POSTPARTUM HEMORRHAGE AT A TERTIARY CARE CENTER IN BELAGAVI"**, is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

(Dr. Arathi Darshan)
Member Secretary
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

(Dr. Roopa M Bellad)
Chairman,
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

6

ANNEXURE II – WAIVER OF CONSENT [129]

To,

Dr.Roopa M Bellad,

Chairman

JNMC, Institutional Ethics Committee

on Human Subjects Research,

Jawaharlal Nehru Medical College, Belagavi.

THROUGH PROPER CHANNEL

Subject: Waiver of consent for the Study.

Respected Madam

I wish to inform you that proposed project, **"AN OBSERVATIONAL STUDY OF MANAGEMENT PRACTICES AND MATERNAL OUTCOME OF POSTPARTUM HEMORRHAGE AT A TERTIARY CARE CENTRE IN BELAGAVI"** is a project wherein consent is not needed as the data will be collected from the medical records.

Kindly grant waiver of consent for the same.

Thanking you

Yours Sincerely

Dr. _____

PG student in Obstetrics and Gynaecology,

J.N. Medical College,

Belagavi

ANNEXURE III - PROFORMA

"AN OBSERVATIONAL STUDY OF MANAGEMENT PRACTICES AND MATERNAL OUTCOMES OF POST PARTUM HAEMMORHAGE AT A TERTIARY CARE CENTRE IN BELAGAVI"

- S No:
- IP No:
- DOA:
- DOD:
- NAME:
- AGE:
- ADDRESS:

- CONTACT NUMBER:
- EDUCATION:

  LITERATE

  ILLITERATE

- SOCIOECONOMIC STATUS
  IF URBAN

  Modified Kuppuswamy scale

  1. 26-29 upper

  2. 16-25 upper-middle

  3. 11-15 lower-middle

  4. 05-10 upper-lower

  5. <05 lower

  IF RURAL

  Modified BG prasad

  1. >=6277

  2. 3139-6276

  3. 1883-3138

  4. 942-1882

  5. less than 942

- BOOKED UNBOOKED
- REGISTERED UNREGISTERED
- REFFERED FROM OUTSIDE:
- PLACE OF DELIVERY IF REFFERED FROM OUTSIDE
  a) Home
  b) Primary health center
  c) Community health center
  d) District hospital
  e) Private hospital/nursing home

Examination

a) Stable:
b) Hypovolemic shock

	Class 1	Class 2	Class 3	Class 4
Blood loss in %	<15 (<=750)	15-30 (750-1500)	30-40 (1500-2000)	>40 (>2000)
Pulse rate	<100	100-120	120-140	>140
Blood pressure	normal	normal	decreased	Greatly decreased
Pulse pressure	normal or increased	decreased	decreased	Greatly decreased
Respiratory rate	14-20	20-30	30-40	>35
Mental status	Slightly anxious	Mildly anxious	Anxious, confused	Confused, lethargic
Urine output	>30	20-30	5-15	Minimal

Primary diagnosis:

a) Parameters at the time of admission:

Hemoglobin	
Platelet count	
Blood group	
Pulse rate	
Blood pressure	
Shock Index	
HIV HBsAg VDRL	
Thyroid Breast Spine	
CVS RS CNS	

b) Per Abdomen examination at admission:

Condition of uterus: flabby/ contracted

Fundal height:

Tense:

Tender:

Irritable:

Relaxed:

Scar:

Scar tenderness:

Presentation:

FHS:

c) Per Vaginal examination at admission:

Bleeding:

Clots:

Vaginal lacerations:

Cervical lacerations:

Dilatation:

Effacement:

Leak:

Show:

Length:

Liquor:

d) Details of present pregnancy:

Total no of ANC visits:

Obstetric score:

Any history of admission during present pregnancy:

If yes, cause:

Days of admission:

Result:

Complaints at the time of admission:

Menstrual history:

LMP:

EDD:

CEDD:

POG:

Previous cycles:

e) Details of previous pregnancy:

Obstetric score:

Mode of delivery:

Place of delivery:

Any antenatal complications:

Any postnatal complications:

f) Details of present pregnancy:

Admission diagnosis:

Mode of delivery:

Vaginal – spontaneous/induced

Cesarean section: if yes – indication:

Instrumental delivery: ventouse/forceps/both

Other procedures:

1. Manual removal of placenta
2. Cervical exploration
3. Cervical tear suturing
4. Vaginal wall tear
5. Perineal tear

Amount of blood loss:

Mode of collection of data of blood loss:

a) From records
b) Measured using BRASS V drape
c) Measured using weighing of mops
d) Other methods

PPH if occurred during current pregnancy

Atonic

Traumatic

Risk factors of PPH present in current pregnancy

Management given to control PPH

MEDICAL MANAGEMENT	SURGICAL MANAGEMENT

DETAILS OF UTEROTONICS – IF GIVEN

NAME	DOSE	ROUTE
Oxytocin		
Methergin		
Misoprostol		
Carboprost		

DETAILS OF BLOOD PRODUCTS – IF GIVEN

NAME	AMOUNT
PCV	
FFP	
RDP	
SDP	
CRYOPRECIPITATE	
WHOLE BLOOD	

VITALS AFTER THE DELIVERY

HEMOGLOBIN	
PULSE RATE	
BLOOD PRESSURE	
PLATELETS	
DIC PROFILE	
RFT	
LFT	

Management given:

Medical management	Surgical management

RISKS FACTORS:

S No.	

Primary diagnosis:

Secondary diagnosis:

Amount of blood loss:

Methods of blood loss estimation:

Type of PPH:

VITALS:

	At admission	After treatment
BP		
PR		
Hb		
Shock Index		

MATERNAL OUTCOME

Disseminated intravascular coagulopathy
Blood and blood product transfusion
Acute renal failure
Sepsis
Dialysis
Devascularisation
Internal iliac artery ligation
Hysterectomy
Massive transfusion
Pulmonary edema
Multiorgan failure

Acute respiratory distress syndrome
Respiratory failure
Intensive care unit admission/near miss
Maternal mortality

PERINATAL OUTCOME

Sex
Birth weight
APGAR score
NICU admission
Status at the time of discharge