

## Review Article

**Role of anaesthetist in antepartum haemorrhage- A complete review**Suchitra Malhotra<sup>1</sup>, Reena Mahajan<sup>2</sup>, Kiran Bhatia<sup>3</sup>, Mohinder Kumar<sup>4</sup>, Prachi Renjhen<sup>5</sup><sup>1,2,3</sup>Department of Anaesthesia, SHKM Govt Medical College, Nalhar, Mewat<sup>4</sup>Department of Surgery, MMIMSR Mullana, Ambala<sup>5</sup>Department of Obstetrics and Gynaecology, SHKM Govt Medical College Nalhar, Mewat**\*Corresponding author**

Suchitra Malhotra

Email: [suchitramalhotra@yahoo.co.in](mailto:suchitramalhotra@yahoo.co.in)

**Abstract:** Maternal mortality is a matter of great concern in developed and developing nations. More than 25% of maternal deaths can be attributed to haemorrhage. Availability, of trained birth attendant and emergency medical services are the main objectives for achieving the Millennium Development Goal 2015 of reducing maternal mortality rate to 109/100,000 from the present 190. One of the major shortcomings for providing high quality emergency obstetric care is a serious shortage of specialists such as obstetricians and anaesthetists at various levels in rural setting. Anaesthetists, perhaps the only perioperative physicians in labour room and operating room with special training in resuscitation and critical care get involved early in management of these bleeding patients. The differences in management options between antepartum haemorrhage (APH) and postpartum haemorrhage (PPH) are that there are two individuals to care for in APH and that delivery of the fetus and placenta will help to arrest the bleeding. The greatest threat in APH is not to the mother but her fetus. Thus a multidisciplinary approach and team effort involving the obstetrician, anaesthetist, haematologist neonatologist, midwifery and paramedic operation theatre staff can go a long way in averting impending death and disability. In this guideline we shall discuss the latest trends in management of APH so that mothers and babies lives and not in jeopardy.

**Keywords:** placenta praevia; accreta; abruption; Uterine rupture; anaesthetic management.

**INTRODUCTION**

Maternal mortality is a matter of great concern in developed and developing nations[1]. More than 25% of maternal deaths can be attributed to haemorrhage[2,3]. Availability, of trained birth attendant and emergency medical services are the main objectives for achieving the Millennium Development Goal 2015 of reducing maternal mortality rate to 109/100,000 from the present 190[4,5].

Antepartum haemorrhage (APH) is bleeding from the genital tract after 24 weeks gestation up to and including delivery of the fetus [6,7] Incidence of APH is 2-5% of all pregnancies [7,10]

Main causes are

1. Placenta praevia
2. Placenta abruption
3. Uterine rupture
4. Vasa praevia

Major complications of APH are perinatal mortality [8] preterm labour and PPH [1,2,4,10,] Current data suggests that placenta praevia and placental abruption are responsible for perinatal mortality of 2.3% and 12% respectively [1,12,13].

**Table-1: Definition**

MINOR HAEMORRHAGE	Blood loss < 50ml
MAJOR HAEMORRHAGE	Blood loss 50-1000ml, no shock
MASSIVE HAEMORRHAGE	Blood loss > 1000ml and/or presence of shock

A recumbent pregnant woman can maintain a normal pulse and blood pressure until she has lost one

third of her blood volume due to relative hemodilution and high cardiac output. Therefore haemodynamic

status may not correspond with apparent blood loss in obstetric haemorrhage

As visual blood loss estimation does not accurately judge the blood loss[14], other reliable methods such as blood collection drapes for vaginal deliveries and weighing swabs ,floor spills and suction bottles are preferred. A laparotomy sponge if 50%soaked with blood gives an estimate of 25ml blood loss and ,in case it is dribbling with blood the estimated loss is 100ml.[15]. Pictorial guides based on experience at Queen Charlotte’s Hospital, London.is a useful aid

for staff working in labour room to measure the bloodloss[16,17].Multidisciplinary observations of estimated blood loss revealed that these were grossly miscalculated by 30-50%[14].

Accurate estimation of blood loss along with measurement of vital signs can be used to classify haemorrhagic shock into 4 different stages. Royal College of Obstetricians and Gynaecologists. RCOG recommends MEOWS(maternal obstetric early warning score) based on above clinical parameters for early identification of the shock[10].

**Table 2: Classification of Shock**

Classification of shock	STAGE 1	STAGE 2	STAGE 3	STAGE 4
BLOOD LOSS	<15%	15-30%	30-40%	>40%
HEART RATE	<100/min	>100/min	>120/min	>140/min
SYSTOLIC BLOOD PRESSURE	normal	normal	decreased	decreased
RESPIRATORY RATE	14-20/min	20-30/min	30-40/min	>40/min
MENTAL STATUS	Slightly anxious	Mildly anxious	Anxious, confused	Confused lethargic

Successful resuscitation of bleeding obstetric patients requires a TEAM(together everybody achieves maximum) approach. A multidisciplinary effort, including obstetricians, nurses, anesthesiologists, haematologists neonatologist paramedical staff should be organized early in the course of obstetric hemorrhage, involving other services as necessary in order to achieve good outcome.

Important signs and symptoms of massive obstetric haemorrhage are: [19]

- Rising pulse rate,
- Pallor,
- Fall in blood pressure,
- Altered conscious level
- Rising respiratory rate,
- Decreased urine output and fetal demise.

In APH signs of fetal jeopardy may occur much before the onset of maternal shock

**Role of Anaesthetist [20]**

- Resuscitation of the bleeding patient-- ABC,s
- Estimation of blood loss•
- Fluid & blood product replacement
- Anaesthesia Induction a & maintenance
- Drug administration
- Sending lab investigations and bedside tests viz haemecue, arterial blood gases, FIBTEM A5 assay
- Monitoring including invasive e.g CVP,ARTERIAL LINE

Delivery room staff are trained Major Obstetric Haemorrhage protocol after 1000 ml blood loss. This

ensures multidisciplinary involvement early in the management of haemorrhage. This will allow obstetrician to search for and control the source of bleeding while the anaesthetist manages hemodynamic and pharmacologic aspect of the patient, blood and fluid replacement, laboratory testing, and ordering and procuring blood products instead of one person (usually the obstetrician) trying to deal with all these issues at the same time. Arterial access with a radial arterial line should be strongly considered early in any haemorrhage that appears to be significant or on-going. This allows repeated sampling to assess haemoglobin and platelet concentrations, coagulation function, arterial blood gases , pH, and ionized calcium levels during on-going rapid transfusion.

CVP monitoring preferrably ultrasound guided by senior anaesthetist early during resuscitation reduces incidence of complications . Central line, is useful for both high-volume infusion and for administration of vasoactive drugs, for example, epinephrine [21].

In cases of major or massive haemorrhage,four units of blood should be crossmatched and a series of lab investigations should be sent for immediately Thee include blood count and coagulation screen . Urea, electrolytes and liver function tests .Latest development is the near patient testing like Haemcue and FIBTEM A5 ASSAY.

**Placenta praevia**

Placenta is implanted partially or wholly in lower uterine segment. It can cause intractable haemorrhage. Trans vaginal ultrasound (TVS) has redefined the degrees of placenta praevia –

Oppenheimer[23] classified placenta praevia according to relationship of placental edge to internal os and risk

of APH and need for caesarean delivery.

**Table 3: OPPENHEIMER,S CLASSIFICATION OF PLACENTA PRAEVIA**

DISTANCE OF PLACENTAL EDGE FROM INT OS	RISK
0-10mm	Caesarean section(CS ) and high risk of bleeding
11-20mm	Low risk of CS and bleeding
>20mm	CS not indicated

Advances in TVS have made DOUBLE SET UP examination (i.e. vaginal exam with all personnel ready for immediate caesarean section ) nearly obsolete in modern obstetric practice. However it may be needed in morbidly obese patient . TVS probe should not be inserted >3cm into the vagina otherwise it may precipitate bleeding.

#### **Anaesthetic management.**

Active labour, persistent bleeding, a mature fetus or non-reassuring fetal status necessitate prompt delivery by caesarean section

- In the pre-operative visit the anaesthesiologist should assess the airway , blood loss, vital signs, senior help should be available, consent for blood transfusion, post-operative ICU care should be obtained as well as possibility of hysterectomy
- While shifting to operation theatre ., the patient should be given oxygen and placed in left lateral position to reduce aorto-caval compression .
- Blood 4 units should be ordered in the operation theatre
- 2 wide bore cannulae should. be inserted
- Invasive monitoring is useful but it should not delay resuscitation.
- All fluid that is administered during resuscitation should be warmed preferably Rapid infusion devices must be used when available.
- Nowadays neuraxial anaesthesia is preferred in patients without active bleeding, coagulopathy or intravascular volume deficit[24]
- The advantages of regional technique are that mother and baby are awake ,the relative problems of general anaesthesia (GA) like tachycardia are avoided , pain relief is better and less number of transfusions are needed
- On the contrary as surgeon has to proceed quickly, the motor blockade must be effective, if haemorrhage is severe compensatory mechanisms being blocked hypotension is more difficult to control. At this juncture many times GA may be required .This is a difficult situation to handle for the patient, obstetrician,

as well as the anaesthesiologist intubating the patient.

- Normally these patients remain at risk of increased blood loss as the obstetrician may injure anteriorly located placenta during uterine incision. Secondly after delivery lower uterine segment does not contract well, thirdly patients with placenta praevia are at increased risk of placenta accreta especially with previous caesarean delivery.
- Most anaesthesiologists prefer providing regional anesthesia for caesarean delivery, others prefer G A under all circumstances[25,26]
- It is more practical to prefer GA in cases of difficult intubation and previous caesarean with present anterior placenta praevia
- Oyelese and Smullian stated that orientation of placenta to the anterior uterine wall and patient status are factors that should be considered when choosing the anaesthetic for parturient with placenta previa [27]

#### **Placenta praevia with accreta**

When an anteriorly located placenta praevia presents in a mother who has a uterine scar the possibility of placenta accreta should be considered. Incidence of placenta accreta is rising because of increased caesarean delivery rate. The risk increases from 24% with one previous caesarean section to 67% in women with 3 or more prior caesareans[28]. Placenta accreta is noted at the time of delivery or CS with difficulty in separating the placenta from uterine wall . MRI may be useful in diagnosis. . Unfortunately, many times placenta accreta occurs in unanticipated patients who are not prepared for hysterectomy.

- When placenta accreta is suspected traditional management is caesarean hysterectomy [27,29] with availability of blood and blood components;
- Conservative treatment to preserve fertility is caesarean delivery and leaving the placenta in situ[30,31] This is accompanied by bilateral embolization of uterine arteries and parenteral methotrexate..
- Hospitals without adequate blood bank supplies should consider transferring patients with placenta accreta to a tertiary care facility where 24 hour in house obstetric consultant, anaesthesia consultant,

gynaecologist, fully stocked blood bank, oncologist, urologist, and radiologist as well as facility for cell salvage are available

- Estimated blood loss is >2000ml in 66% cases.
- Interventional radiologist inserts balloon occlusive devices in both internal iliac arteries prior to surgery. Normally balloons are inflated after delivery so as to provide a less bloody surgical field.
- Fetal bradycardia has been observed so it should ideally be placed in operation theatre to allow rapid delivery and avoid dislodgement
- Intraoperative possibility of infection exists while patient is being shifted from operating room to radiology department. The transfer of parturient can be challenging for paramedical staff and anaesthetist monitoring the bleeding patient
- The advantages of balloon occlusion of internal iliac arteries are that: it is a minimally invasive technique, it involves very less fluoroscopy time, and it does not jeopardize fetal blood supply as the inflation of balloon is done after clamping of umbilical cord.
- If foetal distress develops in the interventional radiology suite, then it would be mandatory to carry out the caesarean section there itself. Such a situation is fraught with problems. General anaesthesia is the technique of choice in these patients. It is better to defer neuraxial block because of chances of hypotension and coagulopathy due to massive blood loss. Besides, these patients have to be anti-coagulated with heparin to prevent thrombosis of the intra-vascular balloon and the sheath.

Royal college of obstetricians and gynaecologists (RCOG) and the Royal college of medicine (RCM) set up an expert working group to develop a care bundle for placenta praevia accreta. called placenta praevia care bundle (PPCB) in February 2010 [22]. There are six elements of this bundle .viz

- Consultant obstetrician planned and directly supervising delivery
- Consultant anaesthetist planned and directly supervising anaesthetic at delivery
- Blood and blood products available
- Multidisciplinary involvement in pre-op planning
- Discussion and consent includes possible interventions (such as hysterectomy, leaving the placenta in place, cell salvage and intervention radiology)
- Local availability of a level 2 critical care bed.

It is vital to normalize haemoglobin and coagulation status and identify the placental site by sonography before surgery. Active management of the third stage of labour is recommended, as this is associated with lower bloodloss. The Obstetric and

Anaesthetic consultant should be informed on admission of patient.

#### Anaesthetic management

- Anesthesia management of the hemorrhage consists of blood and fluid replacement, guided by assessment of the amount of blood loss along with heart rate, systemic blood pressure, central venous pressure and urine output [35].
- Most patients who present for routine planned cesarean sections are anesthetized using neuraxial techniques [32]. Use of neuraxial anesthesia has the added benefit that newborn will be awake even though incision delivery interval will be prolonged which could be harmful for the baby if GA was the anaesthetic technique. In a classic study of cesarean hysterectomy at five institutions from the 1980s, 32% of planned cesarean hysterectomies were performed under regional anesthesia. There was no difference in intraoperative blood loss or hypotension, and no one required induction of general anesthesia [33].
- Gather anesthesia team: It is advisable to have more than one anaesthetist present except in case of emergency.
- Establish at minimum two large-bore (14-16 G) peripheral IVs
- Place an arterial line and central line,
- Rapid infusion and warming devices
- Procure blood and blood products
- Have "Point-of-Care" electrolyte, haemoglobin, and blood gas analysis device, rotational thromboelastometry ROTEM
- Have vasopressors (epinephrine, norepinephrine, Dopamine, dobutamine) immediately available
- Have all available uterotonics
- Order 10 Unpacked red cells PRBCs, 10 U fresh frozen plasma FFP, 10 U platelets to start, with 10 more each available in the blood bank (double the number if known percreta) [20].

A combined spinal epidural (CSE), regional anaesthesia is technique of choice in elective cases. with moderate risk. However, general anaesthesia is warranted if the airway appears difficult, there is significant thrombocytopenia, pre-existing coagulopathy, or if the patient refuses regional anaesthesia. Airway alterations during a caesarean hysterectomy under regional anaesthesia that can make intubation more difficult have been reported, presumably secondary to fluid resuscitation and transfusion [35].

Transfusion Therapy, Research with resuscitation in trauma using massive transfusion has shown an improved outcome by using a 1:1:1 ratio of packed red blood cells, fresh frozen plasma, and platelets[34]. Red blood cell transfusion is required when 30–40% of the blood volume is lost

The common goals for transfusion in the obstetric patient is to achieve

- Haemoglobin >8 g/dl, with PRBC,s
- Platelet count >75 × 10<sup>9</sup>/l, with platelets
- Prothrombin time (PT) <1.5 × mean control ,with FFP
- Fibrinogen >1.0 g/l, with cryoprecipitate or fibrinogen concentrate
- FIBTEM A5 >12with cryoprecipitate or fibrinogen concentrate

Whole blood, a cheaper alternative replaces many coagulation factors, and its plasma expands blood volume. Platelet therapy (6 -10U at a time) is usually considered as the total packed red blood cells( PRBC) units used approaches 10 U,.

. Cell salvage may be particularly useful in cases where homologous blood use is not possible, such as for Jehovah’s Witnesses. Its use in obstetrics has been restricted, mainly due to concerns related to reinfusion of fetal red blood cells and amniotic fluid, and the difficulty of predicting which patients will require transfusion.

Recombinant factor VIIa has been considered a last resort when conventional treatment has failed before proceeding for hysterectomy[36]. For treatment of severe postpartum hemorrhage, it is important to avoid hypothermia and hypocalcemia to maintain normal hemostasis[34]. Tranexamic acid could be considered for prophylaxis after cord clamp Dose is 1 g intravenously, followed by another 1 g if additional bleeding occurs[37].

ABRUPTIO PLACENTA is defined as premature separation of a normally situated placenta. Incidence is 0.6-1% of all births. Maternal haemorrhage may be revealed (80%) or concealed (20%). Fetal compromise occurs because of loss of placental surface area for fetomaternal exchange of oxygen and nutrients.

**Table 5: COMPLICATIONS of abruption [38, 39].**

MATERNAL	FETAL
Disseminated intravascular coagulation	Prematurity
Haemorrhagic shock	Intrauterine growth restriction
Death	Intrauterine fetal death

- The classical presentation is vaginal bleeding ,uterine tenderness and increased uterine activity[40].
- The diagnosis of abruption is primarily clinical. USG is highly specific for abruption(96%), but is not very sensitive.(24%)[39,44,45].
- Blood loss is often underestimated and the amount visible may only be a portion of the total volume of the haemorrhage as the haemorrhage can be concealed, therefore clinicians should also observe for signs of maternal clinical shock and fetal compromise or demise
- One third of coagulopathies in pregnancy are attributable to abruption and coagulopathy is associated with fetal demise[43].
- In abruption placenta the extrinsic pathway triggered by tissue destruction is activated. Thromboplastin is liberated from the placenta leading to consumption of clotting factors and platelets Fibrinolytic system gets activated in response to fibrin deposition. Plasminogen in turn converts to plasmin causing lysis forming fibrinogen, fibrin monomer, fibrin polymer and fibrinogen degradation products-FDP. These in turn cause bleeding.

- Plasma fibrinogen levels are diagnostic in severe haemorrhage. Rapid detection and treatment of hypofibrinogenaemia is essential to stabilize the situation. The use of near-patient testing of coagulation using ROTEM allows monitoring of trends of coagulopathy[46,47] .

**Anaesthetic management**

- If mother develops hemodynamic instability or coagulopathy or fetal status becomes nonreassuring urgent Category 1 caesarean section may be done under general anaesthesia[40,41] .
- 2 intravenous lines(16G ) are established
- Blood is analysed for haemoglobin estimation platelet count, blood grouping and cross-matching (4 or more units ) and clotting profile (including a measure of fibrinolysis, such as Fibrin Degradation Products [FDPs] or D-dimer)fibrinogen level ,prothrombin time(PT)/Activated partial thromboplastin time((aPTT),arterial blood gases(ABG), base line electrolytes , creatinine ,and ROTEM
- If any evidence of Disseminated Intravascular Coagulopathy (DIC) and/or fibrinolysis is found, fresh frozen plasma platelet

- packs, cryoprecipitate, fibrinogen concentrate, tranexamic acid, recombinant factor seven should be ordered as well.
- Regularly monitor volume loss, Consider CVP/arterial line, Non-invasive BP, Pulse oximetry
  - Renal function: monitor urine output hourly report volume <30 mL/hr,
  - Fetal heart rate
  - Intrauterine fetal resuscitation while being transferred to Operation theatre (SPOILT)
  - S-Syntocinon off
  - P-Position full left lateral
  - O- Oxygen
  - I- Iv infusion of 1 L crystalloid
  - L- Low blood pressure, correct with vasopressor
  - T-Tocolysis to stop contractions
  - Surgical team should then be scrubbed with the woman "painted and draped" prior to induction. When fetal bradycardia occurs it becomes mandatory to extract the baby as soon as possible by caesarean section within a span of at least 20 minutes in order to reduce neonatal mortality as well as incidence of cerebral palsy.
  - Rapid sequence intubation with Ketamine and Etomidate are induction agents of choice in volume depleted. For maintenance, adding a volatile agent helps to reduce awareness, however the concentration should be less than 0.5 MAC, to prevent uterine

atony. Nitrous oxide is better avoided in fetal distress

- Volume resuscitation is commenced with crystalloid (2L) and colloid (1.5L).
- Oxytocin should be given to prevent uterine atony
- Tranexamic acid 1gm IV is given when uterotonics fail to control bleeding.
- Selective embolisation of these vessels may lead to cessation of bleeding.
- In cases that fail to respond to these conservative methods, hysterectomy may be necessary

RCOG Green-top Guideline No. 52 states that: 'While results of coagulation studies are awaited, up to 1 litre (equivalent to 4 units) of FFP and 10 units of cryoprecipitate (two packs) may be given empirically in the face of uncontrollable bleeding [47]. Early empirical FFP might be justified if significant consumption is likely as in placental abruption, however the FIBTEM A5 result being available within 10 minutes [48] it is more logical to give FFP after knowing FIBTEM A5 levels. If the FIBTEM A5 is  $\geq 16$  mm (equivalent to a fibrinogen level of about 3 g/L [49]) no coagulation factors are required. If between 12-16 defrost FFP and transfuse if ongoing bleeding. In case FIBTEM A5 is less than 12 which roughly corresponds to a fibrinogen level of 2.2 gm% [49], the available source of fibrinogen either cryoprecipitate or fibrinogen concentrate may be given.

**Table-6: Fibrinogen levels and management**

FIBTEM A5 LEVEL	APPROX FIBRINOGEN	MANAGEMENT
>16	3gm/l	No coagulation factors required
12-16	2-3gm/l	Defrost FFP and transfuse if active bleeding
<12	2.2gm/l	Fibrinogen concentrate or cryoprecipitate
6	1gm/l	Fibrinogen concentrate or cryoprecipitate

Indication for platelets: In abruption consumptive coagulopathy can cause thrombocytopenia, Platelets are infused if the count <  $75 \times 10^9$  /L, low EXTEM but normal FIBTEM levels [49], more than 10 units blood given [49].

If EXTEM monitors coagulation via the extrinsic pathway, FIBTEM monitors clot firmness after blocking platelet contribution to it. Fibrinogen concentrate [50-53], available as a powder for reconstitution, is especially useful in resource limited areas and gives a reliable and quick increase in fibrinogen levels thereby averting coagulopathy. In order to raise the fibrinogen level by 1 g/L, 30 ml/kg of FFP needs to be given, compared with 3 ml/kg of

cryoprecipitate and 60mg/kg of fibrinogen concentrate [54]. Recombinant FVIIa is a controversial option to be given as last resort just before hysterectomy.

If there is fetal death, then the abruption is large and indicates significant maternal blood loss. and a coagulopathy is possible in 30% cases. [55] There is likely to have been up to 1500ml of haemorrhage. It is important to give up to 2 units of blood as soon as possible. The on-call consultant obstetrician and anaesthetist should be informed. The incidence of coagulopathy is very low if the foetal demise has happened within 2 weeks of presentation.

Anaesthetist should assess the patient for possibility of coagulopathy and or sepsis, especially before administering regional anaesthesia.

A coagulopathic patient may present for vaginal delivery after fetal demise. In this case intravenous patient controlled opioid analgesia should be given.

#### After Care:

All women following major APH require intensive monitoring for at least first 24 hours. It is important to remember that thrombo-embolic disease (TED)[56] is still one of the commonest cause of maternal morbidity. Stockings is the bare minimum that can be offered.

#### UTERINE RUPTURE

It is one of the most dreaded complications of childbirth with potentially grave consequences to both mother and fetus. Occurrence is - 0.4-0.6% of all deliveries.

#### Prognosis

4.2% maternal mortality[57] 46% perinatal mortality[57] In half of the cases, uterine rupture occurs at the previous lower segment cesarean section (LSCS) scar. The rupture of classical caesarean scar is related with more severe morbidity and mortality as the anterior uterine wall is highly vascular and may include some part of placenta[58]. The overall incidence of uterine rupture following caesarean section is 1 in 100[57].

**Table 7: Incidence of uterine rupture**

INCIDENCE OF UTERINE RUPTURE	%
After first LSCS	0.7-0.9%,
second LSCS-	0.9-1.8%
short interdelivery interval	1.3-4.8%,
-induction of labor with oxytocin	0.7%
prostaglandin induction	2.4%

Women with previous LSCS scar and having induction of labor are more prone to rupture than those who deliver spontaneously [59, 60].

Warning signs of impending rupture [60, 61, 59]

- Uterine contraction >5 in 10 minutes. lasting >60-90 seconds
- Fetal heart showing tachycardia, bradycardia lasting >10 minutes
- Tenderness over scar.
- Maternal tachycardia
- Bandl's ring formed

Patient may present with

- abdominal pain,
- abnormal fetal heart rate
- vaginal bleeding,
- uterine hypertonia,
- cessation of labour,
- hypotension,
- loss of fetal station and
- change in fetal presentation
- Breakthrough pain of neuraxial labor analgesia may also indicate rupture[60].

Abnormal fetal heart rate pattern on CTG including bradycardia, recurrent, variable or late deceleration is the most diagnostic feature [59, 60, 62]. There can be sudden fetal death (10-80%)[62], or hypoxia and acidosis. Maternal mortality (0-30%) is due to shock, DIC and sepsis. Neonatal outcome following a uterine rupture will depend primarily on the speed with which the C-section is performed.[63] Every minute matters.[85]. It is not necessary that fetal hypoxia will be avoided if the "30-minute decision-to-incision rule" is followed.[64] Studies suggest that babies born within 17 minutes of complete anoxia or severe hypoxia will survive neurologically intact, while babies born after 17 minutes may have severe damage, or will not survive at all.[65, 83]

#### Anaesthetic management

The ASA guidelines recommend that neuraxial techniques are no more contraindicated in patients attempting vaginal birth after cesarean (VBAC)[66] Chestnut stated that the pain of uterine rupture being continuous in nature may not be relieved by epidural analgesia "[67].

The anesthesiologist should be informed before labour of all VBAC patients so that he/she may perform a pre-anesthetic evaluation and be prepared in case an emergency arises[66, 84].

Chestnut's textbook states that "epidural analgesia is a necessary requirement of a successful VBAC program. analgesic doses should be given. Epidural analgesia does not delay the diagnosis of uterine rupture or decrease the likelihood of successful VBAC." [68]. The anesthesiologist should alert the obstetrician if the patient has excessive analgesic requirements[69], suggesting the need for an evaluation for uterine rupture. Anesthesiologists should be actively involved, [84]. In the process of labour. Repeat cesarean section (C-section), has a higher morbidity and mortality in comparison to a successful VBAC. A failed VBAC is associated with a small but significant risk of uterine

rupture that can result in death or serious injury to both the mother and the infant.[66,81].

A patient should not be offered a VBAC in a facility where practitioners capable of performing cesarean sections are not available 24x7[66]. The definitive treatment is hysterectomy in case rupture occurs. General anaesthesia is preferred because of fetal compromise. Pre-existing epidural may be topped up in stable patients. Invasive monitoring is helpful. Give prophylactic antibiotics.

A rapid response institutional protocol should be developed[70].

### Vasa praevia

In this condition fetal blood vessels traverse the lower uterine segment in advance of the presenting part[71,72]. It presents as painless vaginal bleeding at the time of spontaneous or artificial rupture of membranes. Since blood loss is fetal in origin fetal demise or shock may occur rapidly [72,73,74].

Fetal blood loss can be confirmed by the haemoglobin alkaline denaturation test (Apts test)[76] or Kleihauer-Betke[75] test. All women with a history of a low lying placenta should have a colour Doppler ultrasound done before term to confirm location of placenta[77,78,79]. An antenatal diagnosis requires elective caesarean section [80]. Prompt management by neonatologist and volume replacement with O negative blood may improve outcome.

Antepartum haemorrhage irrespective of its cause carries significant risk of adverse perinatal outcome. Ante natal diagnosis of placenta praevia, accreta along with prompt and effective measures have reduced the maternal complications. Changing trends in management of abruption with point of care devices like FIBTEM A5 assay and availability of fibrinogen concentrate has revolutionized the patient care in coagulopathy. Above all is a multi disciplinary team effort involving the experienced anaesthetist at an early stage to achieve desired outcome.

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