Obstetric haemorrhage and the use of blood and blood products

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Introduction

Obstetric haemorrhage remains one of the most challenging conditions to manage in pregnancy. Irrespective of the level of skill and experience of the attending health care provider, bleeding of an obstetric patient poses many difficulties from the moment of presentation, through making the correct diagnosis and providing timely and life-saving treatment. Prompt resuscitation and reversal of coagulopathy are critical while definitive measures are carried out to arrest the bleeding.[i]

Obstetric haemorrhage remains one of the most important causes of maternal morbidity and mortality. This is reflected in the confidential enquiries into maternal deaths for developing countries as well as the developed world. The overall rate in some developing countries appears to be increasing and obstetric haemorrhage remains one of the leading causes of maternal death. Although there is a downward trend in mortality due to obstetric haemorrhage, massive haemorrhage is on the increase as is utilization of blood transfusion in the developed world. World Health Organisation statistics show it complicates up to 10.5% of births, and up to 50% of maternal deaths are attributable to its effects.[ii] The majority of these deaths have been found to be avoidable in developed and developing world.

The continuous training and teaching of management has to remain a high priority in all sectors of maternal care in South Africa.

Data

In South Africa, the confidential enquiries into maternal deaths for 2008 – 2010, reported obstetric hemorrhage to be the second most common cause of deaths. It accounted for 14,1% of maternal deaths. Complications of obstetric haemorrhage, together with hypertension and pregnancy related sepsis, remain the major direct causes of maternal death. Obstetric hemorrhage continuous to be the most common avoidable cause of maternal death (81%).

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The recommendations following these enquiries included: more attention to be given to improving knowledge and skills around managing obstetric emergencies, and the promotion of preventive interventions (community education, prevent prolonged labour, prevent anaemia, use of safe methods for induction of labour and practice active management of the third stage of labour). Severe obstetric hemorrhage must have the status of a 'major alert' requiring a team approach with immediate attention to diagnosis of the cause of hemorrhage, resuscitation and a stepwise approach to arresting the hemorrhage.[iii]

In the United Kingdom, major hemorrhage occurs in approximately 3.7 per 1000 births. Maternal hemorrhage has fallen to being the sixth leading cause of direct maternal death in the 2006-2008 (mortality rate of 0.39 per 100 000 maternities). This was attributed to the improvement in the multidisciplinary management of these patients.[ii]

Although the decreased trend of obstetric haemorrhage during the 2006-2008 triennium in the UK is encouraging, substandard care was a factor in 66% of the deaths caused by obstetric haemorrhage. More than one-half of these deaths were potentially preventable. In the 2003-2005 report the Confidential Enquiries into Maternal and Child Health UK detailed 17 deaths due to maternal hemorrhage, most due to post partum haemorrhage (PPH). Sub-standard care was again a feature in two-third of these cases.[iv] Uterine atony, placenta accreta and failure of routine postpartum observations and recognition of bleeding were the main reasons for the substandard care. They concluded that clinicians managing pregnant women should be equipped with the knowledge and skills for managing obstetric haemorrhage to ensure institution of timely and appropriate life-saving treatment. This is particularly crucial as the incidence of massive PPH has been observed to increase.[i]

A study that was published in 2010 described the trends in PPH in the United States (US) between 1994 and 2006. This population-based surveillance data signaled an increase of 26%, from 2.3% to 2.9%. The increase was primarily due to an increase in uterine atony from 1.6% to 2.4%. This increase could not be explained by changes in

rate of caesarean delivery, vaginal birth after caesarean delivery, maternal age, multiple birth, hypertension or diabetes mellitus.[v]

15% (18000) of women in the US is reported to have a life-threatening hemorrhage during laobur.[v]

Recent reports demonstrated a rising trend in severe maternal morbidity during US delivery hospitalizations that was attributable largely to the increased use of blood transfusions. Data from Canada and Australia indicate recent increases in PPH rates.[vi,vii,viii,ix]

An informal audit of the Near Miss data (severe morbidity during pregnancy) at Steve Biko Academic Hospital (August 2012 to February 2013) showed that of the 51 near miss incidences reported, 39 (76.4%) of these patients received more than 5 units of blood or blood products. Abruptio placentae with an intra-uterine fetal demise was the most common cause among these women receiving massive blood transfusions (30.7%), and all needed surgical intervention. All 39 of these women were referred from surrounding hospitals.

Diagnosis and general management principles

The recognition of major obstetric haemorrhage can be challenging. Blood loss may be concealed and can be difficult to quantify and tends to be underestimated.

Obstetric patients are generally young and fit, and the physiological changes of pregnancy make them particularly well equipped to withstand haemorrhage. As a result, the signs and symptoms of hypovolaemia might not develop until 1200-1500 ml blood has been lost (30-35% of the circulating volume).[x]

Fluid resuscitation in massive haemorrhage is often conservative because of underestimation of blood loss and the rapid speed of blood loss. Failure to maintain optimal haematocrit during the acute event is associated with end organ dysfunction.[x]

A "rule of 30" has been proposed to monitor women with haemorrhage. If the systolic blood pressure falls by 30mmHg, pulse rate rises by 30 beats/min, respiratory rate increases to more than 30 breaths/min and her haemoblogin (hb) or haematocrit drops more than 30%, then the women is likely to have lost at least 30% of her blood volume, and is in moderate shock leading to severe shock. The use of a shock index seems to correlate better in the identification of early acute blood loss.[xi]

The blood flow to the placenta is approximately 700ml/min at term and bleeding can be rapid and may quickly become life threatening. Complete circulatory collapse is often rapid when the limits of physiological compensation are reached.[ii]

The excepted amount of blood loss during the peripartum period is up to 1000 ml after a caesarian section, and 500 ml following a normal vaginal delivery. Major obstetric haemorrhage can be classified as: blood loss > 1500ml, a decrease in hb of more than 4g/dl, or an acute transfusion requirement of more than 4 units of packed red blood cells.[ii] The Healthcare Commission , in its review of maternity services in England and Wales, defined significant blood loss as > 1000ml and major blood loss as >2500ml, or transfusion of five or more units of blood or treatment for coagulopathy.[xii]

The most common causes for major obstetric hemorrhage includes: placenta praevia, placenta abruption, placenta accreta, uterine rupture, uterine atony and amniotic fluid embolism. The management strategy will be determined by underlying cause, and both maternal and fetal considerations, with maternal life always taking preference. The multidisciplinary team involved in the care of these patients include: obstetrician, anaesthetist, experienced midwives, consultant haematologist, blood transfusion laboratory staff, porters for transporting specimens, and ICU personnel.

The medical team should initiate a sequence of non-operative and operative interventions for control of the bleeding, a known protocol for the unit. The obstetrician should promptly assess the success or failure of each measure. If an intervention does not succeed, the next treatment in the sequence must be swiftly instituted, to avoid unnecessary delay and arrest the woman from the morbidity and mortality of haemorrhagic shock.

Massive obstetric haemorrhage contributes towards fetal and maternal mortality and also leads to short-term (multi-organ failure, acute renal failure, pulmonary oedema and coagulopathy) and long-term complications (issues with future fertility, Sheehan's syndrome and psychological sequelae).[i]

The purpose of resuscitation is to restore or maintain the oxygen delivery to the tissue. The aim is to prevent the onset of the irreversible stage of shock when there is multiple organ failure, increased capillary permeability, acidosis and failure of haemostasis.[x]

The administarion of high flow oxygen, the placement of the patient in the left lateral position to reduce aorta-caval compression and to aid uterine perfusion (antepartum) and insertion of two wide bore intravenous cannulae should be sited. Blood must taken for urgent blood count, clotting studies and cross-match.[ii]

Direct arterial monitoring and central venous access and pressure monitoring may be established, both as a guide to response and for ongoing blood sampling to guide transfusion therapy. However, this should not interfere with prompt resuscitation. Few reports of the use of minimally invasive haemodynamic monitoring devices (e.g. oesophageal Doppler monitoring) in the management of major obstetric haemorrhage are available. These devices may aid fluid management in the anaesthetized patient.

All resuscitation fluids and blood should be warmed where possible and rapid infusion devices are beneficial.[ii]

Several techniques are available to avoid peripartum hysterectomy, including balloon tamponade, uterine compression sutures, uterine artery embolization and internal iliac artery ligation. The reported success rates for these techniques differ. They were shown to be equally effective in controlling PPH, with the success rate being 84% for balloon tamponade, 90.7% for arterial embolization, 91.7% tor compression sutures and 84.6% for uterine or internal iliac artery ligation.[xiii] In deciding the surgical intervention, consideration should also be given to the experience and the skill of the operator, as well as familiarity with the chosen surgical procedure.

Interventional radiology is recommended by the Royal college of Obstetrics and Gynaecology in elective and

emergency cases of placenta praevia and placenta accreta. Success rates are over 90%, and in the most recent confidential enquiry, all of the patients survived who underwent radiological embolization survived.[xiv]

After controlling the acute situation, attention should be given to the possibility of rebound hypercoagulation and the risk of thromboembolism. Pregnancy and blood transfusion increase the incidence of thromboembolic disease. Graduated compression stockings and thrombophrophylaxis should be initiated as soon as possible.[xv]

Accurate documentation of all the procedures and interventions as well as the patient's response is essential. Debriefing of the woman, her family and the staff involved, must not be forgotten.

Transfusion

The availability of blood transfusion is one of the major reasons for the decrease in the risk of dying because of pregnancy or childbirth in the UK (from 1:290 to 1:19 000) over the past hundred years. Several studies have shown that women in their reproductive years are the main recipients of blood.[xvi]

Data published by most developed countries show an increase in the transfusion of blood and blood products during labour and delivery. Abnormal placentation, increase in the rate of uterine atony and changes in obstetric practices were reasons given.[xvii]

It appears that we more often get it wrong, by either under or over transfusion.

Retrospective analyses of the clinical scenarios have criticized the employment of blood transfusion as 'too little, too late'. The WHO and UK CCEM recommended that women at high risk of losing more than 1000ml should be strongly advised to deliver in a setting where blood transfusion and intensive care facilities are available.[xiv]

A retrospective descriptive study was undertaken to evaluate the appropriateness of transfusions in our tertiary unit. They found that inappropriate and over- transfusions are common. The reasons identified were lack of education among medical personnel in transfusion protocol, risks and costs. Alternatives to transfusions were underutilised.[xviii]

In the 13th annual Serious Hazards of Transfusion (SHOT) report, inappropriate or unnecessary transfusions were attributed to lack of knowledge and experience or errors of judgment by the clinical staff concerned. The report urges for the education of, and senior support for, staff dealing with transfusion related problems and that this should be a major objective of the Royal Colleges. Other recommendations were better recording and reporting of blood usage and complications from transfusions by the hospital transfusion laboratories and wider use of red cell salvage for obstetric and gynaecological patients experiencing major hemorrhage.[xix]

The process of ordering and receiving blood and products is also hazardous. Incorrect ordering, loss of specimens and delay in issuing of products, (which result in double ordering) contribute to wastage of this scares commodity.

There is agreement that when 30% or more of the circulating blood volume is lost, blood transfusion is required to maintain sufficient oxygen delivery to the tissues. Unfortunately, information from randomized controlled trials to inform best practice is largely unavailable in the discipline of blood transfusion.[xiv]

Massive transfusion

Major transfusion is defined as any one of:

- the total blood volume is replaced in 24 hours
- ≥ 4 units of red blood cells transfused in 1hour
- Replacement of 50% of the total blood volume in 3 hours[xx]

Massive transfusion may be associated with a number of hemostatic and metabolic complications. Massive transfusion involves the selection of the appropriate amounts and types of blood components to be administered, and requires consideration of issues including volume status, tissue oxygenation, management of bleeding and coagulation abnormalities, as well as changes in ionized calcium, potassium and acid-base balance.[xxi]

Transfusion practices

Significant hemorrhage generally requires the early use of blood products. Packed red cells and Fresh Frozen Plasma (FFP) are given in a ratio of between 1:1 and 1:2 in an effort to avoid dilution of clotting factors and development of a coagulapathy. Regular measurements of haemoglobin and clotting are recommended to guide transfusion requirements as well as close liaison with a haematologist.[ii]

The British Committee for Standards in Haematology's guidelines for the management of massive blood loss emphasises the need for prompt action and good communication among the various specialities and laboratory services if bleeding is to be stopped and circulating blood volume restored.[xxii,i]

They suggest the following transfusion threshold:
Haemoglobin < 8/dl
Platelets < 75000 if still bleeding
PT/APTT ratio of >1.5 and
Fibrinogen < 1.0 g/l

Near-patient testing such as haemoglobin assessment with the Haemacue and thrombo-elastography are vital in cases of massive haemorrhage because there are unavoidable delays in obtaining the results from the laboratory.[xxii]

Thromboelastography(TEG) and thromboelastometry (ROTEM) are viscoelastic whole blood point-of-care testing devices that evaluate the haemostatic capacity of blood. The use thereof has been reported in the management of obstetric haemorrhage. Although normal values in pregnancy and labour are only now being established, these devices may have a role in the management of blood product replacement in major obstetric haemorrhage.

It is important to avoid the cycle of hypothermia, acidosis and coagulapathy in the massive transfusion patient. Warmed fluids must be given and care directed to achieving normothermia.

The appropriate use of blood products requires that the potential benefits and risks be carefully weighed for each patient.

Complications of transfusion

Less use of blood products not only reduces the risk for blood-borne illness, but also reduces the burden of obstetrical hemorrhage on local blood banks.[xvii]

Complications associated with transfusion of red blood cells, plasma or platelets include:[xv]

- immunologic and hemolytic reactions
- volume overload: with the potential of pulmonary edema
- hypothermia
- coagulopathy
- citrate toxicity
- acute lung injury
- post-transfusion purpura

Reduction of transfusion

Recommendations by RCOG on how to reduce the chance of transfusion:

- Treatment of anaemia (start treatment when prenantal Hb< 10,5 g/dl)
- Minimized blood loss at delivery
- Active management of the third stage of labour(clear evidence from randomized trials)
- Women at high risk of hemorrhage should be advised to deliver at hospital
- Optimal management of women on anticoagulants, such as low-molecular-weight heparin, will minimize blood loss.[xiv]

Coagulopathy

Coagulopathy is a common consequence of massive haemorrhage when blood loss exceeds 30% blood volume. It can also complicate bleeding, particularly where there is abruption, infection, amniotic fluid embolism or fetal demise.[ii]

Bleeding during the 3rd trimester is in part mediated by thromboplastin activity as result of high levels of tissue factor.[xxiii]

Even if coagulopathy does not exist and coagulation parameters are normal before blood is replaced, coagulation abnormalities may be induced.[xxi] Coagulopathy is generally multifactorial with the main contributors being:

- Haemodilution from intravascular volume replacement with large volume of plasma volume expanders and packed red cells, and prolonged shock
- Hypothermia causing platelet dysfunction and inability to form a clot
- Activation of the coagulation and fibrinolytic cascades
- Endothelial cell damage, which activates intravascular coagulation leading to a consumptive coagulopathy
- Acidosis resulting from haemorrhagic shock, hypovolaemia and the transfusion of packed red cells
- Impaired hepatic synthesis of coagulation factors
- Impaired clearance of activated factors resulting from shock
- Release of tissue factor into the circulation[xxiv]

The fibrinogen level at the time of diagnosis of PPH is predictive of the severity and can be used to guide the aggressiveness of management. A low fibrinogen level is predictive of severe haemorrhage, indicating the need for transfusion of multiple blood units.

Fibrinogen is the first coagulation product to fall during a massive hemorrhage, and this decrease is directly proportional of the degree of haemodilution. The regular monitoring of thrombin clotting time and fibrinogen levels are thus recommended.[xxiv]

Protocols

Standardized and coordinated interventions are critical for optimal maternal and neonatal outcome. This applies to everyone involved: obstetricians, anesthetists, nursing staff, blood bank and haematologist.[xvii] Massive transfusion protocols are useful and should be considered in every obstetric unit, particularly those looking after women at high risk of obstetric haemorrhage.[i]

The development and implementation of a clear local protocol on how to manage major obstetric hemorrhage is known to improve outcome and therefor recommended by the RCOG and various committees.[iii,iv,xiv] These protocols should be practiced in 'fire-drills' to inform and train relevant personnel. Several variations exist, depending on the individual hospital. The protocol comprises the initial number of units of red blood cells, fresh frozen plasma, platelets or cryoprecipitate.[i]

In 2008, a comprehensive patient safety initiative was instituted, that was directed at the treatment of maternal haemorrhage. The study objectives were to assess whether institution of protocols reduces the severity of obstetric hemorrhage and if early intervention reduce the number of transfusions required. The training and protocol instillation was associated with a significant shift toward patients requiring less intervention and successfully being treated at lower acuity levels. They noted a significant shift toward resolution of maternal bleeding at an earlier stage. There were significant improvements in staff and physician perceptions of patient safety.

The number of patients that required high level of care remained unchanged but the need for blood products were significantly reduced, mainly due to a decrease in the incidence of disseminated intravascular coagulation (DIC) (64% reduction). This they attributed to earlier transfusions that ended in patients needing less units of blood and experiencing fewer complications.[xvii]

Similar results were reported by Rizvi et al from a study performed in Ireland.[xxv]

A cluster-randomised controlled trial, on the multifaceted intervention to decrease the rate of severe postpartum hemorrhage in 106 maternity units in six French regions, did not show an effect on the rate of severe PPH but the educational intervention improved some practices.[xxvi]

Blood

Red blood cell transfusion may be performed using packed red blood cells, whole blood, or salvaged autologous blood. Packed red blood cells are used in most clinical situations. Whole blood is rarely indicated and seldom available and only considered in the context of massive blood transfusion to counter the dilutional effect of other components.[xv]

Transfusion of red cells is used to improve and maintain tissue oxygenation. Each unit of packed cells contains approximately 200ml of red cells and will raise the hematocrit by 3 to 4 percentage points and the hb by 1 g/dl, unless there is continued bleeding.[xxi]

Concentrated red blood cells are the first-line treatment in massive obstetric haemorrhage[i] and should be commenced early if bleeding is ongoing to avoid dilutional coagulapthy.[ii] The decision to perform blood transfusion should be made on both clinical and haematological grounds. Transfusion is rarely indicated in the stable patient when hb is greater than 10g/dl and is almost always indicated when less than 6g/dl.[xiv]

If the hb is less than 7g/dl the decision to transfuse should be made according to the individual's medical history, age and symptoms.[xv]

Fresh frozen plasma

Fresh frozen plasma (FFP) is separated from freshly drawn blood by removing the red and white blood cells, and platelets. It is then frozen for storage and thawed when needed for transfusion. Once thawed, the plasma must be transfused within 24 hours or the concentrations of clotting factors begin to decline. FFP is the most commonly used plasma product, in part because it can ameliorate deficiencies of any of the circulating coagulation factors.[xiv]

In the bleeding woman with a DIC combination of FFP, platelets and cryoprecipitate is indicated. The FFP and cryoprecipitate should ideally be of the same group as the recipient. If unavailable, FFP of a different ABO group is acceptable, provided that it does not have a high titre anti-A or anti-B activity. No anti-D prophylaxis is required if an Rh negative woman receives Rh D positive FFP or cryoprecipitate.[xiv]

The indications for the use of plasma products can be therapeutic or prophylactic, when there is a significant risk of coagulopathy occurring (i.e. hypothermia, acidosis and pre-existing coagulopathy or impaired hepatic function).

FFP is critical to reverse coagulopathy after large blood loss requiring four units or more of packed red blood cells, as blood-clotting abnormalities are common. The suggested ratio of clotting products to packed red cells is 1:2 or even 1:1 to prevent coagulopathy.[xxvii]

The administration should be guided by the PT, APTT (threshold of 1.5 times normal control plasma) and the fibrinogen level (should be kept > 1.0 g/L). Transfusion of FFP might also be required when blood loss is rapid (>100ml/min) with inadequate time to obtain results of PT, APTT and fibrinogen. FFP should be administered rapidly, and at 37°C, to avoid hypothermia.[xxiv]

The indications for the transfusion of plasma are less well established than the indications for red blood cell transfusion. Generally speaking, transfusion of plasma is indicated whenever hemostasis is inadequate and the benefit of correcting the insufficient hemostasis is believed to outweigh the risks of the plasma transfusion.

The response to a plasma transfusion is directly proportional to the difference between the patient's levels of coagulation factors and that of the infused plasma. Thus, the more severe the factor deficiencies the more likely a significant decrease in their INR.[xiv]

Cryoprecipitate

Cryoprecipitate is collected by thawing FFP at 4°C and collecting the white precipitate. It is rich in von Willebrand factor, factor VIII, factor XIII and fibrinogen. The chief advantage of cryoprecipitate is that it allows these factors to be replaced using a much smaller volume than if replaced by transfusing FFP.

Cryoprecipitate is most useful in massive haemorrhage as a rapid source of fibrinogen when the level is < 1.0g/L. It can be used:

- early in massive haemorrahge as first-line therapy as source of fibrinogen
- following FFP if persistent fibrinogenaemia
- fibrinogen level disproportionately low compared with other factors

  Dose = 2ml/kg body weight

The response to transfusions of cryoprecipitate is more difficult to predict. However, transfusion of ten bags of cryoprecipitate can be expected to raise the fibrinogen level by approximately 70mg/dl.[xxiv]

It is essential that regular full blood counts and coagulation screens are performed during the bleeding episode. Cryoprecipitate should not be given on clinical suspicion alone unless there is delay in obtaining blood results.[xiv]

Platelets

Each pool of platelets contains four to six units of platelets. Platelet transfusion is of particular importance in cases of disseminated intravascular coagulopathy associated with a low platelet count.[xiv]

Indications for transfusion of platelets may be therapeutic or prophylactic:

- Patients with platelet count < 10000: The purpose is to prevent spontaneous hemorrhage
- Platelet count <50 000 with active bleeding, who are scheduled to undergo an invasive procedure, or have a qualitative intrinsic platelet disorder
- Platelet count < 100 000, with central nervous system injury, multisystem trauma or undergoing neurosurgery, or require and intra-thecal catheter for anesthesia
- Patients with a normal platelet count who have ongoing active bleeding and a reason for platelet dysfunction, such as a congenital platelet disorder, chronic aspirin therapy or uremia

Platelets may not be on-site in many units, so their need should be anticipated and good communication with the transfusion laboratory maintained.

Rh D-negative women should receive Rh D-negative platelets. The platelets should ideally also be group compatible. Anti-Rh D immunoglobulin (250iu) will be needed if the platelets are Rh D positive and the recipient Rh D negative.[xiv]

Platelet transfusion is contra-indicated in the settings of heparin-induced thrombocytopenia, thrombotic thrombocytopenia, thrombotic thrombocytopenia purpura, hemolytic-uremic syndromes and disseminated

intravascular coagulation, unless life-threatening hemorrhage is present. In these patients platelet transfusion may lead to clinical worsening. This is probably the consequence of microvascular thrombi formation. Platelet transfusions are generally ineffective in situations which the thrombocytopenia is the result of rapid platelet destruction, e.g. ITP, drug related thrombocytopenia, hypersplenism, sepsis, high fever and anti-platelet alloantibodies.

Dilutional throbocytopaenia is common in massive transfusion, which generally occurs later in coagulation factor deficiency, and manifests as microvascular bleeding.

Tranexamic acid (TA)

It has been suggested in clinical studies that tranexamic acid reduces the amount of blood loss during deliveries, and reduces the requirement for blood transfusion. TA seems to be safe and effective in the prevention and management of bleeding following delivery.[xxviii] A recent study has shown the role of high-dose TA in reducing blood loss and maternal morbidity in PPH.[xxix]

TA is the most effective of the available anti-fibrinolytics[xxx], which as a class proved to result in worthwhile reductions both in blood loss and the need for allogeneic red cell transfusion.[xxxi] Its use should be considered in cases where blood loss is major and ongoing. The recommended dose is 1g by slow intravenous bolus with a further 1g after 4 hours. It has also been given prior to elective caesarean section. Blood loss was found to be significantly reduced at 2 h post-partum, and hb was higher at 24 h with no apparent complications or side effects.[xxxii]

Antifibrinolytics are useful adjuncts in the pharmacological management of massive obstetric haemorrhage.

Recombinant factor VIIa

Recombinant factor VIIa is licensed for the prophylaxis and treatment of haemorrhage caused by haematological disorders. An increasing number of reports have described its successful 'off-label' use in the treatment off massive PPH, refractory to conventional medical and surgical therapy.[xxx] It is intended for promoting haemostasis by activating the extrinsic pathway of the coagulation cascade. In complex with various clotting factors it leads to the formation of a haemostatic plug by converting fibrinogen to thrombin, thereby inducing local hemostasis. The recommended dose is 90 ug/kg given as an intravenous bolus over 3-5 min. A second dose can be given 20 mins after the first dose. In a review by Franchini et al[xxxi], including a total of 272 women, it was suggested to be effective in stopping or reducing bleeding in 85% of the cases. The high cost and limited availability of the medication limits its use.[i]

Its effectiveness is markedly diminished by hypothermia and acidosis and so effective resuscitation towards normal physiology is a prerequisite of its use. Thrombotic complications remain the major concern with its use.

The use of recombinant factor VIIa may be considered as a treatment for life-threatening postpartum hemorrhage but not as a substitute for, nor should it delay the performance of life-saving procedures.[xiv]

Cell salvage

Intraoperative cell salvage is the process whereby blood shed during an operation is collected, filtered and washed to produce autologous red blood cells for transfusion. It has been introduced into obstetrics relatively recently in an attempt to reduce allogenic transfusion. One should keep in mind that salvaged blood has no coagulation factors.[i] Although endorsed by many, its use is not widely practiced due to limited availability.

Cell salvage is recommended by the RCOG to minimize the use of banked blood for women in whom an intraoperative blood loss of more than 1500ml is anticipated.[xiv]

Cell salvage in both anticipated and unanticipated massive haemorrhage can be useful as this can reduce the exposure to allogeneic transfusion and its costs. Cell salvage is usually started after the majority of the amniotic fluid has been suctioned to decrease the theoretical risk of amniotic fluid embolism. The concerns about amniotic fluid embolism in cell salvage have not been realized.[ii,xxii]

Rhesus immunization may occur if fetal red cells are aspirated and re-transfused into the maternal circulation. The risk has been estimated to be similar to a normal vaginal delivery. Rhesus immunization can be prevented with Kleihauer testing and anti-D treatment.

Conclusion

Women in both the developing and developed world continue to suffer morbidity and mortality form obstetric haemorrhage. The use of blood and blood products has significantly improved the outcome of this life-threatening and challenging condition. Blood and blood products remain a scarce commodity that needs to be administrated timely and with the potential complications in mind. The implementation of individualized protocols and guidelines for high risk units has led to a decrease in the use of blood products mainly due to a decrease in coagulopathy. Techniques, interventions and alternative options to blood transfusion need to be explored and implemented as available, in every day practice. We need to insure that these protocols are developed, rehearsed through fire-drills and utilized during obstetric emergencies in order to improve outcome at all levels of care. Good communication between the different health care workers involved can streamline the management and improve the outcome of this potentially disastrous condition.

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