

Primary Post-Partum Haemorrhage; the Pilgrim Hospital's Experience, Boston, Lincolnshire, United Kingdom

Abstract

Aim: This study was to investigate the incidence of primary post-partum haemorrhage (PPH), during the biennial period of 2007 to 2008; its management and outcomes and to learn from any peculiar challenges that the unit had faced in the management of these women in relation to PPH. The study was aimed to explore any significant risk factors, adverse outcomes and associated risks and compared these with standards, guidelines and other published acceptable practices. It was also aimed to critically appraise our methods of estimation of blood loss (EBL, blood loss) in the unit.

Methods: We reviewed the Pilgrim Hospital Monthly Maternity Statistical Run from 2005 to 2008 for information on trends. We conducted a preliminary review of the Birth Register of 2007-8 with elimination criteria from the definition of primary postpartum haemorrhage (PPH), to identify the target population to be included in the study. Once the target population was identified, the investigators chose a study population of 100 of these women and had used a systematic approach to make sure that the study population clearly reflected with good precision, the target population.

This was done as follows:

Each of the 4 investigators had a group of 25 women to study and each group comprised of 8 women who had normal birth; 8 women who had vaginal operative deliveries; 8 women who had caesarean section and one additional woman with a mode of delivery randomly picked by each of the investigators but with this randomly picked mode of delivery different from that picked by the 3 other investigators. A careful review of 100 case notes was conducted in stages by investigators to ascertain the management these women and the outcomes of such management. The investigators met formally about three times and informally many times to articulate, review, updated and implement the strategies for the study.

Results: From the preliminary screening, the following specific data was collated:

- i. The number of deliveries for 2007 was 1963 and that of 2008 was 2169.
- ii. The total number of deliveries for the same period was 4132. The number of women delivered whose blood loss met the criteria for PPH were 390 or giving rise to an incidence of 9.44% (cf 2-11%) for the 2 years (2007-2008) or average incidence of 4.72% (cf 2-11%) for each of the 2 years.
- iii. These 390 cases as stated earlier constituted the target population. The number of women whose blood loss did not meet the criteria were 621 (15.03%) for the same

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time frame. 100 cases (25.64%) of target population had been chosen as our study population as earlier stated.

- iv. In 44 women (1.06%), the blood loss was recorded as a range of values and therefore the incidence cannot be calculated based on the two figures in the range and thus were excluded from the main study.
- v. Blood loss was not recorded in 35 cases (0.85%) of caesarean section, 9 cases (0.23%) of vaginal operative delivery and in 18 cases (0.43%) of normal birth. One of the normal births took place at home. Thus blood loss was therefore difficult to estimate in such circumstances. These women were also excluded from the main study. In one case (0.02%), the doctor and midwife conducting the delivery did not agree on a figure for blood loss and both gave different figures for the estimated blood loss. About 7 case notes (0.14%) were not available for detailed study but some basic data/information was collated from the Delivery Suite Register. Additionally, on a general management level, there appeared to be no significant issues relating to consenting for blood transfusion, approach to management of antenatal and postnatal anaemia, intra-partum and post-partum blood loss, as these appeared to be within acceptable standards.

Conclusion: This is a study of primary post-partum haemorrhage for a biennial period of 2007 to 2008. The study highlighted our unit's birth statistics and the incidence of post-partum haemorrhage for the period under study. It also highlighted areas our department did well and areas where there was room for improvement. Clearly there was need to clarify the cut off value for blood loss in the definition of post-partum haemorrhage, as some cases were wrongly classified as post-partum haemorrhage. There was also need for accurate documentation which has medico-legal significance and also relevant for future research, so as to learn from

previous experience. On a general management level, there appeared to be no significant issues relating to consenting for blood transfusion, approach to management of antenatal and postnatal anaemia, intra-partum and post-partum blood loss, as these appeared to be within acceptable standards.

This study was elaborate and revealing. It showed where the unit was in relation to the definition and management of PPH. The literature was carefully reviewed and the recommendations from these formed a stable versed template, pivot and high bar for future similar audits. We expected regular audit at two-yearly intervals to close any loop that may have been identified in previous similar studies. This is also in line with the Clinical Negligence Scheme for Trusts (CNST) standard/clinical governance. CNST is a risk pooling scheme administered by the National Health Service (NHS) Litigation Authority (NHSLA) which handles clinical negligence claims made against NHS organisations where the incident took place on or after 1 April 1995.

Keywords: Primary post-partum haemorrhage, pregnancy, delivery, Pilgrim Hospital, United Lincolnshire Hospitals NHS Trust

Abbreviations: BMI: Body Mass Index; Hb: Haemoglobin; PPH: Primary Post-Partum Haemorrhage; APH: Antepartum Haemorrhage; CNST: Clinical Negligence Scheme for Trusts; NHSLA: National Health Service Litigation Authority; RCOG: Royal College of Obstetricians and Gynaecologists; CEMACH: Confidential Enquiry into Maternal and Child Health; SOGC: The Society of Obstetricians and Gynaecologists of Canada; BCSH: British Committee for Standards in Haematology; WHO: World Health Organisation; NHS: National Health Service; EBL: Estimated Blood Loss; IOCS: Intraoperative Cell Salvage; PBM: Patient Blood Management

Introduction

Primary PPH is the most common form of major obstetric haemorrhage. The traditional definition of primary PPH is the loss of 500mls or more of blood from the genital tract within 24 hours of the birth of a baby [1].

Primary PPH can be minor (500-1000ml loss or loss of 10-15% of blood volume) or major (more than 1000ml loss). Major PPH is divided into moderate (1000-2000ml loss) and massive or severe (30-40% of blood volume loss or 2000mls or more loss). The recommendations in this guideline [2] applies to women experiencing primary PPH of 500mls or more. The majority of cases of postpartum haemorrhage, that is, over 99% of cases, are primary PPH. Secondary PPH is defined as abnormal or excessive bleeding from the birth canal between 24 hours and 6 weeks postnatal period [1,2]. Secondary PPH is often caused by infection (for instance; from retained products of conception). However, rare causes are; gestational trophoblastic disease and uterine arteriovenous malformations, including pseudoaneurysms.

With women having birth outside of the hospital settings and early postpartum hospital discharge being a growing trend, PPH that presents to the emergency department may be either early or late. However, it is primary type that the investigators studied. PPH is a major cause of maternal morbidity and mortality and it is estimated that more than 125,000 women worldwide die of

PPH every year. It has been cited as a major cause of death in the UK, often occurring following caesarean section. In the UK the incidence is 2-11% [1]. There were 4,000 cases of severe bleeding in UK according to a more recent literature [3]. CEMACH (UK) and its predecessors regularly identified PPH as one of the main causes of maternal morbidity and mortality [4].

Since this study was conducted, some important related and relevant definitions have changed. At the time of the study, a low haemoglobin (Hb) or anaemia in pregnancy was defined as Hb of 10.5g/dl and this cut across all the three trimesters of pregnancy. Though the definition of PPH has survived over the past decades, that of anaemia has not changed. Recently, the RCOG Green-top guideline 47 [3] states that anaemia in pregnancy is defined as first trimester Hb less than 110 g/l; second/third trimester Hb less than 105 g/l and postpartum Hb less than 100 g/l, in line with British Committee for Standards in Haematology (BCSH) guidance.

On how intra-partum haemorrhage should be managed, RCOG [3] stated that in addition to major haemorrhage guidelines, obstetric units should have guidelines on criteria for red cell transfusion in anaemic women who are not actively bleeding. If the Hb is less than 70g/l in labour or in the immediate postpartum period, the decision to transfuse should be made according to the individual's medical history and symptoms.

Also on how postpartum haemorrhage should be managed, RCOG [3] stated that if the Hb is less than 70g/l in the postnatal period, where there is no on-going or threat of bleeding, the decision to transfuse should be made on an informed individual basis. However, these are relevant mainly in the management of the patients in hospital setting where resources are available for excellent clinical assessment of the women so that appropriate decision can be taken.

Aims and Objectives

This study aimed to investigate the incidence of primary PPH, management and outcomes and to learn if there are any peculiar challenges in the unit in relation to primary PPH. The study explored risk factors, adverse outcomes and associated risks and compared these with standards or guidelines and other published standard acceptable practice. It critically appraised our methods of estimation of blood loss in this unit.

Standards

- The Society of Obstetricians and Gynaecologists of Canada (SOGC) Clinical Practice Guidelines.
- WHO recommendations on the Prevention of Post-partum Haemorrhage.
- The Southampton University Hospital NHS Trust Guidelines, Feb 2008.
- Scottish Obstetric Guidelines and Audit Project; the Management of Post-Partum Haemorrhage.
- RCOG Green-top Guideline 52, May 2009, Minor Revisions in November 2009 and in April 2011.
- Oxford Handbook of Obstetrics and Gynaecology, 2013.

Materials and Methods

This is a retrospective study and 'systematic' review of the case notes of women who had deliveries and had primary PPH between 2007 and 2008 at the Labour ward/Delivery suite of the Department of Obstetrics and Gynaecology, Pilgrim Hospital, Boston, Lincolnshire, UK. The records of patients were retrieved from electronic data base. RCOG guideline [2] and other studies [4-9], from an extensive literature search were retrieved and recruited. The previous study proforma was systematically reviewed, modified and updated to form a new pro forma consistent with the standard practice with which to compare our practice with. An audit protocol was articulated and created. There was a clear time table set for the following study activities; the collation of data, review of pro forma, review of the first 5 case notes, review of the rest of the case notes, analysis of practice/ results and date for presentation. Case notes of these patients were systematically and carefully reviewed twice to ensure consistency in assessing the management these women received and in comparing it with the standard practice represented by the draft pro forma. There was co-operation with the Clinical Audit Department throughout the study.

All the stages of evolution of a clinical audit namely; stated aims and objectives; setting the standards; observing current practice (by review of the case notes); comparing our performance with targets; implementing changes and evaluation were met at the appropriate scheduled time scales on the study rota. We had reviewed the Pilgrim Hospital Monthly Maternity Statistical Run from 2005 to 2008 for information on trends. We had also conducted a preliminary review of the Birth Register of 2007-2008 with elimination criteria from the definition of primary PPH to identify the target population to be included in the study.

Target population included:

- a) Those women who had normal birth or instrumental delivery and had EBL of 500mls or more.
- b) Those women delivered by caesarean section with blood loss of 1000mls or more.

The inclusion of blood loss of 500mls for a normal birth as against the definition and 1000ml for caesarean section as against the definition was very likely due to the following:

- (i) We did not have a precise reproducible accurate method of estimation of blood loss at the time of study.
- (ii) Blood loss was more likely to be underestimated than overestimated.

Once the target population was identified, the investigators chose a study a population of 100 of these women and used a systematic approach to make sure that the study population clearly reflects with precision the target population. This was done as follows:

- i. Each of the 4 investigators had a group of 25 women each to study and each group comprised of 8 women who had normal birth; 8 vaginal operative delivery; 8 women who had caesarean section and additional woman with a mode of delivery randomly chosen by each of the investigators

but with that mode of delivery different from that randomly chosen by the 3 other investigators.

- ii. A systematic review of 100 case notes was performed to ascertain the management and outcomes. The investigations met formally 3 times and informally many times to articulate, review, update and implement the strategies for the audit work.
- iii. Contacts were made to the Clinical Audit Department for relevant support, which was given.
- iv. The relevant guidelines, previous review of cases of PPH in 2004, local protocol and standards stated were reviewed by the investigators.

Results

From the preliminary screening, the following specific data was collated

- a. The number of deliveries for 2007 was 1963 and that of 2008 was 2169.
- b. The total number of deliveries for the same period was 4132. The number of women delivered whose blood loss met the criteria for PPH were 390 or giving rise to an incidence of 9.44% (cf 2-11%) for the 2 years (2007-2008) or average incidence of 4.72% (cf 2-11%) for each of the 2 years.
- c. These 390 cases as stated constituted the target population. The number of women whose blood loss did not meet the criteria were 621 (15.03%) for the same time frame. 100 cases (25.64%) of target population had been chosen as our study population as stated.
- d. In 44 women (1.06%), the blood loss was recorded as a range of values and therefore the incidence cannot be calculated based on the two figures in the range and thus were excluded from the main study.
- e. Blood loss was not recorded in 35 cases (0.85%) of caesarean section, 9 cases (0.23%) of vaginal operative delivery and in 18 cases (0.43%) of normal birth. One of the normal births took place at home. The blood loss was therefore difficult to estimate in such circumstances. These women were also excluded from the main study. In one case (0.02%), the doctor and midwife conducting the delivery did not agree on a figure for blood loss and both gave different estimated blood loss.
- f. About 7 case notes (0.14%) were not available for detailed study but some basic data/information was collated from the Delivery Suite Register.
- g. Additionally, on a general management level, there appeared to be no significant issues relating to consenting for blood transfusion, approach to management of antenatal and postnatal anaemia, intra-partum and post-partum blood loss, as these appeared to be within acceptable standards.

Discussion

Causes of primary include the four Ts and more, namely in order of clinical relevance; Uterine atony (Tone, T, 90%), genital

tract trauma (Trauma, T, 7%), coagulation disorders (Thrombin, T), large placenta or retained placenta (Tissue, T), abnormal placental site, uterine inversion and uterine rupture. Any of the four Ts can in turn be caused by a lot of other problems. Uterine atony can be caused by uterine over distension from twin or polyhydramnios; prolonged labour; infection; retained products of conception; failure to actively manage thirds stage of labour and couvelaire uterus or uteroplacental apoplexy; from placental abruption. Genital tract trauma can be caused by tears, episiotomy, lacerations on the cervix and rupture of the uterus. Thrombosis or coagulation disorder encompass a broad spectrum of causes including; severe pre-eclampsia; placental abruption; sepsis; liver disease and autoimmune diseases. Inherited and acquired coagulation disorders are rare causes. Placental praevia, accreta and percreta cause primary PPH in addition to APH (Supplementary Material A, B & C).

The following antenatal risk factors determine PPH and they include; previous PPH, previous retained placental tissue; maternal Hb less 8.5g/dl at the onset of labour; high body mass index; parity of 4 or more, APH; uterine over distension from causes already stated; uterine abnormalities; low lying placenta and maternal age of more than 35. The importance of these factors lie in the fact that if they are, then it is good practice to advise the woman to deliver in a hospital unit with equipment and manpower for surgical management of PPH and blood transfusion.

The following intra-partum risk factors determine PPH and these include; induction of labour, prolonged labour, use of contractions stimulant like oxytocin; precipitate labour, caesarean section and vaginal operative delivery.

Interventions for managing blood loss in general

- 1) Empty uterus by delivering the baby and removing any retained products of conception;
- 2) Uterine massage to rub up contractions.
- 3) Medical management to increase strength of contractions.
- 4) Oxytocin 40iu infusion stat.
- 5) Ergot alkaloid (ergometrine) 500mcg IV or IM, may cause tinnitus.
- 6) Misoprostol 800-1000mcg (may cause diarrhoea).
- 7) Carboprost 250mcg stat, then every 15 minutes for 3 further doses, May be given intramyometrially at caesarean section.
- 8) Bimanual compression of uterus can stop blood loss.
- 9) Any genital trauma is to be repaired as soon as possible.
- 10) Uterine tamponade test with Bakri balloon; Cooke's balloon; Sengstaken-Blakemore tube or Rusch Balloon, if the blood loss continues. If bleeding stops in about 15 minutes after application, then it is therapeutic and no need to progress to a more invasive option which is 100-500ml of warm saline is infused into the balloon after it had been inserted into the uterine cavity and left for 12-24 hrs. It is therapeutic in about 80% and can also be performed at Caesarean section with or without under-sewing of the placental bed in cases of placenta praevia.

At laparotomy. the following can be performed;

- a. Over-sewing of Placental bed with or without Rusch balloon if the bleeding is entirely from the placental bed.
- b. If medical management is not working then uterine compression or braise suture like the B-Lynch or the Vertical compression sutures can be applied.
- c. a. Internal iliac artery or uterine artery ligation can be undertaken but 50% of cases end up with hysterectomy. The internal iliac artery ligation reduces blood loss in both uterine and vaginal branches of this important vessel, leading to reduction of 85% in pulse pressure, 50% reduction on blood flow which translates to 50% reduction in blood loss.
- d. Uterine artery embolization appeared to be an in that it is less invasive, preserve fertility and can target bleeding vessels. However, it is only available in few centres. It may not be possible to get patient transferred to radiology department or transfer equipment to Obstetric theatre and require a trained interventional radiologist.
- e. Aortic compression can be used to temporarily control blood loss pending a definitive management.
- f. Others intervention include safer and quicker subtotal hysterectomy and total hysterectomy if the bleeding is from lower segment or from major placenta, accreta or tears.

As a guide, the main contents of obstetric haemorrhage surgical equipment tray are;

Access and exposure:

- (a) Vaginal retractors (Breisky-Navratil, Heaney)
- (b) Sponge holding forceps
- (c) Scapel and blade
- (d) Spencer Wells Forceps
- (e) Scissors, tissue and cutting

Eye needles:

- a. Straight needles, 10cm
- b. Curved 70-80mm, blunt

Suture materials:

- a) polyglactin number 0
- b) polyglactin number 1
- c) polyglactin number 2
- d) Monocryl

Uterine/vaginal tamponade set:

- i. Vaginal packs
- ii. Kerlix gauze roll
- iii. Uterine balloon; Bakri, Rusch, Senstaken-Blackmore
- iv. Surgical glove, catheter.

Why study primary PPH? The various consequences of blood loss justify this and these consequences vary depending on the amount lost, speed of loss and the duration of the loss. They include; acute hypovolaemia or hypotension; shock with reduced organ perfusion; cardiovascular decompensation, which can be sudden and rapid; disseminated intravascular coagulopathy from washout phenomenon or loss of clotting factors; tissue hypoxia leading to anaerobic metabolism and metabolic acidosis; multi-organ dysfunction or failure; iatrogenic complications like volume overload from fluid infusions and multiple blood transfusions; pulmonary oedema from volume overload; various transfusion reactions; adult respiratory distress syndrome and hypopituitarism (Sheehan's syndrome).

Significant blood loss of 10-15% blood volume (500-1000ml) can be well tolerated by most young healthy females, and uncomplicated delivery often results in blood loss of more than 500mL without any haemodynamic compromise. The addition of "a 10% drop in haemoglobin levels" to the definition provides an objective laboratory measure. However, this is not helpful in acute situations since it can take hours for losses to create laboratory changes in red blood cell measurements.

In women with a low BMI or low Hb, a loss of 500mls can lead to haemodynamic compromise requiring prompt and appropriate management. Signs and symptoms of hypovolaemia (light-headedness, tachycardia, syncope, fatigue and oliguria) are also of limited utility as they can be late findings in a young, fit and otherwise healthy female. In the lead author's clinical experience, pulse rate is clinically found to be more relevant than blood pressure in the clinical assessment of the extent of blood loss especially in cases of occult blood loss which occur in cases of uterine rupture and concealed placental abruption. In this situation, the degree of haemodynamic compromise in the woman may be out of proportion to the estimated external and visible blood loss. As a result, any bleeding that has the potential to result in haemodynamic compromise or instability, if left untreated, should be considered a postpartum haemorrhage.

As stated in the results section, in 44 women (1.06%), the blood loss was recorded as a range of values and therefore the incidence cannot be calculated based on the two figures in the range and thus these were excluded from the main study. In the view of the lead investigator, investigators, estimated blood loss is supposed to be stated as a figure rather than range. Blood loss was not recorded in 35 cases (0.85%) of caesarean section, 9 cases (0.23%) of vaginal operative delivery and in 18 cases (0.43%) of normal birth. These errors were clearly highlighted by investigators and all the investigators agree that blood loss should be recorded in line with local protocol and other available guidelines. These documentations are relevant medico-legally, and also important for future studies and to learn from previous experience.

About 7 case notes (0.14%) were not available for detailed study but some basic data/information on these cases were collated from the Delivery Suite Register. However, this lack of availability of these case notes, the lead researchers believes, would not significantly affect the overall results and the recommendations that came as a result of this study.

Out of 100 notes selected for study about 7 notes were not

available for study. Some basic information on these women were included in this study, but were collected from delivery suite diary. Details of labour and delivery were thus not included. The data presented reflected the population of women managed. It also illustrated the care they received. There was no recorded maternal death from PPH during the period of study but certainly, morbidity was recorded. The later was measured by parameters including the length of hospital stay and blood transfusion received. Some women had units of blood ranging from 2 units to more than 4 units.

Staff appeared to be aware of the impact of PPH but there appear to be no clear rehearsed proactive approach on prevention and management primary PPH in the unit. There were no educational diagrams or illustrations in the obstetric theatre, labour ward or in the delivery room to constantly remind staff of the importance of primary PPH and what to do if the need arises. It appeared the local protocol for PPH was yet to be reviewed and updated in line with the 2 most recent Green-top Guidelines, the most recent of which was the one in May 2009.

Staff, especially registrars and midwives appeared in occasions to adopt their own methods of management and it is uncertain if these individual approaches have made any difference in improving patient's care and safety. Occasionally disagreement had arisen between medical staff and midwifery staff on the blood loss estimation and management of blood loss. These disagreements could be reduced if there was well rehearsed and regularly updated and strategically visible illustrative in the unit.

Recommendations

These recommendations were articulated from the extensive literature review cited and referenced in this study:

- 1) Appropriate reproducible way of measuring blood loss should be implemented to reduce to chance of underestimation or overestimation of blood loss with its subsequent implications. Suggested option is measuring the swab(s) before and after use to calculate the actual blood loss.
- 2) Proper documentation, classification and grading of blood loss to reduce the chance of substandard care and subsequent litigation. As noted in the study, some 621 deliveries were wrongly labelled as PPH by mistake. This is not acceptable in the opinion of the author and has consequent medico-legal significance.
- 3) Diagrams and illustrations of relevant and appropriate reproducible steps to be taken in the management of primary PPH, when to call a consultant, when to perform B-Lynch suture and total abdominal hysterectomy or uterine artery embolization should be placed in labour ward and obstetric theatre.
- 4) Rehearsed regularly updated protocol should be implemented and advertised in strategic points in the Unit.
- 5) Medical (Obstetric) review should be sought early by the attending midwife.
- 6) Other recommendations were based on the RCOG Guideline 52 of May 2009 (with minor revisions in November 2009 and April 2011).

Pages 5-16 and referral to this document is recommended:

1. Once PPH has been identified, management involves these four components, all of which must be undertaken namely:
2. Communication, resuscitation, monitoring and investigation and arresting the bleeding, all being performed simultaneously.

Minor primary PPH

These are the basic measures for MINOR PPH (blood loss 500–1000ml, no clinical shock and bleeding ceasing):

Consider venepuncture with 20ml syringe for:

- a) Group and screen
- b) Full blood count
- c) Coagulation screen including fibrinogen
- d) Pulse and blood pressure recording every 15 minutes.

Major PPH

Blood loss greater than 1000ml and continuing to bleed or in clinical shock:

Consider venepuncture with 20ml syringe for

- 1) Cross-match (6units of packed cells)
- 2) Full blood count
- 3) Coagulation screen including fibrinogen
- 4) Renal and liver function for baseline.
- 5) Monitor temperature every 15 minutes.
- 6) Continuous pulse, blood pressure recording and respiratory rate (using oximeter, electrocardiogram and automated blood pressure recording).
- 7) Foley catheter to monitor urine output.
- 8) Two peripheral cannulae, 14- or 16-gauge.
- 9) Consider arterial line monitoring (once appropriately experienced staff available for insertion).
- 10) Consider transfer to intensive therapy unit once the bleeding is controlled or monitoring at high dependency unit on delivery suite, if appropriate.
- 11) Recording of parameters on a flow chart such as the modified obstetric early warning system charts.
- 12) Documentation of fluid balance, blood, blood products and procedures.

Stopping or arresting blood loss

Causes for PPH ('the four Ts'):

- a) Tone (abnormalities of uterine contraction)
- b) Tissue (retained products of conception)
- c) Trauma (of the genital tract)
- d) Thrombin (abnormalities of coagulation)

Though the commonest cause of primary PPH is uterine atony, clinical examination must be undertaken to exclude other or additional causes:

- 1) Retained products (placenta, membranes, clots)
- 2) Vaginal/cervical lacerations or haematoma
- 3) Ruptured uterus
- 4) Broad ligament haematoma
- 5) Extragenital bleeding (for example, subcapsular liver rupture)
- 6) Uterine inversion.
- 7) When uterine atony is perceived to be a cause of the bleeding, the following mechanical and pharmacological measures should be instituted, in turn, until the bleeding stops: Bimanual uterine compression (rubbing up the fundus) to stimulate contractions.
- 8) Ensure bladder is empty (Foley catheter, leave in place).
- 9) Syntocinon 5units by slow intravenous injection (may have repeat dose).
- 10) Ergometrine 0.5mg by slow intravenous or intramuscular injection (contraindicated in women with hypertension).
- 11) Syntocinon infusion (40units in 500mls of Hartmann's solution at 125ml/hour) unless fluid restriction is necessary.
- 12) Carboprost 0.25mg by intramuscular injection repeated at intervals of not less than 15 minutes to a maximum of 8 doses (contraindicated in women with asthma).
- 13) Direct intramyometrial injection of carboprost 0.5mg (contraindicated in women with asthma), with responsibility of the administering clinician as it is not recommended for intramyometrial use.
- 14) Misoprostol 1000mcg rectally.

If pharmacological measures fail to control the haemorrhage, initiate surgical haemostasis sooner rather than later:

Intrauterine balloon tamponade is an appropriate first line 'surgical' intervention for most women where uterine atony is the only or main cause of haemorrhage. If this fails to stop the bleeding, the following conservative surgical interventions may be attempted, depending on clinical circumstances and available expertise:

1. Balloon tamponade. Haemostatic brace suturing (such as using compression suture/procedures described by B-Lynch or modified versions of the latter).
2. Bilateral ligation of uterine arteries.
3. Bilateral ligation of internal iliac (hypogastric) arteries.
4. Selective arterial embolisation by an interventional radiologist.

It is recommended that a laminated diagram of the brace technique be kept in obstetric theatre.

- a. Resort to hysterectomy sooner rather than later (especially in cases of placenta accreta or uterine rupture).
- b. A second consultant obstetrician should be involved in the decision for hysterectomy.

Standards for audit

- i. Monitor all cases with blood loss greater than 1000ml.
- ii. Appropriate management of women with previous primary PPH.
- iii. Documentation of management, especially with the timing of events for women who had primary PPH.
- iv. Appropriate management of labour and outcome in women with primary PPH.
- v. Notification to the risk management team for women with PPH.
- vi. Appropriate training of the obstetric team (midwifery and medical staff).

Recent advances and challenges

There are strategies to minimise the use of banked blood. This includes optimising pre-delivery Hb and minimising blood loss at delivery. Currently, there is no role for preoperative/pre-delivery autologous blood deposit and it is not recommended [10,11]. There appear to be a role for intraoperative cell salvage (IOCS). This is recommended for patients where the anticipated blood loss is great enough to induce anaemia or expected to exceed 20% of estimated blood volume [11-13]. However, consenting must be obtained for IOCS where possible. Its use in obstetric patients should be done by multidisciplinary teams who have developed regular experience of IOCS and also be subject to audit and monitoring.

Where IOCS is used during caesarean section in RhD-negative, previously non-sensitised women and where cord blood group is confirmed as RhD positive (or unknown), a minimum dose of 1500iu anti-D immunoglobulin should be administered following the reinfusion of salvaged red cells [3]. Additionally, it is recommended that a maternal blood sample should be taken for estimation of feto-maternal haemorrhage 30-40minutes after re-infusion in case more anti-D may be indicated.

Antifibrinolytics like tranexamic acid can be considered in treatment of major obstetric haemorrhage especially in centres not taking part in clinical trials [3]. There a role for recombinant factor VIIa (rFVIIa) therapy and its use may be considered as a treatment for life-threatening primary PPH, but should not delay or be considered a substitute for a live-saving procedure such as embolization, surgery, or transfer to a referral centre [3].

Recent literature [3] has stated there is role for near patient or point of care testing of coagulation. Centres that are using thromboelastography (TEG®, Haemonetics, Braintree, Massachusetts, USA) or rotation thromboelastometry (ROTEM®, Tem, Munich, Germany) for guiding blood transfusion during

major obstetric haemorrhage must ensure their transfusion algorithm protocol has been validated and that quality assurance measures are followed.

The use of fibrinogen concentrate in primary management is a subject of clinical research and not licensed in the UK for the treatment of acquired bleeding disorders [3].

Some women may decline to have blood or blood products. They need to be managed in a different way. Their Hb should be optimised prior to delivery to prevent avoidable anaemia which has been shown to reduce use of banked blood. In such women, consent/refusal of blood and components or other transfusion-sparing techniques should be discussed and documented during the antenatal period. This is considered a good practice for clinicians managing such patients, there is clear additional benefit from considering the following:

- a. The use of a Patient Blood Management (PBM) programme is recommended by AABB (formerly the American Association of Blood Banks), the Australian National Blood Authority and the National Blood Transfusion Committee, which covers England and North Wales. PBM involves an all-encompassing approach to avoid unnecessary transfusion by optimising preoperative/pre-delivery Hb, avoiding over-transfusion, using cell salvage where appropriate, accepting evidence-based lower transfusion triggers and using intravenous or oral iron supplements in women who are not actively bleeding and who have cardiovascular stability [14].
- b. It is important that an advance directive be completed and carried in the hand-held notes, although a woman should always be given the opportunity to change her mind about the use of blood products. The woman may wish to wear a 'no blood' wristband to make it clear to all members of the treating team that blood transfusion is not to be used [3].
- c. Use of pharmacological, mechanical and surgical procedures to avert the use of banked blood and blood components should be considered early in the care of such women and also others in general.
- d. IOCS has a role in the management of patients who refuse allogeneic blood transfusion current evidence supports the use of IOCS in obstetrics, which has been endorsed by several bodies and is likely to become increasingly commonplace [15].

Conclusion

From the findings stated in the results, it can be seen that the number of deliveries for 2007 was 1963 and that of 2008 was 2169. The total number of deliveries was 4132. The number of women delivered whose blood loss met the criteria for primary PPH were 390 or incidence of 9.44% (cf 2-11%) for the 2 years (2007-2008) or average incidence of 4.72% (cf 2-11%) for each of the 2 years.

There were 390 cases which constituted the target population. The number of women whose blood loss did not meet the criteria were 621 (15.03%) for the same time frame. 100 cases (25.64%) of target population were chosen as our study population. In 44

women (1.06%), the blood loss was recorded in a range, and therefore incidence could be calculated based on the two figures in the range and thus were excluded from the main study.

Blood loss was not recorded in 35 cases (0.85%) of caesarean section, 9 cases (0.23%) of vaginal operative delivery and in 18 cases (0.43%) of normal birth. One of the normal births took place at home. Therefore the blood loss would be difficult to estimate properly in such circumstances. These women were also excluded from the main study.

On a general management level, there appeared to be no significant issues relating to consenting for blood transfusion, approach to management of antenatal and postnatal anaemia, intra-partum and post-partum blood loss, as these appeared to be within acceptable standards.

This is a study of primary post-partum haemorrhage for a biennial period of 2007 to 2008. The study highlighted our unit's birth statistics and the incidence of post-partum haemorrhage for the period under study. It also highlighted areas, our department did well and areas that needed improvement. Clearly there was need to clarify the cut off for post-partum haemorrhage as some cases were wrongly classified as post-partum haemorrhage when they are not. There was also need for accurate documentation which has medico-legal significance and also relevant for future research so as to learn from previous experience.

This study was elaborate and revealing. It showed where the unit was in relation to the definition and management of primary PPH. The literature was reviewed and the recommendations

from these formed a stable versed template, pivot and high bar for future regular audits. We expect similar audit at two- yearly intervals to close any loop that may have been identified in previous similar studies.

This is also in line with the Clinical Negligence Scheme for Trusts (CNST) standard/clinical governance. CNST is a risk pooling scheme administered by the National Health Service (NHS) Litigation Authority (NHSLA) which handles clinical negligence claims made against NHS organisations where the incident took place on or after 1 April 1995. The trend of care is changing as new scientific evidence emerge, for instance; there are different cut off values for Hb to define anaemia in each trimester of pregnancy which was not the case some years ago and the introduction of near patient or point of care testing of coagulation.

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- b. Sandra Pygott, Midwife.
- c. Natalie Kendrick, Midwife.
- d. Mr. SM Aboel-Magd, Consultant Obstetrician and Gynaecologist

Supplementary Material A

Primary Post partum Haemorrhage for the Biennial Period of 2007-2008 in Boston, Lincolnshire, UK

Audit Protocol

Audit Lead: Dr AE Madu

Supervisor: Mr SM Aboel-Magd

Aims and Objectives:

- i. To study the incidence of postpartum haemorrhage, management and outcomes
- ii. To learn if there is any peculiar challenges in the Unit.
- iii. To study risk factors adverse outcomes and associated risks
- iv. To compare with standards or guidelines and other published standard acceptable practice.
- v. To critically appraise our methods of estimation of blood loss in this unit

Available Standards:

1. SOGC Clinical Practice Guidelines
2. WHO Recommendations for the Prevention of Postpartum Haemorrhage
3. The Southampton University Hospital NHS Trust Guidelines Feb 2008
4. Scottish Obstetric Guidelines and Audit Project; The Management of Postpartum Haemorrhage.
5. Other available guidelines (to be specified)

Target population:

- a. Women delivered with estimated blood loss of more than 500ml
- b. Time frame under study: 2007-2008.

- c. Method of Study: Systematic review of case notes using structured pro forma
- d. The aim is to review about 60 case notes randomly selected or all the noted depending on available man power and resources.
- e. Target date for Audit Presentation: July 2009

Supplementary Material B

Patients' Demographic Data

Table 1: Age (years), BMI (kg/M²) and parity.

Age							
<20	20-25	26-30	31-35	36-40	41-45	46-50	
10	28	30	21	10		1	
BMI							
<20	21-25	26-29	30-35	36-40	41-50	>50	Not stated
5	33	20	18	17	2		3
Parity							
0	1	2	3	4	>4		
56	25	14	2	1	2		

Table 2: Medical, Surgical and Family History.

None	Spina bifida	Thyroid disease	Gestational Diabetes/Diabetes	Anaemia	Hypertension
66	1	2	3	3	4
Surgical History					
None		Spina bifida		Others	
85		1		8	
Family History					
None		Diabetes		Hypertension	
80		11		4	

Table 3: Obstetric History e.g. previous PPH, etc.

None	Previous PPH	Caesarean Section	Twin Pregnancy	Hypertension in Pregnancy	Gestational Diabetes	Anaemia	PET/HELLP
83		4		5	1	1	1
Anomaly USS e.g. p/previa							
None		Placenta previa			Other {not relevant to PPH; choroids plexus cyst(1) bilateral echogenic foci(1), dilated renal pelvis(2) single echogenic foci(1)}		
86		5			5		

Table 4: Relevant antenatal problems.

None	APH	Obstetric Cholestasis	Twins	Blood Transfusion	Low Hb	Gestational diabetes	Increased AFI	Increased BP	Big Baby
81	7	1	3	1	7	1	2	3	1

Table 5: Investigations.

None	Gestational Diabetes	Repeat scans/check placental site/liquor
44	1	21

Table 6: Gestation prior to delivery (weeks) No labour/elective lower segment caesarean section (ELCS) and mode of initiation labour.

Labour and Delivery		
<37	37-40	>40
5	39	57
No labour/ELCS		
	11	
Mode of initiation labour		
Spontaneous	Induced	Induced/Augmented
65	24	6

Table 7: Pain relief in labour.

Pethidine	Entonox	TENS machine	Epidural or spinal or combined	Pudend-al block	General anaesthetic	Local anaesthetic	None
53	84	2	63	1	8	1	4

Table 8: Duration of labour (hours) and length of second stage of labour (hours) and Mode of delivery.

<5	5-10	>10	Not stated
22	40	16	3
Length of 2 nd stage of Labour (hrs)			
<1	1-2	>2	
39	15	15	
Mode of Delivery			
Normal Birth	Instrumental Delivery	CS	
34	33	26	

Table 9: Baby weight (kg).

<2.5	2.5-3	3-4	>4
3	7	63	21

NB: 2 twins. Sum total of the weight of twin give one weight. It is the total weight of the twins that is vital in PPH.

Table 10: Estimated blood loss and Blood Transfusion (units).

500-1000	>1000-1500	>1500-2000	>2000-2500	>2500-3000	
76	16	3	4	1	
Blood Transfusion (units)					
None	1	2	3	4	>4
76	1	9	5	2	2

Method(s) of estimation of blood loss: 1 was by visual (eyeballing), none by weighing of swabs and in 97 cases the method of EBL was not stated. The stated or probable cause of PPH 42 cases was by uterine atony; 22 cases were by trauma to the genital tract, 13 cases were by tissues, and 2 by thrombus. In 14 cases there case of PPH was not stated.

Table 11: Treatment of PPH.

Uterine massage/compression Not stated	Oxytocin-infusion	Syntocinon/Syntometrine/Ergometrine	Carboprost	Oxytocin bolus	PR misoprostol	Uterine tamponade.	Subtotal hysterectomy	Uterine massage / compression stated
42	66	15	6	80	3	0	0	15

Other documented forms of management instituted; bladder catheterization (2), re-suturing for lower segment caesarean section (1), suturing of uterine incision extension (2)

Medical staff involvement; 86 cases were managed by registrars, 22 cases by consultant, 7 cases by SHO. In 2 cases there was haematologist input and in 25 cases the anaesthetists (various grades) were involved.

Place of Management of PPH; 42 cases were managed in the delivery room while 56 were managed in the theatre.

Table 12: other complications (including operative complications).

MROP	Surgery	2 nd /3 rd degree tear	Shoulder dystocia	Blood transfusion	Labial haematoma	PLT transfusion	4 th degree tear	Placenta previa noted at birth
11	9	8	2	19	1	1	1	1

Supplementary Material C

Audit Pro-Forma

Management and Outcomes Primary Postpartum Haemorrhage for Biennial Period of 2007-2008 in Boston, Lincolnshire, UK

Patient Demographic Data Template:

Age BMI GA (booking) Rh Parity

Relevant Medical history

Relevant Surgical history

Relevant Family history

Relevant Social history

Anomaly scan

Antenatal problems:

Clinic attendances

Emergency attendances

Investigations: Scans, etc

Antenatal problems (state):

Labour and delivery:

No labour/ELCS

Mode of initiation labour; spontaneous induced

Pain relief in labour:

Pethidine

Entonox

Epidural

Duration of labour (hours): <5 5-9 10-15 >15

Mode of delivery: Normal delivery Instrumental delivery Caesarean section

EBL

Method(s) of estimation of blood loss:

Eye balling

Weighing swabs

Others

None stated

Stated or probable cause of PPH:

Uterine atony

Uterine trauma

Tissue

Thrombosis

Treatment of PPH:

Oxytocin infusion alone

Syntometrine

Bimanual uterine compression

Oxytocin

PR Misoprostol

Uterine Tamponade

Hysterectomy

Others (please specify)....

Blood Transfusion:

1 unit

2 units

3 units

4 units

>4 units (specify)

Medical staff involvement:

Registrar only

Consultant Obstetrician

Anaesthetist

Radiologist

Others (specify)

Place of Management of PPH:

Room

Theatre

Other complications (including operative complications):

Comments

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