GIG CYMRU NHS WALES
Bwrdd Iechyd Prifysgol
Betsi Cadwaladr
University Health Board

Report of Three External Independent Reviews into Eleven Cases of Massivie Obsetric Haemorrhage In Ysbyty Glan Clwyd

August 2023

Version 5.2
(Redacted)

Report includes first iteration of Combined Improvement Plan

Contents Page

1. Introduction

In August 2022 an Independent External Expert Review was commissioned to investgate materily 11 cases of Massive Obsetric Haemorraghe which occured in Ysbyty Glan Clwyd Maternity Unit, between January 2022 and July 2022. The review was carried out by a Consultant Obstetrican and Gynaecologist (Reviwer1a). Reviewer 1a provided the Health Board with 11 case review reports which were reviewed by a local team of Clnicians, Senior managers and Governance colleagues. An anaesthetic review of all the cases reviewed by Reviewer 1a was then completed by Consultant Anaesthetists Reviewer 1b. Concerns were rasied by the local Consultant Anaethetist as to the External Expert Reviwer's working knowledge of the All Wales Obs Cymru Protocol (2017 and 2021) as some of the recommendations where conterary to current national practice. Therefore a second review was commissioned led by Reviewers 2 Consultant Obstetrician and Consultant Anaesthetist from Cardiff and Vale University Health Board. The Second Review also provided the Health Board with 11 case review reports. The themes and summaries from both reviews are provided below and full reports are included as appendecies.

There are two of the eleven individual cases where a Breach of Duty has been identified by both reviews.

The findings and recommendations of both reviews have been collated into one overall improvement plan which will be monitoried by the Women's Service's Senior Leadership Team and assurance updates will beprovided to the Women's Service Board on a quarterly basis or until actions are completed and full assurances recevied.

2. First Review by Reviewer 1a
Summary of Cases August 2022

'I have been asked to prepare this review following a cluster of major obstetric haemorrhages (MOH) at Ysbyty Glan Clwyd (YGC) since January 2022. My comments will be divided into the antecedent factors preceding the MOH and the way the MOH was dealt with.

I have concerns about factors leading to the MOH in four cases. These are detailed in section 1.In case a) in respect of the delivery and failure to repair the uterine angle. In case b) there was a failure to consider uterine rupture in a differential diagnosis.

In case f) there was a gross delay in performing caesarean section with poor progression of cervical dilatation from 8 cm at 11.00 until delivery at 22.05. In case g) the midwife appears to have left the room following an initial brisk bleed.

Overall, management of the MOHs demonstrated a good standard of care. The documentation suggests good communication between midwives, registrars and consultants. There was no hesitation in consultants calling for help from consultant colleagues.

Generally, the standard of documentation in the records is extremely good. I am impressed that the post-partum haemorrhage event checklist has been completed to a high standard in most cases.

I do not see a pattern of individuals involved in repeated cases of MOH.

There is clear guidance on the management of PPH from the Royal College of Obstetricians & Gynaecologists (2016) and the All Wales Guideline (2017). These guidelines are clear and straightforward. There was generally good adherence to these guidelines.

An area that should be kept under review is the time taken to transfer a patient to theatre. I have already discussed the delay in undertaking caesarean section case f) and, arguably,

case i). In my opinion, there was a delay in transfer to theatre in cases j) and k). It is difficult to know if this is a sporadic issue or amounts to a theme.

I would draw attention to one theme. There appears to have been a delay in giving blood products in a number of cases, a), b), d) and e). It is important that blood and clotting products are replaced before the patient becomes haemodynamically unstable or disseminated intravascular coagulation (DIC) is established.

The decisions to perform hysterectomy in cases a) and b) and laparotomy in d) and j) were entirely correct. Action was in concordance with all the literature and advice that a hysterectomy in a massive obstetric haemorrhage should not be delayed such that it is performed in an irretrievable situation.

In summary, there were some individual actions which might have avoided MOH. Overall, there was prompt recognition of MOH, excellent documentation and excellent teamwork. Areas to be kept under

Note: Following local review it was noted that Reviewer 1a had used an out of date version of the Ob's Cymru All Wales guidance from 2017 and a request was made for him to review the latest guidance from 2021 and identify if this would materially change his review findings and recommendations. Reviewer 1a agreed to the request and provided an update:

Response for Reviewer 1a 7th September 2022 - Thank you for your e-mail of 22.08.22 enclosing the updated All Wales Guideline – Prevention and Management of Post-partum Haemorrhage. These guidelines do not materially alter my report. I would, however, note two areas of good practice consistent with the guidelines: Firstly there is excellent documentation in most cases of estimated blood loss from weighing of swabs and drapes. Secondly, there appears to have been good communication in virtually all cases between the midwifery and obstetric staff with anaesthetists.

1. REFERENCES

Royal College of Obstetricians and Gynaecologists, Green-top Guideline No 52, December 2016 Prevention and management of post-partum haemorrhage

NHS Wales. All Wales Guideline. Prevention and Management of postpartum haemorrhage. 2017

Please note that the full Report is included in Appendix 1

3. Anaesthetic Review by Reviewer 1b following Reviewer 1a's Review Summary of Cases January 2023

I have read the conclusions of Reviewer 1a in his review of these cases. I am in agreement with him, and have not reproduced his conclusions in details here. As an anaesthetist, I share his concern that there was a delay in giving blood and/or blood products in four cases. As Reviewer 1a states, it is important that blood and clotting products are replaced before the patient becomes haemodynamically unstable or DIC is established.

Quality of care

The management of any complex clinical case, but perhaps especially haemorrhage in obstetric patients, is a difficult process that is almost impossible to do perfectly. While there are guidelines available, management of each case needs to be bespoke due to differences between Patients and also their pathologies. In addition, there has to be a complex interaction within the multidisciplinary team, which can be difficult to always achieve. While perfection should be strived for, one has to accept that this is likely to be difficult for any hospital to attain with every case.

With the above in mind, and having studied the cases discussed here closely, I am confident that the overall level of care provided by the hospital and the teams working on labour ward was probably above, rather than below, average for a UK hospital. Like Reviewer 1a, I have been impressed by the evidence of prompt recognition of bleeding, excellent documentation, and excellent teamwork. I am also impressed by the regular use of viscoelastometry, which was used more consistently than it is in my own hospital. In addition, the action of the hospital to commission a review of these cases suggests that good patient care is a managerial priority within the hospital.

Nonetheless, there is benefit in the hospital taking account of problems which occurred in these cases, so that future care of patients can be improved further.

Themes

In four cases, there was a delay in the transfusion of blood and/or blood products, and/or a delay in giving sufficient intravenous fluids. In the first case the delay in administering

blood products resulted, on the balance of probabilities, in the need for a hysterectomy; this was extremely unfortunate, especially in view of the patient still being a teenager.

It follows that the greatest service improvement will be achieved by the hospital having training and systems in place to ensure that intravenous fluids, blood, and blood products, are given in a timely manner in cases of obstetric haemorrhage.

I consider the other issues arising as being less important, but nonetheless still needing to be addressed. These include: ensuring that all patients have a name band at all times; ensuring that appropriate blood samples are taken and the results sought; and not administering spinal anaesthesia to inadequately resuscitated patients. The last of these three, not administering spinal anaesthesia to inadequately resuscitated patients, ties in with the importance of timely administration of intravenous fluids, blood and blood products.

Summary

In summary, I think in many instances the hospital provided a good level of care to these patients. However, a delay in giving blood, blood products, and/or adequate intravenous fluids was a common problem. In one instance this failure, on the balance of probabilities, resulted in the need for a hysterectomy in a teenager.

In addition, anaesthetists should be wary of employing spinal anaesthesia in patients who have not been fully resuscitated after haemorrhage.

Please note that the full Report is included in Appendix 2

4. Second Review by Reviewers 2
Summary of Cases June 2023

Even in the best performing units the rate of PPH > 2500mL is about 5-6/1000 https://pubmed.ncbi.nlm.nih.gov/33992094/

Overall the quality of the documentation was good in the antenatal and delivery period It was difficult to see from the notes however the Hb and management of anaemia which is important to reduce the risk of PPH. Overall the OBS Cymru documentation was excellent and overall I have to commend the midwifery and other maternity staff for their diligent documentation.

There were some cases where appropriate blood was not ordered in a timely way but mostly this did happen and I commend the blood bank for their timely response to requests for blood and clotting products. The anaesthetic staff attended rapidly and were clearing part of the MDT.

Their use of the ROTEM was excellent and resuscitation appropriate. Resuscitation of the women with very large PPH by consultant anaesthetic staff was appropriate and lifesaving. It was not clear from the notes when consultant anaesthetic staff were called to on-going PPH out of hours.

I think it should be reinforced that consultant anaesthetic staff should be involved early and their voice heard when dealing with severe PPH. There were clear occasions where the severity of the bleed was underestimated despite cardiovascular instability. There was a much higher use of uterotonics and lower use of mechanical methods to manage uterine atony than our experience. There seemed to be a reluctance overall to manage atonic PPH with mechanical technics that are effective at reducing PPH volume. RCOG guidelines.

This appears to have led in some cases to definitive management in theatre being delayed, where good anaesthesia can improve PPH management. Simple measures such as bimanual uterine compression seems to be sparingly used in most of the cases especially in the earlier stages whilst further investigations are underway and waiting for uterotonics to work, or more senior help to arrive. This Hospital seems to routinely use IM Syntometrine for active management of 3rd stage of labour. This is out with the NICE/UK, All Wales

Maternity & Neonatal Network Guidelines. Prevention and Management of Postpartum Haemorrhage, Reference No; Version Number: 2.8 guideline.

However, apart from the Side-effects of the drug such as nausea, vomiting and an increase in Blood Pressure; this routine practice is extremely unlikely to be a contributory factor to the massive PPH in this case series.

On the contrary in case of Case G, no Syntometrine or Ergometrine was used at all although there were no contraindications such as raised BP. There were cases where on-going bleeding which was well recorded or recognition of risk factors for PPH (i.e. Retained products of conception) was not escalated rapidly especially the necessity to go to theatre.

There were also examples of reluctance to perform laparotomy despite on-going bleeding or cardiovascular instability.

There appears to be a theme of somewhat sub-optimal surgical skills amongst some of the Senior Obstetricians. More surgical training of some senior obstetric staff in insertion of Bakri Balloon should be considered.

Please note that the full Report is included in Appendix 3

5. Overall Recommendations made by the External Independent Reviewers

First Review

a) Consideration needs to be given to the issue relating to delay in administering blood products require review by Anaesthetics

b) Consideration needs to be given to the Breach of Duty indicated for delay in providing / administering blood products and the delay in going to theatre

c) A review of the case of Case E needs to be competed to review where a delay in undertaking a Caesarean Section has been highlighted

d) The Midwife involved in the case of Case G need to undertake a reflection as it appears for the review that they M/W left the room (it is unclear from the records if anyone else in room)

e) A review of the case notes for Case I and Case J needs to be completed as it was identified that there may be an issue of missing notes.

f) Case J needs to be reviewed with Specialist Registrar on actions taken in relation to the issue raised as to need to extend the incision into uterus (33wk, head no engaged)

g) There is a need to review the concern that has been identified in the review as to the length of time taken from the decision for a C/S to getting to theatre.

h) Consideration need to be given to gaining agreement on the techniques to be used and specific training required when dealing with an impacted fetal head to ensure safe delivery.

i) Incidents, findings and learning to be shared across the Women's Service

Second Review

j) Consideration and education of staff regarding appropriateness of IOL for ‘recurrent Reduced Fetal Movements’ in presence of all objective, normal fetal and maternal parameters as shown by close monitoring, at gestations earlier than 39/40.

k) Consideration of further training in management of Impacted Fetal Head at a C/S, in terms of anticipation, preparation, calling for help and use of Tocolysis such as Terbutaline 250ugm SC. Reduction in RCOG GTG No 73, Management of Impacted Fetal Head at Caesarean Birth, June 2023, Scientific Impact paper.

l) The ownership and maintenance of overall perspective of a woman on the wards by a Consultant Obstetrician and making an individualised plan.

6. Overall Summary of the External Independent Reviewers

To ensure complete openness and transparency, two External Independent Reviews have been completed of eleven cases of Massive Obstetric Haemorrhage at Ysbyty Glan Clwyd in 2022. The second review was requested following concerns raised by a Senior Consultant Anaesthetist in relation to the findings of the first Review and their knowledge and understanding of the Obs Cymru Protocol (2017 & 2021). The second review was carried out by consultants based in South Wales having working experience of the Obs Cymru protocol.

Both Reviews have clearly identified that the documentation reviewed overall was of a very good standard, which included the use of the Obs Cymru documentation.

The overall conclusion from the three reviews, although not all issues found in all Reviews, are as follows,

There is a high use of uterotonics and a reduced use of mechanical methods when dealing with a MOH cases. There were clear delays in some cases in the administration of blood products and delays in women being transferred to theatre. There appeared to be a gap in skills amongst Consultant Obstetricians in relation to the use of the Bakri Balloon which may require training to be provided. There was an issue with lack of an agreed technique and procedure, when dealing with an impacted fetal head, which again may require training for some staff.

All of the reviews identified that they did not find any patterns of incidents related to individual practitioners in the MOH cases. The reviews identified that there had been a Breach of Duty in two cases, which had led to procedures which could have been avoided, but which became necessary to preserve the life of the woman.

The completion of the independent reviews has produced a robust overall review and report of the eleven MOH cases, with the second review in general, supporting the findings of the first review.

7. Combined Improvement Plan

Combined Improvement Plan

Two External Reviews of Eleven Cases of Massive Obstetric Haemorrhages at Ysbyty Glan Clwyd

Ref.	Issue identified from First Review in 2022	Action	Lead for the action	Date of completion
a.	Consideration needs to be given to the issue relating to delay in administering blood products require review by Anaesthetics	External review reports to be shared with senior anaesthetists for review and provision of opinion on findings.	Director of Midwifery	31/08/2022 **Completed**
		External Review report to be shared with teams who attended the review meeting for the first review by Reviewer 1a and Reviewer 1b.	Clinical Governance Lead	31/08/2023 **Completed**
b.	Consideration needs to be given to the Breach of Duty indicated for delay in providing / administering blood products and the delay in going to theatre	Cases identified by external reviewer to be flagged with Legal and Risk.	Clinical Governance Lead	31/08/2022 **Completed**
c.	Need to share learning	Cases to be used as scenario training for staff	Practice Development Midwife	01/01/2023 **Completed**
		Develop ½ day Symposium across the three unit. Need support to release staff to attend Support needed from Medical Director to cancel activity	Clinical Governance Lead & Labour Ward Lead YGC	01/01/2023 **Completed**

d.	A review of the case of ET needs to be completed to review where a delay in undertaking a Caesarean Section has been highlighted	Case to be reviewed with specific focus on C/S timings.	Labour Ward Lead YGC	31/08/2023 **Completed**
Ref.	**Issue identified from First Review in 2022**	**Action**	**Lead for the action**	**Date of completion**
e.	The Midwife involved in the case of NW need to undertake a reflection as it appears for the review that they M/W left the room (it is unclear from the records if anyone else in room)	Matron to review case with M/W and clarify	Inpatient Matron YGC	31/08/2022 **Completed**
f.	A review of the case notes for Case I and Case J needs to be completed as it was identified that there may be an issue of missing notes.	Case notes to be reviewed to identify if concern valid.	Inpatient Matron YGC	15/09/2022 **Completed**
g.	The case of Case J needs to be reviewed with Specialist Registrar on actions taken in relation to the issue raised as to need to extend the incision into uterus (33wk, head no engaged)	Case to be reviewed with SpR on actions taken	Labour Ward Lead YGC	31/09/2022 **Completed**
h.	There is a need to review the concern that has been identified in the review as to the length of time taken from the decision for a C/S to getting to theatre.	Labour Ward Lead to share emails with Director of Midwifery	Labour Ward Lead YGC	31/08/2022 **Completed**
		Check on current process to be made with Labour Ward coordinators	Inpatient Matron YGC	31/08/2022 **Completed**

i.	Consideration need to be given to gaining agreement on the techniques to be used and specific training required when dealing with an impacted fetal head to ensure safe delivery.	Impacted Foetal Head intervention technique to be added to PROMPT training.	National PROMPT team	From September 2022 **Completed**

Ref.	Issue identified from First Review in 2022	Action	Lead for the action	Date of completion
j.	Share information of incidents and findings	Overarching report to be developed and produced for Sept PSQ with external and internal reviews being included (1st review report	Clinical Governance Lead	15/09/2022 **Completed**
		To be added to Newsletter	Clinical Governance Lead	15/09/2022 **Completed**
k.	Challenges / clarification identified from the first external review report	Challenges/Clarifications in the first review to be shared with external reviewer. (use of latest MOH All Wales Guidance)	Director of Midwifery	31/08/2022 **Completed**

Ref.	Issue identified from Second Review in 2023	Action	Lead for the action	Date of completion
l.	Consideration and education of staff regarding appropriateness of IOL for 'recurrent Reduced Fetal Movements'	Review of current IOL guidelines to be completed in view of recommendation	RFM WCD Authors	31/10/2023

	in presence of all objective, normal fetal and maternal parameters as shown by close monitoring, at gestations earlier than 39/40.	and any changes identified to be undertaken as per the policy on Policy.		
m.	Consideration of further training in management of Impacted Fetal Head at a C/S, in terms of anticipation, preparation, calling for help and use of Tocolysis such as Terbutaline 250ugm Sub Cutaneous. Rducation in RCOG GTG No 73, Management of Impacted Fetal Head at Caesarean Birth, June 2023 Scientific Impact paper.	A review of the current guidance and for the management of an impacted fetal head to be completed.	Labour Ward Leads YGC/YG/YMW	31/10/2023
		Case to be reviewed with SpR on actions taken	Labour Ward Lead YGC	31/08/2023
		Any new or additional training identified for staff in relation to the management of the impacted fetal head is to be developed an implemented.	Labour Ward leads and College Tutors Professional Development Midwife	30/09/2023
n.	The ownership and maintenance of the overall perspective of a woman on the wards by a Consultant Obstetrician and making an individualised plan.	Issue to be raised with the Consultant body and discussion held as to current and future working practices in relation to the issues raised by the reviewers.	Clinical Directors Women's Services	31/09/2023

Appendix 1 – Reviewer 1a's Full Report
June 2022

Key Points from Individual Case Reviews

In this section the reviewer highlights the key points from each individual case.

a Case A (Breach of Duty Case)

This case raises concerns about the performance of the caesarean section. In particular it is not clear why there should have been poor access given that the patient was under general anaesthesia. The findings prior to transfer to theatre suggest that severe impaction of the fetal head was unlikely. Therefore difficulty in delivery of the fetal head, leading to the attempted breech delivery, is difficult to explain.
In the first instance the left uterine angle was not repaired adequately.
Difficulties were recognised and assistance was called for appropriately.
There was delay in giving blood products.
Eventually, there was no choice but to perform a hysterectomy as a life-saving procedure.

b Case B (Breach of Duty Case)

Following delivery there was prompt recognition of major obstetric haemorrhage. The initial working diagnosis of atonic uterus was reasonable. However, there was no real consideration given to alternative diagnoses. Given the history of previous caesarean section, uterine rupture had to be in the differential diagnosis. There were inappropriate delays in administering blood products, transfer to theatre and performance of the laparotomy.

By the time decision to perform a hysterectomy was made there was no choice. This was undertaken as a life-saving manoeuvre.

c: Case C

There was prompt recognition of the diagnosis of placental abruption. MOH is a recognised complication of placental abruption. Although there was some delay in transferring the patient to theatre for what should have been a category 1 caesarean section, this is unlikely to have caused harm.

d: Case D

There was prompt recognition of large and brisk post-partum haemorrhage (PPH). There was also prompt transfer to theatre with senior help being called appropriately.

There was delay in giving blood. It is likely there was an element of DIC, notwithstanding the normal ROTEM results. The patient was under transfused per-operatively as evidenced by the need for two units of red blood cells on 29.04.22 and two units on 30.04.22 in addition to per-operative transfusion.

Given the loss vaginally, there was no choice but to perform a laparotomy and insert a B-lynch suture.

e: Case E

Appropriately, labour was stimulated with syntocinon following presentation with rupture of membranes and pyrexia. Case E was slow to establish in labour but once established, labour progressed well.

She suffered an MOH due to an atonic uterus. Long labour and possible sepsis were risk factors.

This was recognised promptly and she was treated appropriately with uterotonics. Her condition settled.

Appropriately, blood was taken at 03.15. Haemoglobin was 79 g/l, but the result does not appear to have been noted.

The following morning her haemoglobin was 62 g/L. The haemoglobin result should have been checked following the test at 03.15 and, arguably, blood given at an earlier stage. However, no harm arose.

f: Case F

There was a gross delay in undertaking caesarean section until 22.05. The cervix at 15.30 was 8 cm dilated, i.e. the same as at 11.00 with the head 2/5 palpable and the head 1 cm above the ischial spines. Caesarean Section should have been strongly recommended at that stage. The delay in caesarean section is likely to have contributed to the MOH.

I have not had sight of the PPH checklist but the operation records suggest that all appropriate manoeuvres were performed.

g: Case G

The patient was at increased risk of PPH. She had suffered a PPH in a previous pregnancy. Induction of labour and labour were managed appropriately.

There was a moderate loss of 525 ml up to 11.15 (following delivery at 11.07). The patient should not have been left in the room alone until 11.25 when significant blood loss was seen.

Thereafter there was appropriate management with prompt transfer to theatre. She had one unit of blood during the post-natal course.

h: Case H

PPH is a recognised complication of both twin delivery and retained placental tissue. This was recognised promptly and dealt with appropriately. I have no criticism of the management.

i: Case I

The patient underwent a very prolonged induction process starting with an unfavourable cervix. The possibility of Caesarean Section for failed induction of labour should have been discussed but it was reasonable to continue and progress into labour.

There is an apparent absence of documentation between 00.05 and 06.10 when the cervix remained at 8 cm dilatation. Vaginal examination should have been performed two hours after 00.05 to confirm the cervix was dilating 1 cm per hour and then when full dilatation had been reached. If not, syntocinon should have been instituted.

At 08.50 consideration should have been given to caesarean section but it was reasonable to continue with labour as there was some progress.

There was uterine extension and PPH following prolonged labour and Caesarean Section near full dilatation. The PPH was managed appropriately with consultant input.

j: Case J

No intravenous fluid appears to have been given following the initial collapse at 07.30. Following a second collapse at 08.30 a prompt diagnosis was made of intra-abdominal haemorrhage by the Consultant Obstetrician, at 08.55. There was, however, delay in transfer to theatre and starting a laparotomy between 08.55 and 10.25.

It is possible the patient had increased risk of haemorrhagic events due to chronic liver disease. I have no criticism of the uterine extension at caesarean section. This was repaired by a Consultant.

There is an apparent absence of documentation in respect of the midwifery notes and observation charts following the caesarean section. The PPH check list was not completed.

k: Case K

Retained membranous tissue was recognised promptly following delivery. Initial measures were appropriate. There was delay in taking the patient to theatre for manual removal of the placenta and membranes. Ostensibly, the patient declined transfer to theatre but there should have been a clear explanation of the need for a procedure under anaesthesia. Other aspects of the case were managed appropriately.

Thematic Review

In this section the reviewer outlines the themes identifies and provides a summary of the review.

I have been asked to prepare this review following a cluster of major obstetric haemorrhages (MOH) at Ysbyty Glan Clwyd (YGC) since January 2022. My comments will be divided into the antecedent factors preceding the MOH and the way the MOH was dealt with.

I have concerns about factors leading to the MOH in four cases. These are detailed in section 1.In Case A in respect of the delivery and failure to repair the uterine angle. In Case B there was a failure to consider uterine rupture in a differential diagnosis.

In Case F there was a gross delay in performing caesarean section with poor progression of cervical dilatation from 8 cm at 11.00 until delivery at 22.05. In Case G the midwife appears to have left the room following an initial brisk bleed.

Overall, management of the MOHs demonstrated a good standard of care. The documentation suggests good communication between midwives, registrars and consultants. There was no hesitation in consultants calling for help from consultant colleagues.

Generally, the standard of documentation in the records is extremely good. I am impressed that the post-partum haemorrhage event checklist has been completed to a high standard in most cases.

I do not see a pattern of individuals involved in repeated cases of MOH.

There is clear guidance on the management of PPH from the Royal College of Obstetricians & Gynaecologists (2016) and the All Wales Guideline (2017). These guidelines are clear and straightforward. There was generally good adherence to these guidelines.

An area that should be kept under review is the time taken to transfer a patient to theatre. I have already discussed the delay in undertaking caesarean section Case F and, arguably, Case I. In my opinion, there was a delay in transfer to theatre in Cases J and J. It is difficult to know if this is a sporadic issue or amounts to a theme.

I would draw attention to one theme. There appears to have been a delay in giving blood products in a number of Cases, A, B, D and E. It is important that blood and clotting products are replaced before the patient becomes haemodynamically unstable or disseminated intravascular coagulation (DIC) is established.

The decisions to perform hysterectomy in Cases A and B and laparotomy in Cases D and J were entirely correct. Action was in concordance with all the literature and advice that a hysterectomy in a massive obstetric haemorrhage should not be delayed such that it is performed in an irretrievable situation.

Summary

In summary, there were some individual actions which might have avoided MOH. Overall, there was prompt recognition of MOH, excellent documentation and excellent teamwork. Areas to be kept under review are the timely administration of blood products and transfer to theatre in such cases.

Note: Following local review it was noted that Reviewer 1a had used an out of date version of the All Wales guidance and a request was made for him to review the latest guidance in use and identify if this would change any of his review. Reviewer 1a agreed to the request and provided an update:

Response for Reviewer 1a 7th September 2022 - Thank you for your e-mail of 22.08.22 enclosing the updated All Wales Guideline – Prevention and Management of Post-partum Haemorrhage. These guidelines do not materially alter my report. I would, however, note two areas of good practice consistent with the guidelines: Firstly there is excellent documentation in most cases of estimated blood loss from weighing of swabs and drapes. Secondly, there appears to have been good communication in virtually all cases between the midwifery and obstetric staff with anaesthetists.

REFERENCES

Royal College of Obstetricians and Gynaecologists, Green-top Guideline No 52, December 2016 Prevention and management of post-partum haemorrhage

NHS Wales. All Wales Guideline. Prevention and Management of postpartum haemorrhage. 2017

a) SUMMARY OF MEDICAL INFORMATION CASE A

Case A was aged 19 when she was delivered of her first child by emergency caesarean section on 12.04.22 and subsequently underwent a hysterectomy for major obstetric haemorrhage (MOH). There was no relevant general medical history. She had taken drugs of abuse and was a smoker.

Index pregnancy
Expected date of delivery (EDD) 25.04.20
BMI 31

Case A was initially booked for antenatal care at Liverpool Women's Hospital.

She was seen on a number of occasions for decreased fetal movements (DFM). There are also references to decreased growth. CTG traces were reassuring.

09.04.22 Well
Fetal movements good now
CTG last evening: Normal
Contractions: Irregular
Plan: For CTG this morning followed by VE to assess any change

?ARMable

11.40 Cervix posterior, -3 [cm above ischial spines]
Although head very low [sic]
Soft, 1 cm long, 1 cm dilated

10.04.22 09.05 Planned for IOL
Still having DFM [Decreased fetal movements]

10.55 Cephalic 3/5
Cervix 1 finger dilated
3 cm long, thick posterior
Sweep [membranes]

11.04.22 08.50 Propess [given at] 22.50 on 10.04.22

23.01 Contracting 2:10
Cervix 2 cm dilated
For ARM [artificial rupture of membranes] tomorrow

12.04.22 13.00 ARM with consent
Cervix 2 cm dilated, 0.5 cm thickness
Station -2
Clear liquor draining

14.14 Epidural sited

17.50 Cervix 5 cm dilated, fully effaced
Station -1

18.00 Seen by Mr [redacted], Dr [redacted]

Substance abuse, 38+1
IOL
DFM/growth ↓
Heart rate 118
Temperature 37.2
CTG baseline 140 originally
Gone up to 160 bpm
Accelerations present
Repeat bloods, fluids, VE in two hours
If bloods show signs of infection – low threshold for CS

19.51 Reviewed Mr [redacted]

CTG: Baseline tachycardia 160, (previous 140 bpm)
Variability > 5
Accelerations +
No decelerations
Contractions 4:10
Feels dry and thirsty

Urine output – concentrated, poor volume
Already had 1litre IV fluids and oral fluids
Venous blood gas: Base excess -6.1
Lactate 4.7
WBC 19.8 (previously 14.7)
Haemoglobin level 112 (previously 107)
Cervix 8 cm dilated, small rim of cervix posteriorly, station -1
No caput LOT – LOA [left occipito transverse to left occipito anterior]
Impression: Infection progressing
Apyrexial
Stat 250 ml fluid bolus then continue 125 ml/hour
Monitor temp regularly hourly
VE two hours

20.15 CRP 112
VE at 20.50 – fully for trial/expedite delivery
Another patient in theatre currently

20.20 Cervix 9 cm dilated

20.26 Temperature 38.7
IV paracetamol, blood cultures, IV cefuroxime and metronidazole, IV fluids at 250 ml/hour
Prepare for theatre – if not fully by 20.50 for emergency C- section

21.10 Seen by Dr [redacted]
Progressed to 9 cm
Has raised temperate this evening
Currently on IV antibiotics
Blood culture sent
PE [abdominal examination] uterus = dates
Cephalic head: 0/5
Cervix: Rim felt
Anterior on side
Difficult to assess position as patient not comfortable with pain relief
Station: Spines
Caput +
Plan: Needs adequate pain relief
Examine after pain relief at 9.30 if not fully for EUA in theatre and proceed to C-section

21.40 Cervical rim all round
Station at spines
Caput +
Plan: EUA + trial + proceed to C-section

Timings written in retrospect by Midwife [redacted]
22.01 Arrived in theatre

22.15 Sat up for spinal
22.29 Spinal complete
22.43 Tilly still feeling pain
Decision made for GA
22.48 GA complete
22.50 Surgery commenced
22.52 Uterine incision
22.57 Delivery of baby born in poor condition taken straight to resuscitaire
Apgars 1 and 9 at 1 and 5 minutes
[Birth weight 3030 grams
Cord arterial pH 7.17
Base excess -7.2, cord venous pH 7.36
Base excess -5.3]
23.00 Placenta delivered
Appears complete
23.14 Mr [redacted] called to assist at Dr [redacted] request
23.16 Code out for MOH
00.17 Surgery finished
00.25 Placed in lithotomy for through examination
MBL [measured blood loss] 3561 ml
00.55 [redacted] [?Mr [redacted]] called at the request of Dr [redacted] and Mr [redacted]
00.57 [redacted] [Dr [redacted], Consultant Obstetrician] called at the request of Dr [redacted] and Mr [redacted]
01.08 Decision to re-open C-section wound

There is clear documentation of blood and blood products transfused as well as uterotonics used on the obstetric haemorrhage chart. In summary, 12 units of blood were given between 00.20 and 06.37. 10 units of fibrinogen between 01.55 and 03.18 and one unit of platelets at 03.27, an oxytocin infusion and bolus' Syntometrine and carboprost.

<u>Further timings are documented, I assume by the midwife</u>
01.26 Central line sited
01.41 Vascular surgeon present
01.33 [I assume 01.43] Noradrenalin started – infusion
01.48 Bakri balloon in situ
02.05 For hysterectomy – decision made
02.32 Uterus out
05.21 Abdomen closed
05.25 Final MBL 9242 ml

<u>Operation record, Dr [redacted]</u>
Indication: Pathological CTG with maternal sepsis
Cervical rim still present all around, caput present, LOT position
Decision for caesarean section
Spinal not effective so converted to GA
Surgery started at 22.50
Pfannenstiel incision to skin
Loose UV fold open and bladder pushed down
Lower segment incision
Head low and impacted, rectus muscle very tight

Attempted delivery by breech but since access poor re-attempted flexing head and delivering baby [delivery summary states that delivery was by Dr [redacted]]
Head delivered at 22.57
Baby delivered and handed over to neonatal team and placenta delivered completely
Right uterine angle secured
Left uterine angle extension, attempted to secure a very big bleed at present and significant bleeding
First layer done and second layer continued
Bleeding from angle persistent and blood loss nearly 100 ml [sic, I assume 1000 ml]
1 gram tranexamic acid given at this point
I requested the consultant on-call Mr [redacted] to come in
Mr [redacted] arrived in theatre at 23.20 by this point the left extension had been properly secured and bleeding was mostly under control
We took few additional stitches to the lower uterine segment of the UV fold
Blood loss at this point was 2.5 litres after ensuring haemostasis abdomen closed in layers
While doing vaginal toilet nearly one litre clots removed so I decided to put patient in lithotomy position to check for possible tear in cervix or vagina
Cervix traced, so anterior wall tear sutured but rest of cervix and vaginal wall appeared intact
Bleeding arising from the uterus
Blood loss at this point approached 5 litres so called for third Consultant, Mr [redacted] and Dr [redacted]
Also jointly decided that re-laparotomy to be done to check for any source of bleeding
Mr [redacted] and Dr [redacted] arrived at around 01.00 and re-examined vagina and cervix
No obvious tear noted so we decided to proceed with a laparotomy at 01.38
No obvious source of bleeding identified but bleeding persistent from cervix, uterine tone good
Bakri balloon inserted by Dr [redacted]
350 ml injected and carboprost 250 mg given at this point
Bleeding persistent after 10 minutes so decision for hysterectomy done jointly by all four consultants
Hysterectomy performed by Mr [redacted] and Dr [redacted]
See Mr [redacted] notes about hysterectomy
Oozing persistent at the right lateral wall and bladder base which was secured by Mr [redacted]
All pedicles checked before closure
Surgicel and Floseal applied to the vault
Drain inserted
No suction
Abdomen closed in layers
Staples to skin
Total blood loss 9242 ml
Patient received 14.5 litres of crystalloid, 2.5 litres of colloid, 10 RBC, 10 grams of fibrinogen, 1 unit of platelets, 3 grams of tranexamic acid
Cell saver 623 ml transfused back to patient

Mr [redacted] notes
Called 01.20
Called in for massive PPH at CS – MOH
Mr [redacted], Dr [redacted], Dr [redacted], Dr [redacted] at table
Abdomen closed
PV bleeding assessed
Joined in
Abdomen opened and after Bakri balloon try proceeded to hysterectomy by mutual agreement
Post-natal uterus not [?oedematous]
Tubes and ovaries
No intra-abdominal bleeding and posterior uterus intact
Multiple pedicles but not tubes and ovaries – conserved
Attempt to close vault with some cervical remnant
Initial haemostasis then further ooze from bladder base and left pelvic sidewall [illegible words]
Left pelvic sidewall
Floseal
Methylene blue check [to bladder – no leak]

Mr [redacted]
Received call from obs theatres at 23.14
Arrived in theatre at around 23.24
On arrival MBL around 2 litres
Uterus had already been closed in two layers by Dr [redacted]
Diagram showing bleeding from left uterine angle
Flap of tissue separate from uterine sutures
This was determined to be part of uterine tissue and oversewn and bleeding from angle secured
Abdomen closed by Dr [redacted]
MBL at that point 2.5 litres

Dr [redacted] swabbed vagina and immediately approximately 1 litre of blood gushed out
Very difficult to see source of bleeding and ?extension of tear to vagina
Cervix held with Rampley's [sponge forceps] appeared to come from cervix/vaginal tear
Sutures taken with No.1 vicryl but unable to stop bleeding
Decision by myself to re-open bleeding as bleeding seems to come from inside uterus
By this time MBL reaching 5 litres – asked for Dr [redacted] and Mr [redacted] to be contacted
Asked for vascular surgeon as anticipating that uterine artery or internal iliac artery ligation may be needed
[redacted] and [redacted] arrived while we were getting ready to open abdomen
Legs put up and bleeding stopped
PV examined by [redacted] and Bakri balloon inserted
Abdomen re-opened – clean abdomen, no blood or free fluid, uterus well contracted
Waiting 10 minutes after inserting Bakri balloon – bleeding PV did not stop
Decision to proceed for hysterectomy – MBL at this time 6 litres

Mr [redacted] and Dr [redacted] performed hysterectomy with Dr `[redacted] and myself assisting
Bladder tested with Methylene blue
No leak
Urine very poor output ≈ 200 ml but clear
Contacted haematology consultant and discussed clinical situation and they advised Factor VII if all other measures failed
Bleeding continued even after hysterectomy from peritoneal margins and left inter-pedicle areas – secured with haemostatic sutures
Surgicel and Floseal applied to vault
Drain inserted – non-suction and abdomen closed in layers
Patient received 14.5 litres of crystalloid, 2.5 litres of colloid, 10 RBC, 10 grams of fibrinogen, 1 unit platelets and 4 units FFP, tranexamic acid 1 gram x 3
Final MBL = 9242
Cell saver 623 ml transfused back to patient
Patient went to ITU

16.04.22 12.00 Transferred back from ITU
Pale and tired
Haemoglobin 71

17.04.22 Ms was complained of vomiting

20.25 For CT scan

18.04.22, 00.45 <u>Surgical review</u>
Distended abdomen
Sluggish bowel sounds
For CT abdomen and pelvis

18.04.22 05.00 <u>Dr [redacted]</u>
CT chest, abdo and pelvis: Small bowel obstruction, [illegible words] ?fluid in abdo ?blood
Pelvic collection 7 x 3 cm
No obvious infection
Second area ?Surgicel ?collection of 5 x 5

09.30 <u>Mr [redacted], General Surgery Consultant</u>
Nasogastric tube – drainage of large volume of bilious fluid
CT: Dilated SB [small bowel] with transition point in RIF [right iliac fossa] (No past history of lap appendix)
Likely ileus but possible adhesional obstruction
Possible [illegible word]
Plan: Correct [illegible word] imbalances
(sodium potassium, magnesium, calcium)
Nasogastric tube
Stop opiate

19.04.22 07.00 Case a was informed of Covid positive result

20.04.22 Case A underwent laparotomy. I have not had sight of the operation record but there is subsequent reference to laparotomy for small bowel obstruction.

21.04.22 Just returned from HDU

24.04.22, 09.10 Feeling well
Complaining of dizziness when standing up
Soft non-tender abdomen

25.04.22, 23.25 Clinical rash noted between buttocks
Skin appears to be starting to break and Miss L complaining of pain

29.04.22 Mr [redacted], Consultant Obstetrician & Gynaecologist
Re-laparotomy and release adhesions
Last surgery 20 April
Covid positive, day 11 today
Bowel sounds +
Diagram showing right side of abdomen tender but no guarding
Improving

09.05.22 Discharged home

b) SUMMARY OF MEDICAL INFORMATION CASE B

Case B was aged 34 when she had a vaginal delivery of her fifth child on 14.04.22. She had had two miscarriages. There was no relevant general medical history. She was a non-smoker.

Obstetric history

2012 Delivery of male infant by elective caesarean section for breech presentation
Birth weight 7lb 6oz

2014 Vaginal delivery of male infant
Birth weight 7lb 13oz

2016 Vaginal delivery of male infant
Birth weight 7lb 5oz

2019 Vaginal delivery at home of male infant following quick labour
Birth weight 7lb 6oz

Index pregnancy

The expected date of delivery (EDD) 17.04.22
BMI 29

24.01.22 Antenatal clinic
Keen for VBAC [vaginal birth after caesarean]

Aware of the risks

The antenatal course was uneventful.

14.04.22 Admitted following pre-labour rupture of membranes (PROM) at 01.10
Case B was Covid positive
The initial CTG was reassuring.

09.00 Ward round Ms [redacted], Consultant Obstetrician, and Dr [redacted]
Getting contractions every four to five minutes
No scar tenderness
Should woman induction start immediately, or wait for 24 hours……
Woman agrees to wait for 24 hours

15.00 Dr [redacted], Obstetric Registrar
Asked to review CTG
Few V shaped decelerations (two to three) over 60 minutes
Baseline not changed
Contracting 1-2:10 minutes
No scar tenderness
Cervix 4 cm dilated
No forewaters
Plan: Continuous CTG

17.20 Some deep decelerations
Cervix 4 cm dilated

17.50 Dr [redacted]
Some V shaped decelerations
?loss of contact
Contracting 2:10
Shown CTG to Mr [redacted] (Consultant Obstetrician)
No scar tenderness
For FSE and continuous monitoring

18.45 Contractions becoming more intense and closer together

19.05 Standing up
Feeling pressure ++ all of a sudden

19.15 Vertex visible

19.31 Normal vaginal delivery of live male
Pale and floppy
Dried and stimulation given
Taken to resuscitaire
Apgars 8 at 1 minute
Syntometrine IM given

19.37 Placenta delivered

Another gush of PV bleed
Perineum checked – intact

19.40 Syntometrine IM (second) given
Blood loss > 1000 ml

Midwifery records written in retrospect at 20.45

19.44 MBL [measured blood loss] 1062 ml
Obstetric emergency call put out

19.45 1 gm tranexamic acid given
Reg present
Bimanual compressions
Placenta appears complete

19.46 Anaesthetist, SHO and Midwife [redacted] present
Hemabate given

19.47 IV fluids commenced

19.50 Catheter inserted by Reg
Pulse 130
Attempting to get a BP reading

19.50 IV synto commenced
MBL 1864 ml
Venflon inserted
Rotem obtained then Lowri moved
Venflon out
MOH call-out

19.53 800 mcg misoprostol given
Second anaesthetist present still attempting to obtain a BP reading

19.58 Second Hemabate given

20.00 Pulse 128
Second bag IV fluids commenced

20.02 MBL 2021 ml

20.03 Ergometrine given IM

20.05 Further clots expelled PV

20.07 Legs in lithotomy
Theatre check list completed

20.10 Second dose of tranexamic acid given
Attempting to obtain bloods

MBL 2174 ml
Pulse 134 bpm

20.14 Third Hemabate given
Two x further blood attempts
Rotem sample insufficient

20.19 FBC, Us&Es, LFTS, coag, G&S, Rotem and blood gas obtained
MBL 2374 ml
Decision to go to theatre

20.23 Bleeding stopped
Mr [redacted], Consultant Obstetrician wishing to observe loss prior to transfer to theatre

20.28 Fourth Hemabate given
Pulse 130

20.32 Mr [redacted] remains present to observe
Transfer to theatre not required at present

20.36 For 4 gm fibrinogen and an arterial line

20.38 Second Venflon fell out

20.50 Haematologist, Dr [redacted] aware of events

Entry written in retrospect at 20.30 by Dr [redacted]
Asked to review
MOH post-vaginal delivery
MOH pathway started
Examined the woman
Uterus atonic
Large amount of clots evacuated from the uterus
Blood loss around 1800 ml
On MOH, PPH pathway already [illegible word] patient received two doses of Syntometrine, 1 gm of tranexamic acid
Required carboprost 250 mg IM, misoprostol 800 mcg PR
Uterine massage continued
Bladder catheter
Urine output approximately 100 ml
IV fluids started
Call sent for Mr [redacted] to attend
Mr [redacted] present in room
Ergometrine given IM
Uterine massage continued – still atonic
Third dose of carboprost given
Mr [redacted] examined
Speculum no tear
Trickling from the uterus continued
Uterine massage continued

Second dose of tranexamic acid given
IV fluids continued
Uterus well contracted
Bleeding minimal now
BP 196/45, heart rate 115, oxygen sats 100%
EBL 2370 ml

21.15 Haemoglobin 73 g/L
Lactate 5.14
4 units of blood requested
Some PV bleeding seen vaginally
Mr [redacted] decided to move to theatre

Further timings from midwifery records

20.59 Fibrinogen 1 gm commenced
Pulse 126 BP 67/45

21.20 To theatre
PV loss weighed 300 ml
Total 2789

21.21 On to theatre trolley
Pre-oxygenating

21.22 Blood loss arrived
No name band

21.31 GA
First unit commenced

21.35 Lithotomy began

21.42 MBL [measured blood loss] 3389 ml

21.50 200 ml in Bakri balloon

22.07 No bleeding seen on scan
Plan for ITU
To observe, stabilise
Central line required

22.10 Lactate -7.06
pH 7.173
Haemoglobin 93 g/L
Base excess -13.9
Mr [redacted] asked if he wishes for further help
Mr [redacted] present
Happy at present

22.10 ?Bakri balloon not in situ currently – plan to re-position balloon

22.25 Balloon now in situ

23.00 Mr [redacted] into room to talk to partner and give update

23.10 ITU not yet ready to receive patient
Anaesthetist providing care in theatre
BP still remains ↑↓
Drain checked
40 ml loss in drain
Catheter draining minimal urine

23.25 Anaesthetist unhappy with BP
Remains low and dropping
Further abdo scan performed by Mr [redacted]
Collection of blood at fundus
Mr [redacted] requesting Mr [redacted]

23.40 Mr [redacted] retrospective note
I did ultrasound scan to help insert balloon catheter

23.44 Decision for open surgery

23.58 Knife to skin

15.04.22 00.03 6 unit blood commenced

00.10 Mr [redacted] contacted as [illegible words] Mr [redacted] and Mr [redacted]

<u>Entry written in retrospect by Mr [redacted] on 03.05.22</u>

……anaesthetic registrar difficulty in obtaining good IV access with large cannula
There was difficulty in obtaining blood for FBC, Us&Es, LFT, coagulation, profile and Rotem
She has already bled two litres when I arrived due to atonic PPH Uterus was massaged
She already had received IV Fluids, syntocinon, Syntometrine, carboprost x 2, misoprostol and tranexamic acid
Patient was conscious and oriented
I was informed placenta is completed
On examination the uterus was not well contracted
Speculum examination did not reveal vaginal or perineal tears Urometer inserted
Uterus massaged and bimanual compression given
Given ergometrine, another two doses of carboprost and tranexamic acid
Anaesthetic consultant Mr [I assume Dr] [redacted] present
Rotem result fibrinogen 10
Fibrinogen 4 gm given
With concern to managing uterus well contracted but no active bleeding

Despite the above patient complains of dizziness with associated tachycardia and hypotension therefore decision made to transfer to theatre
I obtained consent for EUA+/- manual evacuation of retained placental tissue +/- Bakri balloon insertion +/- repair of cervical, perineal tear
In the theatre under GA examination performed
No evidence of vaginal perineal tear
Cervix assessed in its entirety – no cervical tear
Uterus was relaxing in between and further bleeding noticed
Manual removal of tiny amount of placental tissue with some membranes
Uterus empty
Caesarean section scar felt intact
Bakri balloon inserted and inflated with 350 ml of sterile water
Vagina packed with ribbon gauze
Second consultant Mr [redacted] present in theatre
Mr [redacted] performed a scan to determine the location of uterine balloon
Noted balloon in the lower part of the uterus
No free fluid noticed within the abdominal cavity
Bakri balloon deflated and re-inserted under ultrasound guidance and confirmation of the right position
Uterus felt contracted
No active vaginal bleeding
At MDT discussion in theatre between [redacted], [redacted] and anaesthetic consultant Mr [redacted]
Decision made to transfer to ITU
Whilst waiting for ITU bed, consultant anaesthetist mentioned patient requiring a lot of vasopressin to maintain her blood pressure
I repeated an ultrasound scan of her abdomen
Uterine balloon in the correct position
I was unable to identify free fluid inside the abdomen
Noticed collection/haematoma lateral to the uterus on the left side
Due to the patient unstable and haematoma decision made to proceed to laparotomy and hysterectomy
Second Consultant Mr [redacted] in agreement for decision
I have informed her husband regarding decision……..

15.04.22 <u>Examination under anaesthesia and Bakri balloon insertion [and sub-total hysterectomy] Mr [redacted]</u>

…….Findings uterine rupture in the left side of previous caesarean section scar
Large left broad ligament haematoma 10 cm x 5 cm
Right ovary and fallopian tube appear normal
Left ovary and fallopian tube oedematous but appear normal
Infundibular pelvic ligaments transfixed with No.1 Vicryl
Vesicovaginal peritoneum dissected and urinary bladder reflected
Uterine on each side ligated with No.1 Vicryl
Sub-total hysterectomy performed by dissecting the cervix
Cervix closed with No.1 Vicryl as continuous interlocking sutures
Extension of the left side of the caesarean section scar under the broad ligament and to the lower part of the cervix

Minimal constant oozing from the left lateral pelvic sidewall
Mr [redacted] attended and took haemostatic stitches with 2.0 Vicryl on the cervical extension after identifying the ureter on the left side
Applied pressure on the left lateral pelvic sidewall in between the anterior and posterior leaf of the broad ligament
Bleeding eased……
MBL 5039 ml
Plan: ITU care

Massive obstetric haemorrhage chart
Uterotonics and blood products given:
Tranexamic acid 2 gm
Oxytocin 10 units
Ergometrine 500 mcg
Syntometrine
Oxytocin infusion
Misoprostol 800 mcg
Carboprost 6 doses
Fibrinogen 5 gm
Red cells 8 units between 21.31 and 22.04

15.04.22 04.10 Mr [redacted]
Had sub-total hysterectomy for PPH
Patient still having low BP and tachycardia
Rotem normal
Suspected intra-abdominal bleeding
Plan made to return her back to theatre for exploration
Explained to her partner the need for re-laparotomy
Contacted vascular surgeon and requested to attend
Also spoke to Mr [redacted] who kindly agreed to attend

15.04.22 Laparotomy, Mr [redacted] and Mr [redacted]
Previous notes of vascular surgeon and notes from me [I assume Mr [redacted]] have been lost by sudden computer re-boot
Phoned by [redacted] re need to return to theatre
Agreed
Haemodynamic instability continued
Prepared for vascular surgeon, Dr [redacted] on way to YGC
PV exam – no bleeding at all after vagina mopped
Abdomen re-opened – 200-300 haemoserous fluid as protocol
Pressure applied with pack to left side of pelvis
No active bleeding – generalised serous oozing
Left ovary engorged and infarcted with left ovarian veins dilated
Ureter identified away from operative field
Mr [redacted] in theatre – no major active bleeding
Incision extended for access with rectus muscle divided partially on left
Agrees with conservative approach at this point
Coag normal
Agrees with salpingo-oophorectomy and same undertaking by [redacted]

Specific advice not to place drain in similar patients encountered in vascular surgery
[redacted] discussion, [redacted], [redacted], [redacted], [redacted], Dr [redacted] and [redacted] with supporting teams – plan agreed

16.04.22 19.45 Case B was transferred from ITU

19.04.22 Discharged home

c) SUMMARY OF MEDICAL INFORMATION CASE C

Case C was aged 30 when she was delivered of her first child by emergency caesarean section for placental abruption on 23.04.22. There was no relevant general medical history. She was a non-smoker.

Index pregnancy

This pregnancy was conceived with IVF
Expected date of delivery (EDD) 28.04.22
BMI 27

Case C attended regularly for antenatal care and underwent serial ultrasound scans. Induction of labour was planned for 40 weeks gestation.

23.04.22 19.00 Hospital admission
History contracting every five to 10 minutes since 16.00
No abdominal tenderness

19.30 Cervix thick, 1.5 to 2 cm dilated
CTG re-commenced

20.05 Discussed latent phase and benefits of going home

20.45 Baseline 160 bpm
Decelerations present with contractions

21.04 Dr [redacted], Locum Registrar

CTG pathological
Uterus – mild tenderness
Cervix 2 cm dilated
< 0.5 cm long
ARM [artificial rupture of membranes]
Blood stained liquor +++ (frank blood)
Impression: APH [antepartum haemorrhage] with ?secondary to placental abruption
Emergency caesarean section discussed and offered – ok with plan
Discussed with Mr [redacted]

22.13 Transferred to theatre

22.27 Anaesthetics start

22.52 Surgery start

22.54 Uterus incision

22.55 Emergency C-section of live girl in good condition
(Birth weight 3370 gm)
Apgar scores 9 and 10 at 1 and 5 minutes

22.58 Placenta delivered
Continued to bleed

23.30 Mr [redacted] called for bleeding
By the time he arrived

I have not had sight of the operation record. The anaesthetic chart indicates that the procedure was performed under regional anaesthesia.

PPH checklist
The chart indicates measured blood loss of 600 ml at 22.50 increasing to 2146 ml at 00.00
Uterotonics including oxytocin 10 units, Syntometrine, oxytocin 40 units infusion and misoprostol were given

24.04.22 09.50 Post-emergency caesarean section placental abruption
Feeling well
Haemoglobin 100 gm/L

d) SUMMARY OF MEDICAL INFORMATION CASE D

Case D was aged 29 when she was delivered of her second child on 28.04.22. There is no relevant general medical history. Her medical history included anxiety and depression.

Obstetric history

2011 Ventouse delivery of female infant at 40 weeks gestation
Birth weight 7lb 12oz

2012 Surgical termination of pregnancy

Index pregnancy

Expected of delivery (EDD) 16.04.22
BMI 21.5

25.04.22 Membrane sweep

28.04.22 03.50 Contracting 1:2

I have not had sight of the labour records

06.34 Normal vaginal delivery of live girl
Case D on all fours position

06.35 Syntometrine 1 ml given IM

06.38 Case D assisted to turn on to back
As turned large gush of blood
Call bell rang for assistance

06.39 Further PV large gush continues
Continues to bleed
Cord cut and clamped
Delivery of placenta
Emergency bell pulled

06.40 Midwife [redacted] present with Reg (unnamed) and Dr [redacted],

06.43 Syntometrine second dose given
Second cannula inserted
Vaginal assessment by reg
Uterus continues to be not contracted
Transfer to theatre requested by reg

07.50 Case D transferred to obstetric theatre

09.50 <u>Entry written in retrospect</u>

Emergency call bell at 06.38
Heavy with large clots ++ after spontaneous vaginal delivery
Placenta delivered
IV access x two
Requested urgent blood done and group and save
Explained to Case D there is continuous bleeding with consent
For tranexamic acid
Foley's catheter inserted
Uterus atonic
Syntometrine, carboprost given
EBL 1700 ml
Urgent transfer to delivery suite
Continued to bleed
Decision to transfer to OT [operating theatre] directly with midwife – informed Dr [redacted] to urgently review
In OT at 07.50
In OT in lithotomy examination

MBL 2018 ml
Large clot removed
Uterus atonic
Repeat carboprost given
In view of persistent bleeding and blood > 2 litres explained to Case D and examination very uncomfortable need for EUA
Procedure risk of laparotomy and proceed as uterus remains atonic explained
Consent taken
IV antibiotics given

Further midwifery timings

07.05 Lithotomy
Placenta complete, membranes ragged
07.08 Decision for GA
07.21 Dr [redacted] present
07.27 GA performance
07.35 Dr [redacted] commenced vaginal assessment and procedure
08.04 Blood loss now 3003
Blood not available
08.07 Decision made for laparotomy
Dr [redacted] requesting assistance from Mr [redacted]
08.30 Bakri balloon inflating
08.34 First unit blood completed
08.35 Mr [redacted] present and scrubbed
08.40 Bakri balloon again by Mr [redacted]
08.45 Blood loss 3288 ml
Second unit blood completed
09.05 B-lynch suture by Dr [redacted]
09.39 Procedure completed and dressing on
Syntocinon infusion running
Vagina pack in situ for 24 hours
09.43 Haemoglobin 97
Lactate 3.45

28.04.22 Laparotomy Dr [redacted] and Mr [redacted]

Dr [redacted] called from home
Arrived obs theatre approx. 07.20
Para 1 vaginal delivery MBLU [Midwifery Led Birth Unit] delivery followed by rapid PPH
?EBL 1.7 litres
On arrival awake in lithotomy
MBL 2210 ml plus ?in delivery room
MOH call already in obs Cymru in progress
Had Syntometrine IM x 2, syntocinon IV bolus infusion and 3 x carboprost and TA [tranexamic acid]
Request continue carboprost at 15 min intels and second TA
Fundus firm well contracted
GA

Vagina NAD, cervix checked with multiple sponge forceps NAD
Manual exploration of uterine cavity
No retained placenta
Empty
PPH bloods including Rotem sent
Normal Fibtem
Continued trickle in uterus appears to be relaxing so decision for Bakri balloon
Bakri inserted with 350 ml but expelled to vagina
Re-inserted, expelled again
Intermittent continued slight tricky with small clots continued so decision for laparotomy
Second Rotem
Normal Fibtem
2 units red blood cells given intra-op
Second Consultant [redacted]
Low transverse incision
Routine opening
No bladder abnormality
[Part of the operation not copied]
Mr [redacted] arrived
Initial Mersilene tape around cervix
Bakri re-inserted under vision
Tape tightened and vaginal pack to maintain situ
350 ml to Bakri
Uterus remains boggy so uterine buttress suture to good effect
Observe for total 30 minutes with abdo open
No ongoing bleeding
Mersilene cervical tape removed
Routine closure

<u>Post-partum haemorrhage chart</u>
Uterotonics given:
06.43 Syntometrine
06.58 Oxytocinon infusion
08.35 Ergometrine
08.50 Misoprostol
8 doses of carboprost
3 doses of tranexamic acid
Measured cumulative blood loss 3375 ml
2 units red blood cells given

28.04.22 19.00 Doing well
Haemoglobin 88 at 14.00

29.04.22 02.00 Second unit of blood commenced

17.45 Beginning to mobilise

30.04.22 14.25 Haemoglobin 69
Transfused 2 units

16.00 Home later today

e) SUMMARY OF MEDICAL INFORMATION CASE E

Case E was aged 21 when she was delivered of her first child on 09.01,22. Her medical history included a childhood back injury. This was documented in the anaesthetic obstetric clinic as soft tissue injury with no significant problems with the low back. Ok to have epidural/spinal. There was no other relevant medical history.

Index pregnancy

Expected date of delivery (EDD) 07.01.22
BMI 22.2

Case E had a number of antenatal attendances with a variety of complaints.

31.12.21 Ultrasound scan for symphysio fundal height > 97th centile
Estimated fetal weight (EFW) with scan 3495 gm
Informed risk of PPH , shoulder dystocia, stillbirth, cord prolapse
Cervix 3 cm dilated
Induction of labour booked 10.01.22

08.01.22 SROM [spontaneous rupture of membranes] at 08.00, varyingly documented as 08.00 and 20.30
Covid positive

09.01.22 00.13 Dr [redacted]
Temperature 38 ◦C
Presentation
Repeat now – 37.6 ◦C
Irregular contractions 1:3:10
Cephalic 4/5
Cervix 1 cm long, 2 cm dilated
Impression: Spontaneous latent phased labour
IV antibiotics
Commenced AOL [augmentation of labour] with syntocinon

02.00 Syntocinon infusion commenced

09.38 Cervix 3 cm dilated
Contractions 4:10

12.00 Cervix 4 cm dilated

16.00 Cephalic 2/5 palpable
Cervix 6 cm dilated

18.20 Cephalic 1/5 palpable
Cervix 8 cm dilated

19.15 Vertex visible and advancing

19.28 Normal delivery of live male, delivered in good condition

19.43 Placenta and membranes delivered
Gush of blood when Case E moved
Emergency call bell put out
Syntocinon 50 IU in 45 ml normal saline
Commenced at 10 ml/hour
Atonic uterus
Uterus rubbed up
Contraction whilst help arrived
Obstetric team present in room

19.50 MOH call put out

21.05 Dr [redacted]
Anaesthetist present
Uterus 25/40 so not contracted
Uterine massage
Actively bleeding +++
Blood clot in vagina removed
First degree perineal tear
IV tranexamic acid 1 gm, IV access (second), IV syntocinon 5 units
Rotem
MOH protocol activated
Carboprost 250 mcg IM
Indwelling catheter
Misoprostol 800 mcg
MOH 2559 ml

Post-partum management check list was completed

Case E was also treated with intravenous antibiotics

10.01.22 03.15 Bloods obtained by anaesthetist (haemoglobin 79 g/L)

06.55 No complaints
Mobilising
Commence oral iron
For RBC transfusion if symptomatic for anaemia or if persistent pyrexia

11.00 Haemoglobin 62 g/L
Dizziness on walking
Feels better at rest
For 2 units of red [blood cells]

11.01.22 Haemoglobin 81 g/L
She prefers oral iron therapy

f) SUMMARY OF MEDICAL INFORMATION CASE F

Case F was aged 22 when she was delivered of her second child by emergency caesarean section on 23.01.22 for delay in the first stage of labour. Her medical history included anxiety and depression treated with sertraline. There was no other general medical history. She was a non-smoker.

Obstetric history

2020 Delivery of stillborn male infant at 36 weeks gestation following feticide for microcephaly

Index pregnancy

Expected date of delivery (EDD) 03.02.22
BMI 29

Antenatal care appears to be uncomplicated.

22.01.22 19.10 For ARM following PV bleed post-coital
Irregular tightenings
No further PV bleeds
No SROM

19.50 Cervix 2 cm dilated
Membranes intact

20.50 ARM [artificial rupture of membranes] performed

23.01.22 00.20 Epidural now sited

00.55 Cervix 3 cm dilated

01.30 Registrar review [previous examinations noted]
Contracting 3-4:10 already strong
Review two hours from last VE
If changed significant between can withhold syntocinon
If change not significant can start syntocinon
Aim for contractions for contraction 3-4:10

03.00 Cervix 3 cm dilated

03.15 Syntocinon commenced

07.00 Cervix 6 cm dilated

11.00 Cervix 8 cm dilated
OP presentation
Head at spines

15.35 Dr [redacted]
Reviewed 15.30
CTG normal
Contracting 2-3:10
Cervix 8 cm dilated, OP, caput +, no moulding
Station -1
Clear liquor
Options discussed
1. VE in two hours
2. Emergency CS
Wishes to wait for two hours
Plan: Aim for 3-4 contractions in 10 minutes

17.40 Dr [redacted]
Cephalic 2/5
Cervix 9 cm dilated, LOP, caput +, no moulding, station -1
Clear liquor
VE in two hours

19.30 For VE in ten minutes [I have not had sight of subsequent labour records until the timings recorded by the midwife]

Timings recorded by midwife

21.00 Anaesthetist present to consent for theatre
Reg and consultant present to consent for code 2 CS

21.22 Arrived in theatre

22.04 Uterine incision

22.05 Time of birth – live male born in good condition
Cried at delivery
[Birth weight 3520 grams]
Syntometrine given IM

22.15 Case F feeling sensation

22.18 GA to continue surgery

Written in retrospect as care with MOH [major obstetric haemorrage]

22.05 Oxytocinon IV given post-delivery

22.05 Syntometrine given IM

22.05 Tranexamic acid given

22.10 MBL 720

22.24 Carboprost 250 mcg

22.25 Total MBL 1169 ml

22.30 Total MBL 1506 ml
MOH call put out

22.34 Second Syntometrine given
Further doses of carboprost given

23.50 Total MBL 2019

24.01.22 00.00 Case F extubated

23.01.22 <u>Emergency caesarean section, Dr [redacted] and Mr [redacted]</u>
Examination in theatre
Cephalic 1/5
Cervix 8 cm dilated, vertex presentation, ROT [right occipito transverse] station -1, caput +++, no moulding
Procedure commenced by Dr [redacted]
Transverse incision on the lower abdomen
Abdomen opened in layers
Uterovesical fold identified
Site and bladder reflected
Transverse incision on the lower segment
Baby delivered as cephalic without difficulty
Placenta delivered by CCT – completed
Uterine angle secured
Blood loss 750 ml
Brisk bleeding
Therefore Mr [redacted] took over and the rest of the procedure completed by Mr [redacted]
Uterus exteriorised
Uterus closed in two layers with No.1 Vicryl
Uterus atonic
Uterus massaged
Uterotonics given
Syntocinon bolus followed by Syntometrine, syntocinon infusion
Carboprost x 4
Tranexamic acid x 2
Despite initial uterotonic uterus atonic therefore gave intramyometrial carboprost
When blood loss exceeded 1500 ml major obstetric pathway activated
Uterus contracted
Haemostasis confirmed
Rotem normal
MBL 2018 ml

Good urine output, clear
PR misoprostol 800 mcg

I have not had sight of the post-partum haemorrhage chart. However, there is no documentation on the anaesthetic record to indicate that the blood products were required.

25.01.22 Haemoglobin 75 g/L
Cellulitis on right buttock
Haemoglobin 75 g/L

26.01.22 Ferinject infusion

Ms W appears to have made a good post-operative recovery.

g) SUMMARY OF MEDICAL INFORMATION CASE G

Case G was aged 30 when she had a vaginal delivery of her third child on 30.01.22. She suffered a major obstetric haemorrage (MOH) and underwent examination under anaesthesia (EUA) in theatre.

Her medical history included gastric bypass in 2010. She suffered from depression. She was a smoker.

Obstetric history

2015 Ventouse delivery of a female infant at 35 weeks gestation
Birth weight 4lb 2oz
Delivery was complicated by post-partum haemorrhage

2017 First trimester miscarriage

2019 Vaginal delivery of female infant at 39 weeks gestation following induction of labour for decreased fetal movements
Birth weight 7lb 2oz

2020 First trimester termination of pregnancy

Index pregnancy

Expected date of delivery (EDD) 31.01.22
BMI 32

29.01.22 Admitted for induction of labour for static growth

18.00 Cervix 2 cm dilated
?ARM [artificial rupture of membranes] performed
Small amount of liquor noted

21.30 Syntocinon commenced

23.00 Contracting 4:10

30.01.22 02.00 Cervix 3 cm dilated

02.30 Epidural sited

06.00 Cervix 5 cm dilated

09.50 Ward round by Mr [redacted]
0/5 palpable
Contracting 4:10
Cervix fully dilated
ROA [right occipito anterior]
Station 0 [at spines]
Start pushing after one hour

10.30 Case G reports some urges to push
However continues to breathe through using Entonox

10.57 Active pushing
Good maternal effort

11.04 Vertex visible

11.06 Head delivered

11.07 NVD [normal vaginal delivery]
[Birth weight 2990 gm, Apgar scores 9 and 10 at 1 and 5 minutes]
Live male infant
Good condition
Cried at birth

In the summary of labour it is noted that Syntometrine was given at the time of delivery.

11.11 Cord no longer pulsating, clamped and cut
Separation bleed noted

11.14 Placenta and membranes delivered complete by CCT
Cord snapped as placenta delivering

11.15 Uterus well contracted
Blood loss stable
Incos weighed 525 ml

11.25 Upon re-entering room blood loss noted on bed
Sheet lifted and significant blood loss seen
Emergency bell pulled

11.30 Current total 1200 ml

11.32 VE by Reg to expel clots
Tranexamic acid 1 gm

11.33 Carboprost 350 mcg IM

11.35 Second cannula sited by anaesthetist and bloods
BP 120/65
Pulse 67

11.37 Running total blood loss 1730 ml

11.44 Discussed theatre

11.48 Carboprost 250 mcg second dose

11.57 Arrived in theatre

12.00 Running total blood loss 2387 ml

12.05 Carboprost 250 mcg IM

Post-partum haemorrhage management check list
Uterotonics given:
11.07 Oxytocin 10 units
11.32 Tranexamic acid 1 gm
11.37 Oxytocin infusion 40 units
12.29 Misoprostol 800 mcg
Three doses of carboprost were also given

30.01.22 Examination under anaesthesia due to massive post-partum haemorrhage, Dr [redacted] and Mr [redacted]
EBL 1844 ml at room
Uterine atony
Explored uterus and small amount of retained pregnancy tissue removed
Cervix: No injury, no tear
No vaginal tear
Bruises on the right labia close to urethra, no bleed
Anal sphincter intact, rectum on injury [sic]
Due to uterine atony: Bakri balloon inserted with 250 ml saline which was expelled immediately
Uterus well contracted and no further PV bleeding noted
800 mcg misoprostol PR given
Mr [redacted] present in theatre to supervise the procedure although Dr [redacted] explored the uterus too
EBL 2687 ml
Rotem normal
Lactate 0.86
Plan: IV antibiotics for 24 hours and follow-up by oral five days

HDU monitoring
Continue syntocinon as per protocol

31.01.22 In view of MOH with HB of 77 offered her blood transfusion, iron infusion

01.02.22 Ferinject not collection ?due to [illegible words]
Patient wishes to self-discharge
Repeat HB shows drop to 72
I explored we could give blood now [sic] as worried it is very low
Then TCI one week to re-check and go with +/- Ferinject line
One unit red blood cells today

h) SUMMARY OF MEDICAL INFORMATION CASE H

Case H was aged 31 when she had a vaginal delivery of a twin pregnancy on 07.03.22. There was no relevant medical history. She was a non-smoker.

Obstetric history

2009 Vaginal delivery of a female infant at 42 weeks
Birth weight 3800 grams

2011 Vaginal delivery of a female infant at 41 weeks gestation
Birth weight 3800 grams

Index pregnancy

Expected date of delivery (EDD) 07.03.22
BMI 25.8

During the antenatal course, Case H was monitored for decreased fetal movements and suspected fetal growth restriction.

07.02.22 Induction of labour

14.20 Artificial rupture of membranes (ARM)
Cervix 4 cm dilated

17.20 Cervix 4 cm dilated

18.30 Syntocinon augmentation

21.20 Cervix fully dilated

21.42 Normal delivery of twin 1 baby girl
Good condition

21.50 Normal delivery of twin 2 baby girl

Good condition

21.59 Delivery of placenta of twin 2 delivered (Syntometrine given at birth)

22.05 Second placenta delivered

22.16 Delivery of placenta Paulina bleeding +++
MBL 788 ml
Syntocinon infusion commenced at 22.00 [sic]
Tranexamic acid given by anaesthetist
Vaginal examination performed by Dr [redacted] – part of placenta remains in situ
For transfer for removal of placenta
Carboprost x 1 given

22.20 Code 2 put out
MBL now 1421 ml

22.26 In theatre

22.32 Anaesthetic commenced
Total MBL 2471 ml

07.02.22 <u>Manual removal of placenta and delivered uterus, Dr [redacted]</u>
Under spinal anaesthesia
PV and PR done
Uterine atony os open and retained placental bits felt manually
Manually removed placental bits from uterine cavity piece by piece and ensure empty at the end
Bleeding minimised after removal of placental tissue
Cervix checked – no tear
Generalised oozing from lips of cervix which was controlled by itself
PR – NAD
One stitch was given to posterior vaginal wall close to introitus with vicryl 2/0
First degree tear
Misoprostol 800 mcg given PR
Mr [redacted] was present
Both placenta and placental tissue sent for histopathology
EBL at room 1885 ml
Total MBL 2471 ml

<u>PPH checklist</u>
Uterotonics given included:
21.50 Syntometrine
22.00 Syntocinon 40 units infusion
22.10 Oxytocin 10 units
22.50 Misoprostol 800 mg
Three doses of carboprost
Tranexamic acid 1 gm

08.02.22 06.20 Haemoglobin 64
Two units of blood transfusion
Patient declined to have second unit of blood before
She wants one unit blood transfusion followed oral iron

10.02.22 Haemoglobin of 61 g/L , Advised two units of red cells
Feels weak but not dizzy
Clinically pale and heart rate > 100

i) SUMMARY OF MEDICAL INFORMATION CASE I

Case I was aged 31 when she was delivered of her first child by emergency caesarean section on 10.03.22. There was no relevant general medical history. She was a non-smoker.

Index pregnancy

Expected date of delivery (EDD) 22.02.22
BMI 26.4

The antenatal course was uneventful.

02.03.22 Vaginal examination: Sluggy posterior cervix, uneffaced
Unable to perform sweep

07.03.22 Admitted for induction of labour
Bishop's score 1
Propess given

08.03.22 Bishop's score
Prostin 2 mg given

09.03.22 Placenta: Posterior and anterior succenturiate lobe
High risk for PPH/retained placenta

09.03.22 Prostin 1 mg given

21.37 Admitted to labour ward

21.43 Cervix 4 cm dilated, thick meconium draining

23.10 Epidural sited

10.03.22 00.05 Cervix 8 cm dilated

Around 06.00
The partogram indicates that syntocinon was started

06.10 Cephalic 3/5
Cervix 8 cm dilated
Head -2 [cm above ischial spines]

08.50 Ward round Mr [redacted]
SROM
Thick meconium
Was on syntocinon
Stopped on arrival
0/5 palpable
VE: OT
Small rim of cervix posteriorly, almost 10 cm dilated
Station 0/-1
Rim of cervix pushed up
Review in one hour

10.30 Temperature 37.7 °C
OT at spines
No caput/moulding
No descent with pushing
Impression ?infection
For trial in theatre +/- CS

11.05 Into theatre

11.15 Mr [redacted]
Cervix present
For CS

10.03.22 <u>EUA in theatre, proceeded to emergency caesarean section, Dr [redacted]</u>
Indication: Failure to progress, maternal pyrexia, fetal tachycardia
EUA: Cervix still present posterior, not fully dilated, LOT at spines
Not suitable for instrumental delivery
Findings explained to patient
For emergency caesarean section
CS by Dr [redacted]
Low transverse skin incision
Modified Joel-Cohen entry into abdomen
Free fluid in abdomen noted
Bladder reflected down
High transverse incision on lower segment made
Baby's shoulders delivered with difficulty
Liquor slightly meconium stained
Delayed cord clamping done
Baby cried at delivery
[Female infant delivered at 11.29, weight 3260 gm, Apgar scores 9 and 10 at 1 and 5 minutes]
Significant bleeding from broad ligament tear noted
Uterus exteriorised and placenta removed manually
Cavity checked empty

Syntometrine given and syntocinon bolus and infusion started
Tranexamic acid 1 gm given
Taken over by Mr [redacted]
Spurters in broad ligament
Haemostatic sutures x three in broad ligament to control bleeding
Uterus closed in two layers
Further haemostatic sutures over uterine incision
Surgicel applied over wound
MOH call put out
Carboprost x 2 given
Rotem and blood gas done just after 1 litre PPH
Rotem normal
Haemoglobin on ABG 115
Lactate 2.17
Urine clear
Uterus well contracted
Both tubes and ovaries normal
MBL 2569 ml
PPH post-event checklist
Uterotonics used
Oxytocin
Syntometrine
Oxytocin infusion
Carboprost two doses

Fluid volume chart indicates that 2 units of blood were given post-operatively.

j) SUMMARY OF MEDICAL INFORMATION CASE J

Case J was aged 36 when she was delivered of her first child by Emergency Caesarean Section on 13.03.22. Her medical history included chronic liver disease secondary to alcohol abuse. She was a smoker.

Index pregnancy

Expected date of delivery (EDD) 27.04.22
BMI 30

13.03.22 08.20 Cervix 4 cm dilated

13.03.22 Caesarean Section for abnormal CTG (SROM) [spontaneous rupture of membranes] at 33+4, SGA [small for gestation age], breech presentation, 4 cm dilated, CLD [chronic liver disease]
Pfannenstiel skin incision and dissected to the peritoneal cavity
Poorly formed lower uterine segment noted
Uterovesical peritoneal incised and bladder reflected
Transverse lower uterine incision, minimal clear liquor

Neonate delivered by breech extraction with some difficulty, born in good condition with three loops of cord tightly around neck
Male infant delivered at 08.43, birth weight 1500 gm, Apgar scores 9 and 9 at 1 and 5 minutes
Delayed cord clamping cutting, endometrial cavity cleaned and uterine incision inspected
Vertical extension of the left margin of the incision extending to the vagina
Uterus exteriorised and incision extension repaired as one in two layers with Vicryl 1 by Mr [redacted]
Angles identified and secured
Haemostasis achieved
MBL 200 ml

I have not identified post-natal midwifery records or observation charts following the Caesarean Section.

14.03.22 07.30 Obstetric SHO
Collapsed on the bed at 07.15
There were no seizures
Loss of consciousness during the collapse
Abdomen is soft
Painful on palpation on RUQ [right upper quadrant]
impression ?postnatal hypotension
BP 92/64 mmHg

08.55 Heart rate 95
BP 80/64
Fluids not attached

08.55 Reviewed by Dr [redacted], Consultant on-call
BP 103/64
Saturations 100% pulse 82
Patient looks very pale
Distended tense abdomen
Seems like intra-abdominal haemorrhage
Decision made to go to theatre for exploration of abdomen

09.30 Transferred to delivery suite
Prepared for theatre

09.40 Commenced blood transfusion

10.00 Transferred to theatre

Only stage 0 of the PPH post-event check list was completed.

10.17 Arterial line sited

10.27 Laparotomy commenced

10.30 Second unit blood transfusion

10.33 Haemoglobin 91, lactate 2.52

10.40 BP 70/42

10.40 4 units FFP [fresh frozen plasma] requested

10.44 MBL 1146 ml

10.50 BP 77/32

10.55 Major haemorrhage call put out

11.00 Third unit blood commenced

11.25 Bloods from 09.15
Haemoglobin 75 g/L
Fibrinogen 1.4

11.30 Closing skin

11.34- 11.35 4 units FFP given

12.30 Transferred to recovery care
Handed over to ITU

14.03.22 Laparotomy, Dr [redacted]
Indication: Collapsed 24 hours post emergency C/S
Suspected Hemoperitoneum
Findings: No obvious bleeding points
Anterior abdo wall anterior to sheath
Clot +++ and dark altered blood +++ hemoperitoneum
Mild ooze from left broad ligament, anterior peritoneum adjacent to the left round ligament
Uterine lower segment scar - no active bleeding
Posterior uterus, tubes and ovaries - No active bleeding
Upper abdomen
Clot++ removed from below liver and paracolic gutters
Haemostasis secure
MBL 2319 ml and sheet
Procedure low trans incision haemoperitoneum as above
Blood clot removed findings as above
Vicryl 2/0 to close visceral peritoneum left anterior broad ligament
Haemostasis secured
Saline washout
No ongoing bleeding
Had 4 units RBC (1 O Neg, 3 A Positive)

15.03.22 Reviewed back from ITU

16.03.22 20.45 Haemoglobin 80 g/L

18.03.22 17.50 Patient can be discharged tomorrow

k) SUMMARY OF MEDICAL INFORMATION CASE K

Case K was aged 26 when she was delivered of her second child on 18.03.22. She suffered from anxiety and depression. She was a smoker. She suffered a major obstetric haemorrhage (MOH) and underwent examination under anaesthesia (EUA) in theatre.

Obstetric history

2015 Vaginal delivery of female infant at 41 weeks gestation
Birth weight 3629 gm

Index pregnancy

Expected date of delivery (EDD) 18.03.22
BMI 23

Case K booked late for antenatal care at 16-18 weeks gestation.

18.03.22 06.04 Case K arrived on delivery suite in spontaneous labour

06.10 Cervix fully dilated

06.20 Case K pushing well with contractions

06.43 Normal vaginal delivery of live girl in good condition
[Birth weight 3640 gm, Apgar scores 9 and 9 at 1 and 5 minutes]
Syntometrine given

06.50 Attempted to deliver placenta

07.00 Lofric [bladder catheter] passed
70 ml drained

07.15 Placenta delivered
Membranes still in situ

07.25 Dr [redacted]
MBL 300 ml
Uterus well contracted
Some membranes delivered with pushing but big portion still in the uterus
Plan IV access, syntocinon infusion
?needs EUA

07.35 IV syntocinon infusion commenced

08.40 Blood loss moderate
Inco [sheet] heavy 224 ml weighed

09.40 Dr [redacted]
Ongoing bleeding
MBL > 600 ml
Speculum sponge holders to carefully remove placental tissue and membranes and blood clot from the uterus
Procedure tolerated
Offered anaesthetic in theatre – declined
MBL 1399 ml

09.26 BP 107/72 mmHg
Pulse 87

10.50 Mr [redacted]
Major obstetric haemorrage call in view of blood loss total > 1500 ml but “all under control”

Mr [redacted]
Additional 150 ml over the last hour
RR, P and BP stable
Uterus contracted, non-tender currently though is having “after pains”
Discussed with patient and partner re review if EUA when theatre free
As MBL > 1500 ml now – MOH called
Source has been “tissue” and still could be some remaining therefore may still need theatre

11.00 Pelvic gush
Will need EUA

11.15 Theatre checklist completed

12.00 Into theatre reception
General anaesthetic given

12.12 Anaesthesia procedure completed

12.17 Tranexamic acid 1 gm given

12.25 Misoprostol 500 mcg given

12.30 Syntometrine IM
Total blood loss 2257 ml
Placenta and membranes delivered x two cotyledons and membranes seen

13.00 In obstetric recovery

Examination under anaesthesia and manual removal of placenta
Uterus approximately 30/40 size
Cervix open, placental tissue protruding from os
Manual exploration of endometrial cavity reveals 10 cm placental tissue adherent to the left fundal region
Manual removal of placenta done, further exploration revealed an empty cavity
Bimanual uterine compression
IM Syntometrine given, 1 mg misoprostol PR
Haemostasis secured
Perineum intact
Total MBL 2257 ml

PPH checklist
Uterotonics given
07.35 and second infusion at 12.35
Oxytocin infusion
12.25 misoprostol 1000 mcg
12.30 Syntometrine

19.03.22 Symptomatically fine
Haemoglobin 64 g/L
In view of low Hb offered blood transfusion (2 units)
Risks and benefits explained
Other alternatives – iron transfusion described
Patient agrees to go ahead with blood transfusion

Appendix 2 – Reviewer 1b's Full Report
January 2023

Introduction

Material instructions

My instructions in detail are given below.

"Although we do not require a report in the form and detail of a report prepared for the purpose of disclosure during litigation, it is important that your report is sufficiently detailed to enable the recipients to understand the medical issues that this case raises and the reasons why you have reached your opinion on the standard of medical treatment in question.

You are instructed to undertake a thematic review of all 11 cases of MOH, considering issues including, but not limited to, patient specifics, clinical details, and the management of the MOHs.

In addition, you are instructed to undertake an individual review of the care of two patients, Cases A and B, who experienced blood losses of 9 litres and 5 litres, which resulted in the patients undergoing a hysterectomy. Case A was 19 years old at the time.

In relation to the issue of breach of care, please analyse the standard of treatment that Cases A and B received, and consider whether that standard of treatment fell below the standard of a reasonably competent practitioner at the relevant time. Please summarise your criticisms, if any, of the treatment that these patients received and, if appropriate, explain what ought to have been done for that treatment to have measured up to minimum standards of reasonable professional competence.

In relation to the issue of causation, please analyse the consequences of the shortcomings, if any, in the treatment that Case A and Case B received. Please set out what treatment these patients would have required and what each patient's condition and prognosis were likely to have been if the treatment that they received had been of an acceptable standard. In particular, please assess if the hysterectomies could have been avoided.

Please do not confine yourself to these specific issues, as we are sure that there are others that will be of relevance and significance that you will wish to consider in your report."

I have available to me the following documents:
Hospital records of:

a. Case A
b. Case B
c. Case C
d. Case D
e. Case E
f. Case F
g. Case G
h. Case H

i. Case I
j. Case J
k. Case K

2. Obstetric Thematic Review – Reviewer 1a
3. Thematic Review Correspondence – Reviewer 1a, 7 September 2022
4. Individual Obstetric Review, Case A – Reviewer 1a
5. Individual Obstetric Review, Case B – Reviewer 1a
6. Royal College of Obstetricians and Gynaecologists, Prevention and Management of Postpartum Haemorrhage (2016)
7. All Wales Guideline, Prevention and Management of Obstetric Haemorrhage (2017, 2021)

Report Layout

After this introductory chapter there is a chapter where I review relevant literature. Following this each chapter considers one of each of the cases. I have used the same a. to k. labelling of the patients as used in the letter of instruction. The amount of medical information given for each case varies, but is sufficient to explain the conclusions reached for each patient. Finally, there is a chapter containing my overall conclusions.

Literature

There are two guidelines which are relevant to management of postpartum haemorrhage. Each are addressed below, where I list guidance specifically relevant to anaesthetic care. I consider that any significant failure to achieve the guidance as listed here represents a breach of duty of care, unless there is good reason as to why it could not be achieved.

Royal College of Obstetricians and Gynaecologists, Prevention and Management of Postpartum Haemorrhage (2016)

This guidance includes the following recommendations that are of relevance to both anaesthetic care and the patients discussed in this report.

- Relevant staff with an appropriate level of expertise should be alerted of postpartum haemorrhage (PPH).
- The midwife in charge and the first line obstetric and anaesthetic staff should be alerted when women present with minor PPH (blood loss 500-1000 ml) without clinical shock.
- A multidisciplinary team involving senior members of staff should be summoned to attend to women with major PPH (blood loss of more than 1000 ml) and ongoing bleeding or clinical shock. This team should include an anaesthetist.
- Measures for minor PPH (blood loss 500–1000 ml) without clinical shock:
    - intravenous access (one 14-gauge cannula)
        - urgent venepuncture (20 ml) for:
            - – group and screen
            - – full blood count
            - – coagulation screen, including fibrinogen

    - pulse, respiratory rate and blood pressure recording every 15 minutes
    - commence warmed crystalloid infusion
- Full protocol for major PPH (blood loss greater than 1000 ml) and continuing to bleed or clinical shock:
    - A and B – assess airway and breathing
    - C – evaluate circulation
    - position the patient flat
    - keep the patient warm using appropriate available measures to prevent hypothermia
    - transfuse blood as soon as possible, if clinically required
    - until blood is available, infuse up to 3.5 litre of warmed clear fluids, initially 2 litres of warmed isotonic crystalloid; further fluid resuscitation can continue with additional isotonic crystalloid or colloid (succinylated gelatine)
    - hydroxyethyl starch should not be used
    - the best equipment available should be used to achieve rapid warmed infusion of fluids
    - special blood filters should not be used, as they slow infusions
- There are no firm criteria for initiating red cell transfusion. The decision to provide blood transfusion should be based on both clinical and haematological assessment. While blood transfusion is almost always required when the haemoglobin is less than 60 g/l and rarely required when the haemoglobin is more than 100 g/l, patients with acute haemorrhage can have normal haemoglobin and clinical evaluation in this situation is, therefore, extremely important.
- Major obstetric haemorrhage protocols must include the provision of emergency blood with immediate issue of group O, rhesus D (RhD)- negative and K-negative units, with a switch to group-specific blood as soon as feasible.
- If clinically significant red cell antibodies are present, close liaison with the transfusion laboratory is essential to avoid delay in transfusion in life-threatening haemorrhage.
- If no haemostatic results are available and bleeding is continuing, then, after 4 units of red blood cells, fresh frozen plasma (FFP) should be infused at a dose of 12–15 ml/kg until haemostatic test results are known.
- If no haemostatic tests are available, early FFP should be considered for conditions with a suspected coagulopathy, such as placental abruption or amniotic fluid embolism, or where detection of PPH has been delayed.
- If prothrombin time/activated partial thromboplastin time is more than 1.5 times normal and haemorrhage is ongoing, volumes of FFP in excess of 15 ml/kg are likely to be needed to correct coagulopathy.
- Clinicians should be aware that blood components must be ordered as soon as a need for them is anticipated, as there will always be a short delay in supply because of the need for thawing.
- A plasma fibrinogen level of greater than 2 g/l should be maintained during ongoing PPH. Cryoprecipitate should be used for fibrinogen replacement.
- During PPH, platelets should be transfused when the platelet count is less than 75 based on laboratory monitoring.
- Consideration should be given to the use of tranexamic acid in the management of PPH.

- Full protocol for monitoring and investigation in major PPH (blood loss greater than 1000 ml) and ongoing haemorrhage or clinical shock:
    - immediate venepuncture (20 ml) for:
        - – cross-match (4 units minimum)
        - – full blood count
        - – coagulation screen, including fibrinogen
        - – renal and liver function for baseline
    - monitor temperature every 15 minutes
    - continuous pulse, blood pressure recording and respiratory rate (using oximeter, electrocardiogram and automated blood pressure recording)
    - Foley catheter to monitor urine output
    - two peripheral cannulae, 14 gauge
    - consider arterial line monitoring (once appropriately experienced staff available for insertion)
    - consider transfer to intensive therapy unit once the bleeding is controlled or monitoring at high dependency unit on delivery suite, if appropriate
    - recording of parameters on a modified early obstetric warning score (MEOWS) chart and acting and escalating promptly when abnormal scores from a MEOWS chart are observed
    - documentation of fluid balance, blood, blood products and procedures
- The management of PPH requires a multidisciplinary approach; the anaesthetist plays a crucial role in maintaining haemodynamic stability and, if necessary, in determining and administering the most appropriate method of anaesthesia.
- While general anaesthesia in obstetric patients is associated with increased morbidity and mortality when compared with regional anaesthesia due to the physiological changes that occur in pregnancy, it may be preferable in patients who are haemodynamically unstable or who have a coagulopathy.

All Wales Guideline, Prevention and Management of Obstetric Haemorrhage (2017, 2021)

This guidance has been based on the Royal College of Obstetricians and Gynaecologists guidelines detailed above. Nonetheless, the All Wales Guideline does postdate the guidance detailed above, and there are some additional recommendations of relevance which are listed below.

- Placenta praevia, accrete, increate or percreta requires a consultant anaesthetist planned and directly supervising anaesthetic at delivery.
- When measured blood loss reaches 1000ml, tranexamic acid 1g IV should be given. If bleeding continues, a further 1g should be administered after 30 minutes and within 3 hours. (This is more specific than the guidance on tranexamic acid from the Royal College of Obstetricians and Gynaecologists.)
- During obstetric haemorrhage there should be clinical evaluation to help guide if blood transfusion is required and regular point of care testing including ROTEM, haemoglobin and lactate. (ROTEM is a device to test coagulation at the point of care using a method called viscoelastometry. One measure it gives is a FIBTEM A5 value.)
-

Coagulopathies may evolve rapidly and repeated testing (every 30 minutes or every 500ml blood loss) during continued bleeding for observation of trends are more useful than single measurements. Point of care testing using viscoelastometry, combined with an agreed treatment algorithm has been associated with decreased blood loss and blood product use within the obstetric setting. The main advantage is that results are known sooner than laboratory tests. Point of care testing for coagulation will inform .

With respect to risk management, the All Wales Guideline suggests the following:

- All staff should receive training in the management of obstetric emergencies, including the management of PPH. This should be included in the PROMPT Wales's training.
- Training for PPH should be multi-professional and include team rehearsals.
- A Datix Cymru reporting form should be completed at agreed thresholds as per OBS Cyrmu.
- All PPH events which are classified as Serious Incidents and/or require Root Cause Analysis should be reported to the Maternity Network Safety Subgroup for dissemination of learning across Wales. Learning from cases that were managed well is also encouraged.

a. Case A

Summary of medical information

Prior to delivery

Case A was aged 19 when she was delivered of her first child on 12 April 2022. She was in good health and had a BMI of 31. She had a history of smoking and drug abuse, including cocaine.

She had an induction of labour on 11 April 2022 and an artificial rupture of membranes at 13.00 on 12 April 2022. An epidural for analgesia in labour was sited uneventfully at 14.14.

At 20.20 her cervix was 9cm dilated and she had developed a raised temperature and CRP (C-Reactive Protein, a measure of infection). When she was examined at 21.10, she was difficult to assess because of inadequate pain relief, but at 21.40 there was a cervical rim and fetal caput (swollen top of head) on examination and transfer to theatre was planned.

She arrived in theatre at 22.01 and, as the epidural had been unreliable, a spinal was inserted by 22.29. However, at 22.43 she was still feeling pain and the decision was made for a general anaesthetic, with induction of anaesthesia completed by 22.48.

Surgery

Surgery commenced at 22.50 and the uterine incision was at 22.52. The surgeon was Miss [redacted] Consultant Obstetrician. The baby was difficult to deliver due to the head being impacted in the pelvis, and was eventually delivered at 22.57. Miss [redacted] reported that one cause of the difficulty was contraction of the abdominal muscles, and specifically that the rectus muscles were "*very tight".*

Following delivery of the baby and placenta, significant bleeding was noted from the left uterine angle. Miss [redacted] called for Mr [redacted] to assist. After a recorded blood loss of 2.5 litres the abdomen was closed. 1 litre of blood was found in the vagina and the anterior vaginal wall was sutured. However further bleeding seemed to be coming from the uterus and blood loss rose to 5 litres.

Mr [redacted] and Miss [redacted] came to assist. The abdomen was reopened and there was persistent bleeding from the cervix. An intrauterine balloon was inserted, but bleeding continued, so the decision was made for hysterectomy. Even after hysterectomy there was still bleeding from the right lateral pelvic wall and bladder base, which was treated with suturing and the administration of blood vessel sealants. The abdomen was then closed and Case A was transferred to ITU (Intensive Therapy Unit). Total blood loss was over 9 litres.

The anaesthetic record

The anaesthetic record notes details of the attempted spinal anaesthetic and the induction of anaesthesia, which was complicated by bronchospasm. It gives details of the muscle relaxants employed, which are discussed further in the opinion section below. There is also record of several doses of tranexamic acid being given, with the first dose at 23.05. Transfusion of 14.5 litres of crystalloid fluid and 2.5 litres of colloid fluid, together with the blood and blood products detailed below, are recorded. There is no record of Case A's temperature. The names of two anaesthetists are given, but not their grade.

Blood loss, blood tests, and transfusion of blood and blood products

Details of blood loss, point of care blood tests, and transfusion of blood and blood products are given both in the anaesthetic record and the Postpartum Haemorrhage Management Checklist, which are within the medical record. There is no record of laboratory blood tests in the medical record.

Blood loss

Delivery was at 22.57. Times and levels of blood loss recorded included:

23.05	715ml
23.25	1,846ml
00.00	2,599ml
00.20	3,561ml
00.50	4,021ml
01.10	5,560ml
01.30	5,969ml
01.48	6,240ml
03.24	7,995ml

05.15	9,241ml

Point of care blood tests

Viscoelastometry (FIBTEM A5 test, normal is 12 or greater):

23.25	26
00.05	20
01.15	11
02.20	8

Blood gas analysis haemoglobin estimations (normal is 110g/l or greater; a preoperative haemoglobin of 107 is recorded in the anaesthetic record):

23.25	91
00.05	71
00.55	89
01.32	48
02.57	117

Transfusion of blood and blood products

- Twelve units of blood were transfused. The first at 00.20, the fourth at 00.50, and the last at 04.37. In addition, 623ml of cell saver blood (blood salvaged from the operation site) was transfused.
- Blood products administered included ten units of fibrinogen concentrate, four units of FFP, and one pool of platelets:
    - The first unit of fibrinogen was given at 01.55, and the last at 03.18.
    - The units of FFP were transfused between 03.31 and 03.37.
    - The pool of platelets was transfused at 03.27.

Synopsis of blood loss, tests, and transfusion in the hours after delivery

Time	Time after delivery	Blood loss	Point of care tests and transfusion
22.57	0 minutes		
23.25	28 minutes	1.8 litres	Haemoglobin 91, FIBTEM A5 26
00.05	68 minutes	2.6 litres	Haemoglobin 71, FIBTEM A5 20
00.30	93 minutes	3.6 litres	First two units of blood started
00.50	113 minutes	4.0 litres	Fourth unit of blood started
01.15	138 minutes	5.6 litres	FIBTEM A5 11
01.32	155 minutes	6.0 litres	Haemoglobin 48
01.55	178 minutes	6.2 litres	First unit of fibrinogen started
02.20	203 minutes	6.8 litres	FIBTEM A5 8
03.27	270 minutes	8.0 litres	Platelets started

Postoperative

Case A had a complicated postoperative course requiring care on ITU for some days. She was transferred back to the ward on 16 April 2022. However, she developed small bowel obstruction and underwent laparotomy on 20 April 2022 with a further HDU (High Dependency Unit) admission. She was finally discharged on 9 May 2022. I am not critical of the anaesthetic care she received

at any point after her surgery which culminated in hysterectomy, and therefore I have not given further details here.

25 The opinion of Reviewer 1a, Obstetrician

Below I have given a summary of Reviewer 1a's opinion with respect to this case. In as much as it is within my area of expertise, I am in agreement with his conclusions.

- The haemorrhage was most likely due to uterine trauma at the time of delivery. 1.5 litres of blood were lost within 18 minutes of delivery and Miss [redacted] recorded persistent bleeding from the left uterine angle. The fetal head was difficult to deliver with a breech delivery attempted at one point, which increases the risk of trauma to the uterus.
- The rectus sheath was reported as being tight at the time of delivery, although the procedure was under general anaesthesia. Reviewer 1a does not specifically state whether this might have made delivery more difficult.
- It was appropriate that Miss [redacted] called for help from Mr [redacted] who found a bleeding flap of tissue that was part of the left uterine angle. This had not been repaired adequately by Miss [redacted], although it was "*secured"* by Mr [redacted].
- There was an inappropriate delay in giving blood and blood products; blood was not given until 00.30. This led to DIC (disseminated intravascular coagulation, which is a clotting abnormality associated with excess haemorrhage). The ongoing blood loss was due to DIC and unsecured uterine trauma.
- Reviewer 1a is not critical of the decision to perform a hysterectomy at the the decision was made; it was probably lifesaving.
- There is excellent documentation of oxytocic drugs given, blood and blood products transfused, and measured cumulative blood loss.
- In summary, the haemorrhage was caused by uterine trauma that might have been avoided. There was a delay in giving blood products. It is difficult to say whether more timely administration of these products would have averted the need for hysterectomy.

My opinion

<u>Breach</u>

As detailed in the introductory chapter of this report, I have asked to consider the standard of treatment that Case A received, and whether it fell below the standard of a reasonably competent practitioner. I have been asked to summarise criticisms and explain, if necessary, what ought to have been done to achieve the minimum standards of reasonable professional competence.

I am not critical of the following aspects of Case A's anaesthetic care.

- Insertion and management of the epidural
- The decision to replace the epidural with a spinal for caesarean section, as the epidural was unreliable
- The failure of the spinal to be adequate for caesarean section, as there is a recognised failure rate
- The decision to therefore administer the general anaesthetic
- The technique employed for the general anaesthetic

With respect to the technique employed for the general anaesthetic, further explanation is required concerning the choice of dose of muscle relaxant employed by the anaesthetists.

- Case A received the muscle relaxant suxamethonium to facilitate intubation for anaesthesia. Suxamethonium is a short acting muscle relaxant.
- She then received 25mg of atracurium, a longer acting muscle relaxant, at 22.15, and a further 10mg at 22.40.
- The recommended dose of atracurium is 0.3 to 0.6mg/kg. Taking Case A's weight as 86kg, 25mg is 0.3mg/kg, and 35mg is 0.4mg/kg; hence she did receive the recommended dose. However, some obstetric anaesthetists often don't employ an additional muscle relaxant following suxamethonium at all.
- The reason why this is relevant is that Miss [redacted] noted that the rectus muscles (abdominal muscles) were "*very tight*" (not relaxed) and this might have hindered delivery. Usually, even if no muscle relaxant is active, excess abdominal muscle tone is not found to be a problem for delivery. I am therefore not critical of the anaesthetists in this respect.
- Nonetheless, if Miss [redacted] found that excess abdominal muscle tone was causing difficulty for delivery, she should have requested that the anaesthetists administer further muscle relaxant. I defer to obstetric opinion as to whether this was a breach of duty of care by Miss [redacted].

With respect to management of the obstetric haemorrhage, some aspects of Case A's care complied with the guidelines discussed in the literature section of this report. For example, tranexamic acid and viscoelastometry were both employed. However, there are three aspects of Case A's care where I am unable to determine if guidance was complied with or not, and one very significant breach where guidance was not complied with.

The three aspects of Case A's care where I am unable to determine if guidance was followed or not are given below.

- The guidance calls for senior anaesthetic staff to be summoned and I cannot determine if senior anaesthetic staff (by which I think it is meant consultant level) did attend. The names of two anaesthetists are given on the anaesthetic record, but not their grade.
- The guidance also calls for regular laboratory blood samples to be sent, including full blood count, coagulation screen, and fibrinogen. There is no information in the medical record as to whether these were sent, or what the results were. It is likely that these tests were done and are recorded on the hospital computer system, but no print off has been placed in the medical record. Point of care testing results are available, including blood gas analysis giving haemoglobin levels and viscoelastometry results.
- There is no record of Case A's temperature in the anaesthetic record and therefore I do not know if it was measured. However, the anaesthetic record does state that active warming measures were taken. Low body temperature is associated with poor blood coagulation and increased haemorrhage.

The one significant breach, where guidance was not complied with, was the delay in giving blood and blood products.

The guidelines discussed in the literature section are not specific about when exactly blood transfusion should be started. Likewise, because no laboratory blood results are given in the medical record, there is no record of platelet count, and therefore it is hard to determine when platelet transfusion was required.

Nonetheless, there is good evidence that there was a significant delay in giving blood and blood products. This is explained below.

- Blood transfusion was not started until 00.30. This was 93 minutes following delivery, which is most likely when the haemorrhage commenced. At 00.30 blood loss had been recorded as over 3.5 litres (probably about two thirds of Case A's total blood volume). By any standard this was an unacceptable delay in starting blood transfusion.
- The lowest haemoglobin recorded was significantly low at 48g/l at 01.32, 155 minutes after the haemorrhage commenced. This indicates that the amount of blood that had been transfused by that stage was inadequate.
- With respect to blood products, Case A was initially transfused with fibrinogen concentrate rather than the FFP recommended in the guidance discussed in the literature section. Clinical studies have shown that fibrinogen concentrate and FFP are equally effective in moderate haemorrhage. I defer to haematological opinion as to whether such a substitution was acceptable under the circumstances here.
- Guidelines state that: "*If no haemostatic results are available and bleeding is continuing, then, after 4 units of red blood cells, FFP should be infused at a dose of 12–15 ml/kg until haemostatic test results are known.*" As discussed above, in Case A's case fibrinogen concentrate, rather than FFP, was used in lieu of FFP. There is no record of laboratory coagulation (haemostatic) tests, but point of care viscoelastometry was showing decreasing coagulation function. The fourth unit of blood was transfused at 00.50, at which point blood loss was over 4 litres and had been ongoing for 113 minutes. Clearly by this point, and probably considerably earlier, FFP or fibrinogen concentrate needed to be given, but it was not started until over an hour later, at 01.55, by which time blood loss stood at over 6.2 litres and had been ongoing for 178 minutes. While it could be argued that fibrinogen concentrate could be withheld until the FIBTEM A5 yielded an abnormal result, the degree of blood loss of over one circulating blood volume prior to fibrinogen being given is, by any standard, an unacceptable delay in giving blood products.
- The results of any full blood counts taken, which would have included platelet count, are not available in the medical record. Platelet transfusion was not commenced until 03.27, at which point blood loss stood at 8.0 litres and had been ongoing for 270 minutes. Despite the unknown platelet count, it is highly likely that this was an unacceptable delay. Nonetheless, this delay may have been due to factors outside the hospital's control, as platelets are not always stored on-site in medical facilities.

The unacceptable delays in Case A receiving blood products would have greatly contributed to the development of DIC. The longer major obstetric haemorrhage is allowed to continue without correction with transfusion of blood products, the more DIC develops with consumption of clotting products within the bloodstream, which in turn will lead to further bleeding. These unacceptable delays represent a very significant breach of duty of care.

Causation

As detailed in the introductory chapter of this report, I have been asked to consider the consequences of any shortcomings in Case A's care, and what the condition and prognosis would have been had she received acceptable care. In particular, I have been asked to assess if a hysterectomy could have been avoided.

As discussed above, it is possible that the rectus muscle was "*very tight",* although this is only rarely a problem, even when no additional muscle relaxation has been administered. I agree that if this was the case, it would have made the delivery more difficult for Miss [redacted] and so may have significantly contributed to the subsequent need for hysterectomy. As explained above, I do not think that this was a breach of duty of care by the anaesthetist, but I am critical inasmuch as had Miss [redacted] found the tight rectus muscle was causing difficulties, she should have requested further muscle relaxation be given. I defer to obstetric opinion as to whether this was a breach of duty of care by Miss [redacted].

I agree with Reviewer 1a that it is difficult to say whether more timely administration of blood products would have averted the need for hysterectomy.

Nonetheless, in terms of balance of probabilities, I think it is more likely than not that that appropriately prompt administration of blood products would have avoided the need for hysterectomy. This is because even after the hysterectomy had been completed, there was still some on-going bleeding. If the bleeding necessitating hysterectomy had been entirely due to surgical damage to the uterus, there would have been no such on-going bleeding after hysterectomy. This bleeding after the hysterectomy would have been due to DIC. I therefore think that the DIC, secondary to the delay in administration of blood products, made a significant contribution to the need for hysterectomy.

Conclusions

The delay in the administration of blood products was a significant breach of duty of care, and the DIC that resulted was, on the balance of probabilities, responsible for the need for hysterectomy.

b. Case B

Summary of medical information

Prior to delivery

Case B was aged 34 when she was delivered of her fifth child on 14 April 2022. She was in good health, although she had tested Covid positive. Her BMI was 29. Her first child had been delivered by caesarean section due to breech presentation. Her second, third and fourth children were all delivered vaginally.

Delivery and subsequent haemorrhage

Case B had a spontaneous vaginal delivery of her fifth child, without any anaesthetic intervention, at 19.31 on 14 April 2022. Following delivery of the

placenta, at 19.37, there was a "*gush"* of bleeding per vaginum. She received appropriate uterotonics (medicines to contract the uterus), but by 19.40 blood loss was over 1 litre and at 19.44 an obstetric emergency call was put out.

Appropriate staff attended, including an anaesthetist, and subsequent treatment included tranexamic acid, further uterotonics, and bimanual uterine compression. The pulse was 130, there was difficulty obtaining a blood pressure reading, and difficulties with intravenous access. By 19.47 intravenous access had been secured, blood samples taken, and intravenous fluids commenced (presumably crystalloid). By 19.50 the blood loss was over 1.8 litres. By 20.19 the blood loss was nearly 2.4 litres. The decision was taken to move to the operating theatre. However, the bleeding then stopped, although the pulse remained at 130, and it was decided to not transfer to the operating theatre.

A low FIBTEM A5 value of 10 was obtained at 20.20 and at 20.26 fibrinogen concentrate was ordered, with an infusion of 4 units starting at 20.53. Intravenous fluid had been given, but no blood. At 20.32 a Consultant Anaesthetist attended and at 20.50 it is recorded that the Haematologist was "*aware of events".*

Transfer to the operating theatre and surgery

At 21.15 the haemoglobin was found to be 73g/l. Four units of blood were ordered and Case B was moved to the operating theatre at 21.20. The blood arrived at 21.22, but could not be transfused immediately, as Case B had no name band against which the blood could be checked. Blood transfusion was eventually commenced at 21.31, the same time as general anaesthesia was induced.

At 21.42 blood loss had reached 3.4 litres and there followed attempts to insert an intrauterine balloon, which was successfully positioned by 22.25. However, blood pressure remained unstable, falling as low as 60 systolic, and requiring inotropic support, and at 23.44 the decision was made to perform a laparotomy. By this time it was well over four hours since delivery. At surgery the uterus was found to be ruptured at the site of the previous Caesarean Section scar. There is nothing in the medical record to indicate that a uterine rupture had previously been considered as a cause of the bleeding. A hysterectomy was performed, and at the end of surgery blood loss was over 5 litres.

The anaesthetic record

The anaesthetic record gives details of the anaesthetic and subsequent management in the operating theatre, both of which were uncontroversial. Measurements of Case B's temperature were satisfactory. There is record of at least one dose of tranexamic acid being given, which is in addition to at least two doses that Case B had received earlier. A total of ten litres of Hartmann's solution (a crystalloid) were transfused in addition to the blood and blood products detailed below. One of the anaesthetists was a consultant. The heart rate is recorded as 130 at the start of the record at 21.15 and remained at around that level for the next three hours. During that period the blood pressure was generally low despite inotropic support with an adrenaline infusion, with the lowest recorded blood pressures being 75 systolic.

Blood loss, blood tests, and transfusion of blood and blood products

Details of blood loss, blood tests, and transfusion of blood and blood products are given in the anaesthetic record, the Postpartum Haemorrhage Management Checklist, and tables recording blood loss. There is only one record of laboratory blood tests done prior to hysterectomy in the medical record.

Blood loss

Delivery was at 19.31. Times and levels of blood loss recorded included:

19.44	1,062ml
19.50	1,864ml
20.02	2,021ml
20.10	2,174ml
20.19	2,374ml
20.45	2,789ml
21.42	3,389ml
21.45	3,489ml
21.55	3,579ml
02.15	5,039ml

Point of care blood tests

Viscoelastometry (FIBTEM A5 test, normal is 12 or greater):

20.20	10
21.15	15
22.00	17
00.04	12

Blood gas analysis haemoglobin estimations (normal is 110g/l or greater; no preoperative haemoglobin is available in the medical record):

21.14	73
22.00	93
22.33	113
23.49	91
00.47	105

Laboratory blood tests

Only one set of laboratory blood tests that were done between delivery and the hysterectomy are available in the medical record. The sample was taken at
21.10. Results include:

- Haemoglobin 72 (low)
- Platelet count 192 (normal)
- Coagulation tests:
    - Prothombin time 10.6 (normal)
    - APTT 25.3 (normal)
    - Fibrinogen 2.8 (normal)

Transfusion of blood and blood products

- The blood product employed to prevent coagulopathy was fibrinogen concentrate. Unusually, four units of fibrinogen concentrate were transfused prior to the blood transfusion. This was between 20.53 and 21.33 according to the transfusion record. A second four units of fibrinogen concentrate were given between 01.56 and 02.35.
- Nine units of blood were transfused according to the transfusion record. The first to the seventh were transfused between 21.31 and at 00.20, the final two were given between 02.02 and 02.04.
- Cell salvage (collection of blood from the operation site) was employed, but no useable blood was produced.

Synopsis of blood loss, tests, and transfusion in the hours after delivery

Time	Time after delivery	Blood loss	Blood tests and transfusion
19.31	0		
19.50	19 minutes	1.7 litres	
20.20	49 minutes	2.4 litres	FIBTEM A5 10
20.53	82 minutes	2.8 litres	Fibrinogen concentrate started
21.10	99 minutes		Haemoglobin 72, coagulation normal
21.31	120 minutes		First unit of blood started
21.42	131 minutes	3.4 litres	Second unit of blood started
22.00	149 minutes		Fourth unit of blood being transfused FIBTEM A5 17, Haemoglobin 93
23.44	253 minutes		Decision to perform a laparotomy and subsequent hysterectomy

Post operative

After surgery Case B was taken to ITU, but there she continued to have low blood pressure and tachycardia, and at 04.10 the decision was made to take her back to the operating theatre. At this further laparotomy no active bleeding was found. Case B returned to ITU, but was discharged to the postnatal ward on the evening of 16 April 2022 and discharged home on 19 April 2022. I am not critical of the anaesthetic care she received at any point after her hysterectomy was performed, and therefore I have not given further details here.

The opinion of Reviewer 1a, Obstetrician

Below I have given a summary of Reviewer 1a's opinion with respect to this case. In as much as it is within my area of expertise, I am in agreement with his conclusions.

- The haemorrhage immediately following delivery was appropriately managed with uterotonics and making a major obstetric haemorrhage call.
- While it was reasonable to ascribe the bleeding to an atonic uterus (failure of the uterus to contract) and take Case B to the operating theatre, the transfer to the operating theatre should not have been delayed. In addition, it was a failure not to consider the possibility of uterine rupture in view of her previous Caesarean Section.

- There was a delay in giving blood products. The first unit of blood was not transfused until two hours after delivery; this was a breach of duty given the haemodynamic instability.
- Insertion of an intrauterine balloon was recognised and accepted practice, but the subsequent two-hour delay before laparotomy was unacceptable in view of the haemodynamic instability.
- Reviewer 1a is not critical of doing a hysterectomy; by that stage it was lifesaving procedure. Likewise, the further laparotomy was reasonable in view of the continuing haemodynamic instability.
- Case 1a should have received blood products earlier, should have been transferred to theatre earlier, and a laparotomy performed earlier. As massive blood loss results in DIC with consumption of further blood products resulting in further bleeding, these delays would have increased bleeding. While it is "*finely balanced"*, timely management would have avoided the need for hysterectomy.

My opinion

Breach

As detailed in the introductory chapter of this report, I have asked to consider the standard of treatment that Case B received, and whether it fell below the standard of a reasonably competent practitioner. I have been asked to summarise criticisms and explain, if necessary, what ought to have been done to achieve the minimum standards of reasonable professional competence.

I agree with Reviewer 1a that there were surgical delays, and specifically a delay in diagnosing uterine rupture; although I defer to his opinion in this respect. I also agree that there was a delay in the transfusion of blood (i.e. red blood cells), but I consider the timing of the transfusion of blood products, specifically fibrinogen, was acceptable; I expand on this further below.

Some aspects of the management of the obstetric haemorrhage complied with the guidelines discussed in the literature section of this report. For example, tranexamic acid and viscoelastometry were both employed, a consultant anaesthetist attended, and body temperature was maintained.

There is one aspect of Case B care where I am unable to determine if guidance was followed or not. The guidance calls for regular laboratory bloods to be sent, including full blood count, coagulation screen, and fibrinogen. Only one set of laboratory results prior to hysterectomy are given in the medical record. Nonetheless, it is likely that further tests were done and are recorded on the hospital computer system, but no print off has been placed in the medical record. Point of care testing results are available, including blood gas analysis giving haemoglobin levels and viscoelastometry results.

The one breach, where guidance was not complied with, was the delay in giving blood. The guidelines discussed in the literature section are not specific about when exactly blood transfusion should be started. Nonetheless, they do state: "*transfuse blood as soon as possible, if clinically required".* In Case B case blood transfusion did not occur until 120 minutes after delivery and commencement of the haemorrhage, and by this time blood loss probably stood at over 3 litres and the haemoglobin had fallen to 72g/l. In addition, there was haemodynamic instability

with a heart rate of 130. I therefore consider that there was a significant delay in the transfusion of blood, and this was a breach of duty of care. Because Case B had no name band when the blood arrived, it could not be quickly cross-checked with her details, and this led to a further delay of a few minutes before it could be ransfused. It is possible that a name band had been removed during the difficulties with intravenous access and had not been replaced. Nonetheless, all hospital patients should have a name band at all times, and it was a breach of duty of care that the absence of one caused a further delay in blood transfusion.

As noted above, Case B care was unusual in that she received blood 40 products, in the form of fibrinogen concentrate, prior to receiving blood itself. Thus, although the administration of blood was inappropriately delayed, I do not consider that the administration of other blood products, given in the form of fibrinogen concentrate, was significantly delayed.

Fibrinogen concentrate was given 82 minutes after delivery, and blood loss stood at 2.8 litres. It had probably been ordered half an hour earlier when the FIBTEM A5 result had been found to be 10, indicating a developing coagulopathy. Although a 'gold standard' would have been for blood products to have been given earlier still, the administration of fibrinogen concentrate was sufficiently timely to prevent significant DIC developing, and subsequent FIBTEM A5 results were normal. As such I believe that the standard of Bolam was achieved.

Finally, with respect to blood products, Case B was transfused with fibrinogen concentrate rather than the FFP recommended in the guidance discussed in the literature section. Clinical studies have shown that fibrinogen concentrate and FFP are equally effective in moderate haemorrhage. I defer to haematological opinion as to whether such a substitution was acceptable under the circumstances here, but I suspect that it was.

Causation

As detailed in the introductory chapter of this report, I have been asked to consider the consequences of any shortcomings in Case B care, and what the condition and prognosis would have been had she received acceptable care. In particular, I have been asked to assess if a hysterectomy could have been avoided.

Although there was a delay in the transfusion of blood, this is unlikely to have had an effect on causation and the need for hysterectomy. Haemoglobin levels were maintained sufficiently to sustain life, and low haemoglobin levels do not, in isolation, cause DIC.

Administration of fibrinogen appears to have been sufficiently timely to prevent significant DIC developing, as judged by the FIBTEM A5 results. Thus, if there were thought to have been any delay, I do not believe it could be argued that it was of consequence.

I agree with Reviewer 1a that on the balance of probabilities more timely Management would have avoided the need for hysterectomy. However, I believe the principal factor was the delay in considering the diagnosis of uterine rupture and performing a laparotomy, rather than any delay in transfusion of either blood or blood products.

Conclusions

It was a breach of duty of care that there was a delay in the transfusion of blood, but this would not have caused DIC. The absence of a name band contributed to this delay by a few minutes.

The administration of blood products, in the form of fibrinogen concentrate, was acceptable, and was sufficiently timely to prevent significant DIC. Therefore any transfusion delays did not contribute to the need for hysterectomy.

c. Case C

Summary of medical information

Case C was aged 30 when her first child was born by emergency caesarean section for placental abruption on 23 April 2022. She had no relevant past medical history. She had a BMI of 27.

She was admitted in labour on 23 April 2022 at 19.00. At 21.40 she was seen by a locum Obstetric Registrar who noted a pathological CTG and performed an examination and artificial rupture of membranes. There was frank blood in the liquor and the diagnosis of antepartum haemorrhage, with possible secondary placental abruption, was made. Emergency caesarean section was discussed with Case C and cleared with the consultant obstetrician.

A consent form was signed that listed the Caesarean Section as category 2 (maternal or fetal compromise, which is not immediately life-threatening).

Surgery

At 22.13 Case C was transferred to the operating theatre. Spinal anaesthesia started at 22.27 and surgery started at 22.52, with uterine incision at 22.54 and delivery of a baby girl in good condition at 22.55. The placenta was delivered at 22.58.

After delivery Case C continued to bleed. The operation notes record that pooling of blood was noted during closure of the rectus sheath and that a haemostatic suture was applied to a bleeding point on the uterus. Following this, the bleeding settled. The consultant obstetrician was called at 23.30, but the bleeding had been brought under control by the time he arrived.

Blood loss was 600ml at 22.50 (just before the start of surgery), but had risen to 1,475ml by 23.00 and was 2,146ml by 00.00 (at the end of surgery). Appropriate uterotonics and tranexamic acid were given during surgery. By 00.05 surgery had finished and Case C was transferred to recovery.

Anaesthetic record

Preoperatively the anaesthetist recorded that it was a category 2 Caesarean Section. Spinal anaesthesia was employed. During surgery three litres of Hartmann's solution were transfused. No blood or blood products were given. Up until 23.10 the maternal heart rate was below 100, but after this time it remained above 100, peaking at 130. Blood pressure remained normal throughout. Although maternal temperature was not recorded, active warming measures were taken.

Blood tests

The Postpartum Haemorrhage Management Checklist gives blood results from a sample taken at 23.14 on 23 April 2022: Haemoglobin 116g/l (normal); and FIBTEM A5 13 (normal). The following morning, 24 April 2025, the haemoglobin was 100g/l, but it had fallen to 86g/l by later in the day. No blood or blood products were transfused at any point.

The opinion of Reviewer 1a, Obstetrician

Below I have given a summary of Reviewer 1a's opinion with respect to this case. In as much as it is within my area of expertise, I am in agreement with his conclusions.

- There was prompt diagnosis of placental abruption, of which haemorrhage is a recognised complication.
- Although there was some delay in transferring Case C to the operating theatre for what should have been a category 1 caesarean section, this is unlikely to have caused harm.

My opinion

I am not critical of any aspect of Case C's anaesthetic care. She did not receive any blood or blood products despite a relatively high blood loss, but blood tests confirmed that this was not required.

I agree with Reviewer 1a that there was an inappropriate delay in transfer to the operating theatre (over 30 minutes from when the locum obstetric registrar first saw Case C). This appears to be because the surgeon classified the caesarean section as category 2 (maternal or fetal compromise, which is not immediately life-threatening), rather than category 1 (when there is immediate threat to the life of the woman or fetus). Nonetheless, as Reviewer 1a states, this is unlikely to have caused harm on this occasion.

About half of Caesarean Sections classified as category 1 are done under spinal anaesthesia, and it is likely that even if the caesarean section had been called as a category 1 by the surgeon, spinal anaesthesia would nonetheless have been employed. Spinal anaesthesia is slower than general anaesthesia, but has less risks. It would have been reasonable for the anaesthetist to still use spinal anaesthesia for Case C, even if a category 1 caesarean section had been called.

Conclusions

I am not critical of any aspect of Case C's anaesthetic care. Even if her caesarean section had been called as a category 1 by the surgeon, the spinal anaesthesia that she did in fact receive would still have been a reasonable choice.

d. Case D

Summary of medical information

Case D had had one previous vaginal delivery in 2011. She was 29 when she had her second child on 28 April 2022. Her BMI was 21.5.

Delivery

On 28 April 2022 at 06.34 she had a normal vaginal delivery without any anaesthetic intervention. Following delivery there was ongoing bleeding despite administration of Syntometrine. The placenta was delivered and the emergency bell activated at 06.39 with attendance of obstetric and midwifery staff at 06.40.

Further Syntometrine was administered and a second intravenous cannula inserted. Intravenous fluid was commenced. Blood was sent for tests including group and save. Carboprost and tranexamic acid were given. She was transferred to the operating theatre at 06.45 (although an obstetrician noted in error that transfer was at 07.50).

Surgery

In the operating theatre bleeding continued. She was placed in the lithotomy position at 07.08 and the decision was made for a general anaesthetic, which was administered at 07.27. A consultant obstetrician, who had been called in from home, examined Case D, but could find no cause for the bleeding other than uterine atony. An intrauterine balloon was inserted with some difficulty, and a uterine brace suture was performed at 09.05. The bleeding then settled.

During surgery Case D received appropriate uterotonics (ergometrine, misoprostol, and eight doses of carboprost) and also three of tranexamic acid. At 07.58 the anaesthetist requested blood, but at 08.04 it was recorded that although blood loss was over three litres, blood was not yet available for transfusion. However, Case D did subsequently receive two units of blood between 08.20 and 08.45. She received a total of six litres of Hartmann's solution during surger. At the end of surgery total blood loss was 3,375ml. There was full documentation on the Postpartum Haemorrhage Management Checklist.

Anaesthetic Chart

The anaesthetic chart confirms that active warming measures were taken and normal body temperature was maintained. The heart rate during anaesthesia

started at nearly 150, fell at some points during the surgery to around 100, but had risen to 125-130 by the end of surgery. Two anaesthetists' names are recorded on the anaesthetic chart, although their grade is not given.

Postoperative

Following surgery Case D had a persistent tachycardia, which was 180 at 10.00, but had fallen to 120 by 11.25. Blood pressure was normal. She received three further litres of Hartmann's solution. The Haemoglobin fell during the course of the day from 107g/l at 09.15 to 67g/l at 21.18, at which point two further units of blood were transfused overnight. On the day following surgery, 29 April 2022, the haemoglobin was still only 74g/l. On 30 April 2022 haemoglobin was 69g/l, and two more units of blood were given prior to discharge.

Blood loss, blood tests, and transfusion of blood

Blood loss

Delivery was at 06.34. Times and levels of blood loss recorded included:

06.50	1,048ml
07.00	2,018ml
07.23	2,118ml
07.50	2,753ml
08.04	3,003ml
08.29	3,188ml
08.45	3,288ml
09.16	3,375ml

Blood tests

Viscoelastometry (FIBTEM A5 test, normal is 12 or greater):

07.55	18 (from the printout; incorrectly recorded as 14 on the PPH chart)
08.47	12
13.45	11
20.09	11

Note that the last two readings were taken after surgery was completed.

Haemoglobin levels:

- Normal is 110g/l or greater
- It is not clear from the medical record which of the below values were point of care readings and which were laboratory blood tests
- I can find no record of a haemoglobin level following delivery until 08.47

Predelivery	113
08.47, 28 April 2022	107
09.43	97
10.46	104
12.45	98
17.30	88
21.18	67
08.15, 29 April 2022	74
17.45	75
14.25, 30 April 2022	69

Transfusion of blood

- Two units of blood were transfused during the surgery starting at 08.20. The first unit had been given by 08.34, the second by 08.45.
- After surgery four further units of blood were transfused over the following two days.
- No fibrinogen or FFP were given.

The opinion of Reviewer 1a, Obstetrician

Below I have given a summary of Reviewer 1a's opinion with respect to this case. In as much as it is within my area of expertise, I am in agreement with his conclusions.

- There was prompt recognition of the haemorrhage and prompt transfer to the operating theatre, with senior help being called appropriately. Insertion of a B-lynch suture was appropriate.
- There was a delay in giving blood and under-transfusion per-operatively, as evidenced by four units of blood being required after surgery.
- It is likely there was an element of DIC notwithstanding the normal FIBTEM A5 results.

My opinion

Many aspects of Case D's care were of a high standard. Reviewer 1a makes eeference to the prompt diagnosis and transfer to the operating theatre. In addition: there was timely administration of tranexamic acid and uterotonics; active measures were taken to maintain body temperature; and documentation on the Postpartum Haemorrhage Management Checklist was thorough.

I agree with Reviewer 1a that the administration of blood could have been timelier.

I make the following observations:

- Although delivery and the bleeding started at 06.34, there is no record of a haemoglobin measurement until 08.47, over two hours later. It is likely that a measurement was taken earlier than this, but it has not been recorded. Two units of blood had been given by 08.45, and the haemoglobin was then 107g/l. This value, and subsequent reasonable values during the course of the day (for example 88g/l at 17.30) probably gave a false sense of reassurance that further blood was not required.
- However, Case D's tachycardia at the end of surgery and subsequently should have raised concerns that she was still volume depleted intravascularly even though her haemoglobin was near normal. Thus, consideration to giving further blood transfusion should have occurred

  Blood was requested at 07.58, by which time blood loss had reached over 2.7 litres. Blood was available and being given by 08.20. This was an appropriate point at which to start blood transfusion, but arguably it could have been sooner.

  The clinical picture may have been complicated by further bleeding even after the surgery was completed, although the amount of blood loss after surgery was not documented.

Overall, although the timing of the administration of blood was not 'gold standard', I do consider it to have been sufficient to fulfil the standard required by Bolam. There is no evidence that any delay in blood transfusion resulted in harm.

I also agree with Reviewer 1a that it is likely there was an element of DIC. Initial FIBTEM A5 results were normal, but the two tests done postoperatively were both slightly low. Nonetheless, I do not think that any blood products, such as fibrinogen or FFP, were indicated at any point. By the time the FIBTEM A5 results were abnormal, the haemorrhage had been largely or entirely controlled.

Conclusions

Many aspects of Case D's care were good. Although the timing of the administration of blood was not 'gold standard', I do consider it to have been sufficient to fulfil the standard required by Bolam.

e. Case E

Summary of medical information

Case E was 21 when she was delivered of her first child on 9 January 2022. She had a BMI of 22.2.

Delivery

Case E presented with spontaneous rupture of membranes at 23.00 on 8 January 2022 and was Covid positive. Her haemoglobin was measured as 105g/l. In the early hours of 9 January 2022 her labour was augmented with an oxytocin infusion. She delivered at 19.28. There had been no anaesthetic intervention.

Haemorrhage

At 19.43 the placenta was delivered and there was a gush of blood. An emergency call bell was activated and an oxytocin infusion started. The uterus was atonic and uterine massage was employed to produce a contraction. The obstetric team arrived.

A major obstetric haemorrhage call was put out at 19.50. The blood pressure was 77/50 and the pulse was 143, improving to 118/74, pulse 130, by 19.58.

An anaesthetist attended and uterine massage was continued for an atonic uterus. Tranexamic acid and an oxytocin bolus were given, a second intravenous access and blood samples were obtained, the MOH protocol was activated, the uterotonics carboprost and misoprostol were given, and there was repair of a first-degree vaginal tear. One litre of intravenous fluid was given, and this was followed by an infusion of 150ml per hour.

At 20.05 the blood loss was 1,791ml. However, with the above measures the haemorrhage had resolved by 20.30, and total blood loss was 2,559ml. A

Postpartum Haemorrhage Management Checklist was completed. Haemoglobin measured at 21.04 was 101g/l. Although it is recorded that a viscoelastometry (ROTEM) test was to be done, I can find no result in the medical record.

At 03.15 the following day, 10 January 2022, a further blood sample was taken for a haemoglobin level. Reviewer 1a states that the result was 79g/l, although I have been unable to find it in the medical record. In any case, the result was not commented in in the handwritten medical record, and it is likely that medical staff were not aware of it.

Later that day a further blood sample was taken at 9.45, and at 10.15 the haemoglobin result was noted to be 62g/l. ET was feeling dizzy on walking, and so she received two units of blood. A haemoglobin level was taken that evening at 23.15, after transfusion, and was 81g/l.

Case D was discharged the following day, 11 January 2022.

The opinion of Reviewer 1a, Obstetrician

Below I have given a summary of Reviewer 1a's opinion with respect to this case. In as much as it is within my area of expertise, I am in agreement with his conclusions.

- Induction of labour with oxytocin was appropriate.
- A long labour and sepsis were risk factors for the haemorrhage, which was due to an atonic uterus.
- The haemorrhage was recognised promptly and treated appropriately with uterotonics.
- Appropriately blood was taken at 03.15, but the haemoglobin result of 79g/l does not appear to have been noted. The haemoglobin the following morning was 62g/l, and, arguably, blood should have been given at an earlier stage, although no harm arose.

My opinion

There are three aspects of Case D's management which concern me:

- Either no sample for viscoelastometry was obtained, or the result was not recorded. This result should have been available, and had it been abnormal it might have indicated a need for fibrinogen / FFP.
- Only one litre of intravenous fluid (presumably Hartmann's) was given for resuscitation during the haemorrhage. Considering that blood loss was nearly 2.6 litres, Case D needed to receive about three litres to replenish her intravascular volume. It was because she did not receive sufficient intravenous fluid at the time of the haemorrhage that initially her haemoglobin levels were surprisingly high despite the blood loss; for example, the level of 101g/d at 21.04. Had she received appropriate amounts of intravenous fluid during the haemorrhage, the measured haemoglobin would have shown a lower result earlier, and it is likely that blood transfusion would have commenced earlier.
- As Reviewer 1a notes, the haemoglobin result from the sample taken at 03.15 does not appear to have been noted or acted upon.

All three issues raised above are breaches of duty of care. I agree with Reviewer 1a that blood probably should have been given at an earlier stage. I also agree that no harm arose because of this delay.

Conclusion

Two blood samples, one for viscoelastometry, and one for haemoglobin, appear not to have been recorded and/or acted upon. These were breaches of duty of care. Likewise, it was a breach of duty of care that only one litre of intravenous fluid was given when the blood loss was nearly 2.6 litres. Blood probably should have been given at an earlier stage, although no harm arose.

f. Case F

Summary of medical information

Case F had had delivery of a stillborn male infant at 36 weeks following feticide for microcephaly in 2020. She had a history of anxiety and depression, but no other medical problems. She was aged 22 when she had an Emergency Caesarean Section to deliver her second child on 23 January 2022. She had a BMI of 29.

Labour

On the evening of 22 January 2022 Case F had an artificial rupture of membranes. At 00.20 on 23 January 2022 an epidural was inserted for pain relief in labour. At 03.15 an oxytocin infusion was commenced and by 11.00 her cervix was 8cm dilated.

Caesarean section

That evening, at 21.00, Case F was consented for a category 2 Caesarean Section for failure to progress in labour. She was taken to the operating theatre, her epidural was topped up, and surgery started at 21.56.

The baby was born at 22.05, and Case F received Syntometrine IM, oxytocin IV, and tranexamic acid IV.

Haemorrhage

There was brisk bleeding due to uterine atony after delivery. At 22.10, 5 minutes after delivery, the blood loss was 720ml. By 22.30 it was 1,506ml, and final total blood loss, at 23.50, was 2,018ml.

Measures undertaken in relation to the bleeding included the following.

- A Consultant Obstetrician taking over the surgery. Ultimately, he brought the bleeding under control by administering intramyometrial carboprost (direct injection of carboprost into the uterine muscle) to achieve uterine contraction.
- Other drugs and uterotonics administered included: oxytocin infusion, four doses of carboprost IM, tranexamic acid IV, and misoprostol PR.

- Blood was taken for viscoelastometry at 22.31 and the FIBTEM A5 value was 17 (normal).
- A Postpartum Haemorrhage Management Checklist was completed.
- No blood or blood products were given.

The anaesthetic chart records the epidural top up and, following delivery, administration of a general anaesthetic due to Case F feeling pain. Three litres of Hartmann's solution were administered during surgery, and a further litre was commenced as surgery finished. At this point the haemoglobin, measured on a blood gas sample, was 102 g/l.

By 25 January 2022, two days later, the haemoglobin level had fallen to 75g/l. This was treated with iron injections. Case F was discharged on 26 January 2022.

The opinion of Reviewer 1a, Obstetrician

Below I have given a summary of Reviewer 1a's opinion with respect to this case. In as much as it is within my area of expertise, I am in agreement with his conclusions.

- There was a gross delay in undertaking the Caesarean Section, which is likely to have contributed to the haemorrhage.
- The operation record suggests that appropriate actions were taken to deal with the haemorrhage.

My opinion

There was no breach of anaesthetic care. Appropriate actions were taken to control the haemorrhage.

Conclusions

Despite the delay in undertaking the caesarean section, which may have contributed to the haemorrhage, there was no breach of duty of care in the management of the haemorrhage.

g. Case G

Summary of medical information

Case G had previously had two vaginal deliveries. The first had been complicated by a post-partum haemorrhage. She had previously had gastric- bypass surgery, and had a BMI of 32.

Labour and delivery

She was admitted for Induction of Labour on 29 January 2022. At 21.30 an oxytocin infusion was commenced, and at 02.30 the following morning, 30 January 2022, an epidural was inserted for pain relief in labour. Normal vaginal delivery occurred at 11.07 and Syntometrine was given IM.

The placenta and membranes were delivered at 11.14 and at 11.15 the midwife recorded "*Uterus well contracted, blood loss stable",* and the measured blood loss was 525ml.

Haemorrhage

At 11.25 the midwife recorded "*Upon re-entering room blood loss noted on bed. Sheet lifted and significant blood loss seen. Emergency bell pulled."* By 11.30 the total blood loss was 1,200ml.

By 11.35 there had been a vaginal examination by the Obstetric Registrar to expel clots, tranexamic acid had been given IV, carboprost had been given IM, and a second cannula had been placed by the anaesthetist and blood samples taken. Two litres of Hartmann's solution were given.

Further carboprost IM was given, and there was a decision to move to the operating theatre with arrival at 11.57. At 12.00 the blood loss was 2,387ml; the blood loss must have largely stopped by then, as no further blood loss is recorded. A third dose of carboprost IM was given at 12.05 and misoprostol PR at 12.29.

Surgically the cause of the haemorrhage was found to be uterine atony with some placental tissue remaining in the uterus which was removed. An attempt to insert an intrauterine balloon was unsuccessful, but the uterus was in any case well contracted by this time, probably due to the administration of uterotonics, and there was no further bleeding.

The anaesthetic chart records that the epidural was topped up in the operating theatre. A further two litres of Hartmann's solution were administered in the operating theatre (making a total of four).

A Postpartum Haemorrhage Management Checklist was completed. It recorded that at 11.44 the viscoelastometry FIBTEM A5 result was 17 (normal) and the haemoglobin was 104. Later that day, as 19.35, the haemoglobin was found to be 72g/l, and NW did receive one unit of blood prior to discharge on 1 February 2022.

The opinion of Reviewer 1a, Obstetrician

Below I have given a summary of Reviewer 1a's opinion with respect to this case. In as much as it is within my area of expertise, I am in agreement with his conclusions.

- As Case G had suffered a haemorrhage after a previous delivery, she was at increased risk of haemorrhage.
- Induction of labour, and the labour itself, were managed appropriately.
- Following delivery at 11.07, there was a moderate blood loss of 525ml up to 11.15. [redacted] should not have then been left in the room alone until 11.25, when significant blood loss was seen.
- Thereafter there was appropriate management with prompt transfer to theatre.

My opinion

There was no breach of anaesthetic care. Appropriate actions were taken to control the haemorrhage.

Conclusions

Despite the midwife leaving Case G unattended for up to 10 minutes shortly after delivery, there was no other breach of duty of care in the management of the haemorrhage.

h. Case H

Summary of medical information

Case H had had two previous vaginal deliveries. Her BMI was 25.8.
There was no other relevant medical history. She was pregnant with twins and her haemoglobin had been 101g/l on 28 January 2022.

Induction of labour and delivery

On 7 February 2022, a month before her due date, she had Induction of Labour for decreased fetal movements and growth restriction. Her twins were delivered vaginally at 21.42 and 21.50.

Haemorrhage

Syntometrine was given IV after the birth of twin 2. After delivery of the placenta there was severe bleeding and by 22.16 blood loss was 788ml. An oxytocin infusion had already been commenced, and an anaesthetist had attended and given tranexamic acid IV. Carboprost was given IM, and following a vaginal examination and part of the placenta being found in situ, transfer to the operating theatre was arranged. At 20.20 a major obstetric haemorrhage call was put out, and the blood loss was 1,421ml. By 22.26 PG was in theatre.

When she was first placed on the operating table, she "*became haemodynamically labile, eyes rolled out and tachycardia".* This was thought to be a vasovagal reflex, and she was laid down for spinal anaesthesia. By 22.32 preparations for spinal anaesthesia had commenced, and blood loss was recorded as 2,471ml.

Placental pieces were manually removed and two further doses of carboprost IM, oxytocin IV, and misoprostol PR, were given. The bleeding subsided. Recorded blood loss remained at 2,471ml.

A Postpartum Haemorrhage Management Checklist was completed. At 22.30 the haemoglobin was 106g/l and FIBTEM A5 was 19mm (normal). At 23.00 the haemoglobin was 92g/l and FIBTEM A5 was 18mm (normal).

Anaesthetic chart

The anaesthetic chart also records the flowing relevant information.

- There was a vasovagal episode prior to spinal anaesthesia.
- Three attempts were required to insert the spinal anaesthetic; the third by a

different anaesthetist.

- A standard spinal dose was employed of 2.5ml of 0.5% heavy bupivacaine and 300mcg diamorphine. This was administered at 22.41.
- The blood pressure and heart rate of the chart is partially obscured, and it is difficult to be certain if systolic and/or diastolic blood pressure values are being recorded. The heart rate was 120 at 22.30, falling to 72 at 22.45. At 22.45 a blood pressure of 50mmHg was recorded, although I am uncertain if this is systolic or diastolic.
- Two litres of Hartmann's solution were infused. One starting at 22.00, the second at 23.00, which was after the spinal had been administered.
- In the recovery ward at 23.30 the heart rate was 130, blood pressure was 115/80. Further Hartmann's solution was given, but the heart rate did not fall below 120 in the recovery ward. She was discharged from the recovery ward at 23.50.

Postoperative

Two hours later, on the ward, the heart rate did fall to about 90.

The following day, 8 February 2022, the haemoglobin was 64g/l, and [redacted] received one, or possibly two (the record is contradictory), units of blood. Two days after that, 10 February 2022, the haemoglobin was 61g/l, after which she received two further units of blood, raising her haemoglobin to 76g/l. On 11 February 2022 she received one further unit of blood, and on 13 February 2022 the haemoglobin was 96g/l.

She was finally discharged with her twins on 18 February 2022.

The opinion of Mr Reviewer 1a, Obstetrician

Below I have given a summary of Reviewer 1a's opinion with respect to this case. In as much as it is within my area of expertise, I am in agreement with his conclusions.

- Haemorrhage is a recognised complication of both twin delivery and retained placental tissue.
- Haemorrhage was recognised promptly and managed appropriately.

My opinion

I agree with Reviewer 1a that the bleeding was recognised promptly, and was managed appropriately by the Obstetricians.

Nonetheless, there is one aspect of the anaesthetic care which does cause me some concern, although there was no consequent bad outcome. This is explained below.

- Case H appears to have only received two litres of Hartmann's between the start of the haemorrhage and her discharge to the recovery ward. She received no blood or blood products. This is insufficient in view of the blood loss of nearly 2.5 litres.
- At the time she had her spinal dose administered, at 22.41, it appears less than one lite of Hartmann's solution had been given, as the second litre was not started until 23.00. Blood loss had already been previously recorded as 2,471ml at 22.32.

- Her intravascular volume depletion due to haemorrhage and inadequate transfusion of fluids is demonstrated by the heart rate of 120 shortly after arrival in the operating theatre; the subsequent fall probably being secondary to the spinal anaesthetic.
- In addition, I am suspicious that the "*vasovagal"* episode recorded by both the obstetrician and the anaesthetists was triggered by intravascular volume depletion. Indeed, it is unlikely to have been a vasovagal episode at all, as it was associated with tachycardia, whereas vasovagal episodes are associated with bradycardia.
- The persistent tachycardia in the recovery ward and thereafter also suggests inadequate transfusion of intravenous fluids.
- After the spinal anaesthetic was done, at 22.41, the blood pressure fell markedly, with a reading of 50mmHg at 22.45. While it is not clear if this value is systolic or diastolic, it is nonetheless much lower than all other recorded values.
- Anaesthetic textbooks caution against administering spinal anaesthesia in patients with a depleted intravascular volume, as the further vasodilation due to the spinal anaesthetic may precipitate cardiovascular collapse, and sometimes cause cardiac arrest in such patients.
- This is also why the Royal College of Obstetricians and Gynaecologists guidelines state: "*While general anaesthesia in obstetric patients is associated with increased morbidity and mortality when compared with regional anaesthesia due to the physiological changes that occur in pregnancy, it may be preferable in patients who are haemodynamically unstable or who have a coagulopathy*."
- The blood pressure value of 50mmHg shortly after spinal anaesthesia is probably an indication of that cardiovascular collapse, and it is probably fortuitous that cardiac arrest did not ensue.

I should also add that the large amount of blood required over the next few days after the haemorrhage indicates that, at least in retrospect, blood probably should have been given at the time of the haemorrhage. Had it been, Case H is unlikely to have been so intravascular volume depleted. Nonetheless, I am not overly critical of the failure to transfuse blood at the time, as measured blood loss was less than 2.5 litres. However, I am moderately critical of the failure to transfuse more intravenous fluids, and particularly critical of performing spinal anaesthesia when insufficient intravenous fluids had been given. This was a breach of duty of care, and it is fortuitous that there was no consequent bad outcome.

Conclusion

While many aspects of the management of Case H's haemorrhage were reasonable, I am concerned that insufficient intravenous fluids were transfused during the haemorrhage, and it was a breach of duty of care that spinal anaesthesia was administered under these circumstances. It is fortuitous that there was no consequent bad outcome.

i. Case I

Summary of medical information

Case I had her first child by Caesarean Section on 10 March 2022. Her BMI was 26.4. There was no other relevant medical history.

Labour

On the 7 March 2022 she was admitted for induction of labour for being post- dates. It was noted that her placenta had a posterior and anterior succenturiate lobes, and that therefore she was at high risk of haemorrhage and retained placenta.

On the evening of 9 March 2022 she was admitted to labour ward and found to have a 4cm dilated cervix with thick meconium draining. An epidural was inserted for pain relief.

At 00.05 on 10 March 2022 the cervix was 8cm dilated. There was then no documentation until 06.10, but at that time the cervix was still 8cm dilated and an oxytocin infusion had just been started. At 08.50 the cervix was almost 10cm dilated, and the oxytocin was stopped. At 10.30 Case I was thought to have an infection, as her temperature was 37.7 ^{o}C. The plan was for a trial of instrumental delivery in the operating theatre, with a Caesarean section if required. The epidural was topped up, and she arrived in the operating theatre at 11.05. At 11.15 the cervix was found to still be palpable, and the plan was for a Caesarean Section.

Caesarean section and haemorrhage

Caesarean Section was complicated by the baby's shoulders being difficult to deliver, and significant bleeding from a broad ligament tear was noted. Haemostatic sutures were inserted to control the bleeding, and Surgicel was employed.

The following additional actions were taken with respect to the haemorrhage.

- An MOH call was put out.
- A Postpartum Haemorrhage Management Checklist was completed.
- Syntometrine and two doses of carboprost IM were given.
- Oxytocin was given as both a bolus and an infusion.
- At just over one litre of blood loss viscoelastometry was performed with a FIBTEM A5 of 19 (normal). The haemoglobin on a blood gas sample was 114g/l.
- The anaesthetic chart records that three litres of Hartmann's solution were transfused in the operating theatre, the heart rate was between 90 and 115, and the blood pressure was satisfactory.

Total measured blood loss was 2,569ml. The haemoglobin was 73g/l on the following day, 11 March 2022, and two units of blood were transfused. NJ was discharged on 12 March 2022.

The opinion of Reviewer 1a, Obstetrician

Below I have given a summary of Reviewer 1a's opinion with respect to this case.

In as much as it is within my area of expertise, I am in agreement with his conclusions.

- It was reasonable to induce labour, although the possibility of Caesarean Section should have been discussed.
- There is an absence of documentation during labour, and oxytocin may have been indicated earlier.
- There was haemorrhage due to an extension of the uterine incision at caesarean section, which followed prolonged labour and near full cervical dilatation.
- The haemorrhage was managed appropriately.

My opinion

I agree the management of the haemorrhage was appropriate.

Conclusion

The management of the haemorrhage was appropriate, and there was no anaesthetic breach of duty of care.

j. Case J

Summary of medical information

Case J was 36 when she had her first child by emergency Caesarean Section. She had a medical history of chronic liver disease due to alcohol abuse and had had a portal vein thrombosis. She had a BMI of 30.

Caesarean section

On 13 March 2022 she had a Caesarean Section for the following given reasons: abnormal CTG; spontaneous rupture of membranes; fetus small for gestational age (she was 33 weeks and 4 days pregnant); breach presentation; cervix 4cm dilated; and chronic liver disease. Surgery was under general anaesthesia.

During the surgery a poorly formed lower uterine segment was noted, and there was an inadvertent vertical extension of the left margin of the uterine incision extending to the vagina. This was repaired by a consultant obstetrician.

The postnatal midwifery records and observation charts are absent from the medical record.

Intraabdominal haemorrhage

The following day, 14 March 2022, Case J "*collapsed on the bed"* at 07.15. There were no seizures but there was a temporary loss of consciousness. On examination the abdomen was soft, albeit with pain on palpation of the right upper quadrant. The blood pressure was 92/64. There was a plan for intravenous access and infusion of one litre of Hartmann's solution, but this fluid was not attached.

At 08.30 she had a second collapse when she tried to get up from the bed. This time there was no loss of consciousness. Following the collapse, she had a heart rate of 95, a blood pressure of 80/64, and it was found that the planned Hartmann's solution had not been attached.

At 08.45 she was reviewed by a Consultant Anaesthetist, who among other observations noted a prolonged capillary refill time of 3.5 seconds and venous blood gas haemoglobin level of 76g/dl. The anaesthetist made a "*working diagnosis*" of intraabdominal haemorrhage.

At 08.55 the diagnosis of intraabdominal haemorrhage was confirmed by a consultant obstetrician. Case J was "*very pale"* with a distended tense abdomen. Blood pressure was 103/64 and pulse was 82. Bloods were taken at 09.15, and the results, recorded later at 11.25, included haemoglobin 75g/l and fibrinogen 1.4. A viscoelastometry sample was taken and the result noted to be normal, although no actual values are given in the medical record.

At 09.30 she was transferred from the postnatal ward to the delivery suite. At 09.40 blood transfusion was commenced, and at 10.00 she was transferred to the operating theatre. Here an arterial line was sited, and general anaesthesia was induced. Surgery commenced at 10.27.

At laparotomy there was mild ooze from the left broad ligament and large amounts of blood clots were removed and haemostasis secured. The skin was being closed by 11.30. Total blood loss was 2,319ml.

The following is relevant with respect to the haemorrhage:

- At 10.33 the haemoglobin was 91g/l.
- At 10.40 the blood pressure was 70/42, and at 10.50 it was 77/32.
- At 10.44 blood loss was 1,146ml, and at 10.55 a major obstetric haemorrhage call was put out.
- Active measures were taken to warm Case J and maintain body temperature.
- In total three litres of normal saline and four units of blood were given during the surgery. Four units of FFP were given immediately after the surgery between 11.34 and 11.45. One unit of cryoprecipitate was also given.
- At 11.55 a central line was inserted. Blood was taken for viscoelastometry and the FIBTEM A5 was 10 (normal is 12 or above).
- A Postpartum Haemorrhage Management Checklist was not completed. (One had been started the previous day, presumably for the caesarean section. Only the first section of this had been completed, as there had been no significant haemorrhage at the caesarean section.)

<u>Postoperative</u>

Case J made a good recovery from surgery and was discharged on 19 March 2022. She was referred to haematology in view of her previous portal vein thrombosis and risk of liver-disease induced coagulopathy.

The opinion of Reviewer 1a, Obstetrician

Below I have given a summary of Reviewer 1a's opinion with respect to this case. In as much as it is within my area of expertise, I am in agreement with his conclusions.

- Reviewer 1a is not critical of the uterine incision extension at caesarean section. This was repaired by a consultant.
- No intravenous fluid was given following the collapse on the day after caesarean section at 07.15.
- Following the second collapse at 08.30 the diagnosis of intraabdominal haemorrhage was made promptly.
- There was a delay between 08.55 and 10.25 before laparotomy commenced.
- It is possible Case J had an increased risk of haemorrhage because of her chronic liver disease.
- There are absences in documentation. These include midwifery notes and observation charts following caesarean section, and the Postpartum Haemorrhage Management Checklist.

My opinion

It was a breach of duty of care that after the collapse at 07.15, although infusion of Hartmann's solution was planned, it was not attached. Nonetheless, it is unlikely that this influenced the clinical outcome.

It was also a breach of duty of care that some of the midwifery paperwork is missing, including the Postpartum Haemorrhage Management Checklist when a major obstetric haemorrhage call was made. Again, it is unlikely that this influenced the clinical outcome, but if medical records are either not completed, or go missing, it is harder for the hospital to demonstrate what clinical care was given.

I agree with Reviewer 1a that the delay between the diagnosis of intraabdominal haemorrhage and starting the laparotomy was unusually long. Nonetheless, there were probably limitations due to operational factors, I do not consider that this was a breach of duty of care.

The anaesthetic care Case J received was of a good standard, and there was no breach of duty of anaesthetic care.

Conclusions

Although there were breaches of duty of care relating to the failure to attach intravenous fluids and the completion and/or loss of paperwork, neither seem to have altered clinical outcome. There was no breach of duty of anaesthetic care.

k. Case K

Summary of medical information

Case K had had one previous vaginal delivery. She was 26 at the time of delivery of her second child. She had a BMI of 23 and had no relevant past medical history. Her haemoglobin on 2 March 2023 was 104g/l.

Labour and delivery

On the morning of 18 March 2022, the estimated date of delivery, she was admitted in spontaneous labour. She had a normal vaginal delivery at 06.43.

Haemorrhage

At 07.15 the placenta was delivered. At 07.25 an obstetrician noted that the blood loss was 300ml, the uterus was well contracted, and a large proportion of the membranes were still within the uterus. The plan was for intravenous access, an oxytocin infusion, and possibly an examination under anaesthetic.

The oxytocin infusion was started at 07.35. The measured haemoglobin was 115g/l. At 08.45 the blood pressure was 112/75 and the heart rate 84.

At 09.25 intravenous Hartmann's solution was started and tranexamic acid administered. The blood pressure was 107/72 and the heart rate 87. A second intravenous line was inserted and blood tests taken. The haemoglobin was 120g/l and the FIBTEM A5 was 20 (normal). At 09.40 there was still on-going bleeding and the blood loss was more than 600ml. There was an attempt to remove placental tissues and membranes in the delivery room without anaesthetic. Case K was offered transfer to the operating theatre for anaesthesia, but she declined, although the measured blood loss had risen to 1,399ml. At 10.30 a second one litre bag of Hartmann's solution was commenced.

Management in the operating theatre

At 11.00 there was a further gush of blood, and it was agreed to move to the operating theatre. Blood loss was over 1,500ml, and a major obstetric haemorrhage call was put out. The Blood pressure, pulse and respiratory rate remained stable. At 11.15 RD was reviewed by an anaesthetist in preparation for transfer to the operating theatre. The blood pressure was 100/68 and the heart rate was 104.
At 12.00 she arrived at theatre reception. Induction of general anaesthesia had been completed by 12.12. The following is relevant with respect to the management of the haemorrhage.

- Further tranexamic IV, misoprostol PR and Syntometrine IM were given. A second oxytocin infusion was commenced.
- A further litre of Hartmann's solution was administered.
- Two retained placental cotyledons and membranes were delivered.
- The temperature was not recorded, but an intravenous fluid warmer was employed.
- A Postpartum Haemorrhage Management Checklist was completed.
- At 12.29, by which time the haemorrhage had been controlled, the haemoglobin was 93g/l and the FIBTEM A5 was 19 (normal).

- Total blood loss was 2,257ml.

Postoperative

That evening, 18 March 2023, Case K had a haemoglobin of 73g/l. The following day, 19 March 2022, she had a haemoglobin of 64g/l and she had a two-unit blood transfusion. She was discharged on 20 March 2022.

The opinion of Reviewer 1a, Obstetrician

Below I have given a summary of Reviewer 1a's opinion with respect to this case. In as much as it is within my area of expertise, I am in agreement with his conclusions.

- Retained membranous tissue was recognised promptly following delivery and initial measures were appropriate.
- There was a delay taking the patient to theatre; ostensibly the patient declined transfer, but there should have been a clear explanation of the need for a procedure under anaesthesia.
- Other aspects of the case were managed appropriately.

My opinion

The Royal College of Obstetricians and Gynaecologists Guidelines indicate that a major obstetric haemorrhage call should be made when blood loss exceeds 1000ml and there is ongoing bleeding or clinical shock. In Case K's case no call was made when the blood loss stood at about 1.4 litres, although it appears there was no clinical shock and the bleeding may have temporarily abated. Therefore, this was not a breach of duty of care. A call was made once blood loss exceeded 1.5 litres.

There was a significant delay in the surgical management of the bleeding. Expediency would have reduced blood loss. Nonetheless, operational and patient factors probably contributed to the delay, and there was not necessarily any breach of duty of care.

Other than the delay in surgical management, the treatment of the haemorrhage was appropriate. There was no anaesthetic breach of duty of care.

Conclusions

There was a delay in instituting surgical management of the bleeding. There was no anaesthetic breach of duty of care.

Overall conclusions on the eleven cases

Conclusions of Reviewer 1a, Obstetrician

I have read the conclusions of Reviewer 1a in his review of these cases.
I am in agreement with him, and have not reproduced his conclusions in details here. As an anaesthetist, I share his concern that there was a delay in giving blood and/or blood products in cases a, b, d and e. As Reviewer 1a states, it is important that blood and clotting products are replaced before the patient becomes haemodynamically unstable or DIC is established.

Quality of care

The management of any complex clinical case, but perhaps especially haemorrhage in obstetric patients, is a difficult process that is almost impossible to do perfectly. While there are guidelines available, management of each case needs to be bespoke due to differences between patients and also their pathologies. In addition, there has to be a complex interaction within the multidisciplinary team, which can be difficult to always achieve. While perfection should be strived for, one has to accept that this is likely to be difficult for any hospital to attain with every case.

With the above in mind, and having studied the cases discussed here closely, I am confident that the overall level of care provided by the hospital and the teams working on labour ward was probably above, rather than below, average for a UK hospital. Like Reviewer 1a, I have been impressed by the evidence of prompt recognition of bleeding, excellent documentation, and excellent teamwork. I am also impressed by the regular use of viscoelastometry, which was used more consistently than it is in my own hospital. In addition, the action of the hospital to commission a review of these cases suggests that good patient care is a managerial priority within the hospital.

Nonetheless, there is benefit in the hospital taking account of problems which occurred in these cases, so that future care of patients can be improved further. From an anaesthetic perspective I have the following concerns.

Case a

The delay in the administration of blood products was a significant breach of duty of care, and the DIC that resulted was, on the balance of probabilities, responsible for the need for hysterectomy.

Case b

It was a breach of duty of care that there was a delay in the transfusion of blood, but this would not have caused DIC. The absence of a name band contributed to this delay by a few minutes. The administration of blood products, in the form of fibrinogen concentrate, was acceptable, and was sufficiently timely to prevent significant DIC. Therefore, any transfusion delays did not contribute to the need for hysterectomy.

Case d

Many aspects of care were good. Although the timing of the administration of blood was not ‘gold standard’, I do consider it to have been sufficient to fulfil the standard required by Bolam.

Case e

Two blood samples, one for viscoelastometry, and one for haemoglobin, appear not to have been recorded and/or acted upon. These were breaches of duty of care. Likewise, it was a breach of duty of care that only one litre of intravenous fluid was

given when the blood loss was nearly 2.6 litres. Blood probably should have been given at an earlier stage, although no harm arose

Case h

While many aspects of the management the haemorrhage were reasonable, insufficient intravenous fluids were transfused during the haemorrhage, and it was a breach of duty of care that spinal anaesthesia was administered when the patient was not fully resuscitated. It is fortuitous that there was no consequent bad outcome, such as cardiac arrest.

Underlying themes

In all of the cases a, b, d, e, and h listed above, there was a delay in the transfusion of blood and/or blood products, and/or a delay in giving sufficient intravenous fluids. In the first case the delay in administering blood products resulted, on the balance of probabilities, in the need for a hysterectomy; this was extremely unfortunate, especially in view of the patient still being a teenager.

It follows that the greatest service improvement will be achieved by the hospital having training and systems in place to ensure that intravenous fluids, blood, and blood products, are given in a timely manner in cases of obstetric haemorrhage.

I consider the other issues arising as being less important, but nonetheless still needing to be addressed. These include: ensuring that all patients have a name band at all times; ensuring that appropriate blood samples are taken and the results sought; and not administering spinal anaesthesia to inadequately resuscitated patients. The last of these three, not administering spinal anaesthesia to inadequately resuscitated patients, ties in with the importance of timely administration of intravenous fluids, blood and blood products.

Achieving improvement

The All Wales Guideline, Prevention and Management of Obstetric Haemorrhage, provides advice on how to achieve service improvement in the management of obstetric haemorrhage, and I urge the hospital to ensure that all of the following from the guideline is undertaken.

- All staff should receive training in the management of obstetric emergencies, including the management of PPH. This should be included in the PROMPT Wales's training.
- Training for PPH should be multi-professional and include team rehearsals.
- A Datix Cymru reporting form should be completed at agreed thresholds as per OBS Cyrmu.
- All PPH events which are classified as Serious Incidents and/or require Root Cause Analysis should be reported to the Maternity Network Safety Subgroup for dissemination of learning across Wales. Learning from cases that were managed well is also encouraged.

With respect to the anaesthetic error of inserting a spinal in a patient who was not fully resuscitated, I would suggest that the hospital's local obstetric

anaesthetic guidelines are modified to emphasise the risks of spinal anaesthesia in this respect. This issue should also be included in regular anaesthetic labour ward training.

Synopsis

In synopsis, I think in many instances the hospital provided a good level of care to these patients. However, a delay in giving blood, blood products, and/or adequate intravenous fluids was a common problem. In one instance this failure, on the balance of probabilities, resulted in the need for a hysterectomy in a teenager.

In addition, anaesthetists should be wary of employing spinal anaesthesia in patients who have not been fully resuscitated after haemorrhage.

Reviewer 1b , Consultant Anaesthetist

Please note: the cases outline below by Reviewer 2 are identified in the same manner as Reviewer 1a and 1b, but the order in which they appear in Reviewers 2 report is different. The same identification has been used to ensure consistency in being able to cross reference the cases.

Appendix 3 – Reviewer 2 Full Report

Review Completed by Reviewer 2, Consultant Anaesthetist and Consultant Obstetrician from Cardiff and Vale University Health Board

The following are the case reviews completed and provided to the Health Board by the Named Consultants above.

Key Points from Individual Case Reviews

In this section the reviewers highlight the key points from each individual case.

Case D

Background

Twenty eight year mother, in her second ongoing pregnancy having had a previous vacuum delivery 11 year ago. Wr 68 Kg, booking BMI 21. Commenced on LDA as per guideline due to pregnancy interval of more than 10 years and a family history of pre-eclampsia. Booking Hb = 126. Booked under MLC. Second trimester routine blood results were normal with HB = 112 on 17.02.2022. History of childhood Asthma, no concerns. EDD 16.04.2022. IOL booked at T+12/40 on 28.04.2022.

Had a spontaenous onset of labour followed by a quick normal vaginal birth on 28.04.2022 @ T+12/40. **Total blood loss = 3,575ml.** Babay's weight 4040g.

Labour/delivery: on 28.04.2022

Case D was seen on Triage on 28.04.2022 at 03:55 hours with uterine contractions at a frequency of 1:2. This is the same day when an IOL for T+12/40 was planned. Case D was transferred to MLU at 04:25 hours as she was diagnosed to be in labour. Active management of 3rd stage planned. The labour progressed well.

05:30 Cervix 9cms dilated

06:34 Spontaneous normal vaginal birth of a live baby on the MLU.

06:35 IM Syntometrine as planned given.

06:38 'large gush of blood'.

06:39 further 'large gush of blood', cord cut and clamped, delivery of placenta, emergency call bell, Obstetric emergency bleep call put out

06:40 Senior MW with Registrar and SHO present.

06:43 second sytometrine Im given, Two canulae sited by the SHO and bloods taken for FBC & G/S. VE by Reg 'uterus continues to be not contracted'. No evidence of bimanual massage, considering there is ongoing heavy bleeding. What did the Reg do during the 3 minutes of being present in the room?

06:45 1st Carboprost

06:45 In theatre

06:58 Oxytocin infusion

06:50 1st TXA

06:50 activation of MOH

06:51 Consultant [redacted] called

06:58 Speculum by the Reg

07:00 Vagianl examination by the Reg, MBL 2018 Maternal Obs- BP =104/78, Pulse 123bpm.

07:03 2nd Carboprost

07:05 Rotem A5 = 18, EXTEM CT = 41, Lactate = 6.12, Hb = 119, ‘uterus continues to not be contracted’. ‘Placenta complete, mebranes ragged’

07:05 Lithotomomy, ‘placenta complete, membranes ragged’.

07:08 a decision for a GA

07:10 ‘Rotem normal’

07:11 consent for EUA by the Reg

07:18 3rd carboprost

07:21 [redacted] present

07:27 GA commenced

07:35 Rotem A5 = 14, EXTEM CT = 50

07:44 4th Carboprost

07:58 Blood requested by the anaesthetist

08:04 MBL = 3003, blood not available, emergency O Neg Blood requested

08:07 [redacted] requesting another Consultant Obstetrician ([redacted] to attend

08:20 2nd TXA

08:22 MBL = 3100ml

08:26 Knife to skin by [redacted]

08:20 2nd dose of TXA

08:21 5th Carboprost

08:29 MBL = 3,188

08:30 Bakri balloon inserted

08:34 1st Blood transfusion completed

08:34 Ergometrine 500Ugm IV by Anaesthetist

08:35 [redacted] present

08:36 6th Carboprost 250 ugm

08:40 Bakri re-inteserted by [redacted]

08:45 MBL 3288ml, 2nd unit of blood completed

08:47 ROTEM A5 = 12, EXTEM CT = 51

08:50 Misoprostol 800ugm PR

08:51 7th Carboprost

09:03 Hb 107, lactate 3.09

09:05 B Lynch suture by [redacted]

09:10 Rotem-A5 = 12, EXTEM CT = 51

09:14 3rd TXA by anaesthetist

09:16 Carboprost, 8th dose given

09:16 MBL = 3,375

09:30 Vaginal pack inserted by [redacted]

09:36 abdomen closed

09:36 MBL 3,575 including blood drained from Bakri Balloon

09:43 Hb = 97, Lactate 3.45

09:50 Case D transferred into recovery

09:58 Transferred to the recovery

10:10 Review by [redacted], Pulse rate 181bpm

10:35 Pulse 166bpm, Temp = 38.5C, BP = 126/68

10:46 Hb = 104, Lactate 4.7

11:55 'conditon stable' transferred to a room on the Labour Ward

Theatre team and anaesthetic team's documentation is good. Documentation by Obstetric team does not seem to be as clear.

30.04.2022 SB SHO HB = 69, for 2 more units of blood, obs stable

PPH summary

6:38 abnormal bleeding noted and first call for help

6:39 cord clamped and cut and delivery of placenta emergency obstetric bleep put out

6:40 Obstetric SHO and registrar arrived

6:43 second syntometrin & Decision to transfer to delivery suite

Arrived in theatre 6:45

Blood loss already 1700ml

Bladder emptied

Carboprost given

7:00 MBL 2108

7:08 decision for GA

ROTEM normal

7:11 consent for EUA (registrar)

7:21 [redacted] present (Consultant)

7:27 GA

[redacted] then [redacted] present ?consultant ? time of arrival

MBL>2L 200mg Propofol and fentanyl

In theatre 45 minutes prior to GA severe tachycardia 120-150

7:58 Blood requested

8:04 MBL 3003mL

8:05 request emergency O Neg blood

2units given in theatre (2-hours after emergency call)

8:07 request additional help Mr [redacted] second consultant

8:10 decision for laparotomy

8:29 MBL 3188

8:30 Bakri balloon (from surgeons notes-Bakri inserted 2X not staying in cavity decision for laparotomy and B Lynch brace suture.)

Huge number of uterotonics documented in OBS Cymru

Very good documentation of accumulative measured blood loss

8:35 Mr [redacted] present

8:40 Bakri balloon reinserted by Mr [redacted]

9:05 B Lynch suture

ROTEM still normal and normal throughout. ROTEM traces available in notes.
No documentation of paired lab coag results. 3 ROTEMs during PPH

9:16 MBL 3365 no further bleeding

Final MBL 3,575 liters

OBS Cymru filled out well

MOH activated appropriately

ROTEM used NAD, A5 became abnormal due to ongoing massive haemorrhage uncorrected in timely manner

Hb in theatre 97, lactate 3.45

Tranexamic acid: 3 doses

Uterotonic

First line IM Syntometric @ 06:35, and repeated once more. Synto infusion , Carboprost X 8 almost every 15 minutes pre and post transfer to theatre. Ergometrine IV by anaesthetist in theatre. Misprostol PR 800ugm.

Total RBC 4 Units.

Absence of Bimanual Uterine compression is conspicuous.

Post-op

2 anaesthetists present including a consultant

Obstetric Consultants present x2

Appropriate OBS Cymru plan made

Monitored in recovery area, frequent blood gases from Art line over next 3 hours.
Notable Practice

2 further RBCs

Condition stable and settling

Summary

MOH activated appropriate: Yes, although blood was slow to arrive. Therefore we think it is possible that blood was not ordered at 1500ml blood loss and ongoing bleeding. Required O neg blood 90 minutes after PPH started

Appropriate bloods taken at the correct time

Antenatal: Yes

Labour: Yes

During PPH: Yes

WHO check list for theatre cases: Not in the notes

Plan for uterotonics: IM ergometrine at delivery

PPH documentation: Good

OBS Cymru well filled out: Yes

ROTEM taken at appropriate time: Yes

POC lactate and Hb at appropriate time: Yes

Acted upon: We think the Hb during the PPH from blood gas probably falsely reassured the team of severity of the situation

Communication during PPH: documentation following PPH and prior to transfer to the theatre unclear recording of events and measurement of MBL, apart from this, the communication seems appropriate

Appropriate seniority for surgical procedure: Started off with on-call team. Escalated to the consultant who arrived 50 minutes after PPH, then second consultant arrived, 2 hours after MOH was recognised

Rapid escalation to senior staff at start of PPH: Yes Consultant anaesthetist present.

Recognition of deteriorating patient: Yes

Delay in return to theatre: No

Evidence of measured accumulative blood loss: Yes very clear

Time of day

In hours: No

Out of hours: Yes, 6am

Out of hours day time weekend: No

Started during hand over: Yes, Midwives' handover

Primary cause of PPH

Uterine Atony

Risk factors: Multipara with rapid labour and 4000g baby

Cause: Resistant Atonic PPH not exacerbated by coagulopathy.

Notes: Excess reliance on Uterotonics mainly Carboprost. Bimaual terine massage /compression is a very useful initial manouvre to stem bleeding from atonic PPH whilst more senior help is awaited. This can be repeatedly done in conjunction with the uterotonics to reduce the amount of blood loss. Unusual to give IM syntometric as first line at delivery. But this appears to be the UHB's policy

Measured blood loss

3,575mL

Transfusion required

4 units RBC

Evidence of Recognition: Initial PPH recognized very promptly and record of accumulative blood loss excellent.

Record on anaesthetic chart indicated significant tachycardia potentially indicating lack of understanding of severity of the situation

Evidence of good Response:

Initial response from midwives in MLU was good

Early bimanual compression may have limited initial blood loss

Earlier GA/EUA and insertion of Bakri balloon may have reduced overall blood loss

Delayed arrival of blood. Although didn't effect outcome in this case this could have led to a poor outcome

Overall the response was slow with delayed treatment. Early bimanual compression of the uterus and more rapid EUA and earlier insertion of Bakri balloon may have changed/improved outcome.

Summary

There does not seem to be any evidence of Bimanual Uterine Compression right from the outset, either by the M/Ws or the Obstetricians after the 1st 'large gush of blood' or the 2nd 'large gush of blood' soon after the birth of the baby. The uterine message did not seem to happen even whilst awaiting transfer to theatre. Perhaps this practice needs to be embedded. (Please refer to the attached References for the evidence of benfit of such a manouvre)

45 minutes in theatre. ? actions at this point apart from uterotonics. Evidence of over reliance on uterotonics

First Bakri balloon inserted >60 minutes after PPH recognition

? waiting for consultant to attend before GA

Despite MBL>2L blood does not seem to have been ordered and O neg was ordered 90 minutes after PPH recognition with MBL>2500mL at this point Consultant Anesthetist arrived after GA?

Good practice that second obstetrician attended but this was nearly 2 hours.

Review Case I

Case I is a first time mother, aged 31 years. MLC booked as low risk. EDD =

22.02.2022. Booking BMI = 26.4. Close monitoring of pregnancy. Hb at 28 weeks 126.

Serial growth scans, no concerns.

Close monitoring during pregnancy with US. No significant antenatal concerns.

IOL booked for 07.03.2022, for post dates at T+13/40. Emergency C/S due to failure to progress, cervical dilatation 9 cms. Total MBL 2569ml. Uneventful recovery.

Labour summary

IOL @ T+13

Prostaglandin over 3 days

9/3/22 21:30

T+15 SROM thick mec transferred to Del suite

Monitored in labour

Frequent review

Epidural for pain relief No issues

Oxytocin augmentation

10/3/22 @ 8.55 thought to be 10cm dilated CTG concerns rise in base line maternal temp

Oxytocin off ‘don’t push’

Delivery summary

Thursday day time

Full labour ward team

10:30 trial in theatre +/- C/S delay because theatre in use with an El C/S decision [redacted]

11.05 in theatre [redacted] in theatre

Not fully dilated decision for C/S because of CTG concerns

11.29 delivery Baby 3260 good condition

PPH summary

11:35 >1L

11:45 1655

12:00 2320

Final 2569

OBS Cymru filled out very well

MOH activated

ROTEM used NAD

Hb in theatre 114 lactate 2.17

Tranexamic acid given

Uterotonics

First line IM syntometric then IV syntocinon 5 units then Synto infusion then carboprost X2 all given rapidly

Cause of significant blood loss from broad ligament tear as stated in operation note

Dr [redacted] started operation. Taken over by Mr [redacted] who was scrubbed up in theatre.

Post-op

2 anaesthetists present including a consultant

Appropriate OBS Cymru plan made

Monitored in recovery area

No immediate problems

Hb dropped to 73. 2 units RBC given

Home on 12/3

Summary

MOH activated appropriate: Yes

Appropriate bloods taken at the correct time

- Antenatal: Yes
- Labour: Yes During
- PPH: Yes

Risk factors for PPH identified: Placental extra lobe

WHO check list for theatre cases: Yes

Plan for uterotonics: Not written

PPH documentation: Yes

OBS Cymru well filled out: Yes

ROTEM taken at appropriate time: Yes

POC lactate and Hb at appropriate time: Yes

Acted upon: NA

Communication during PPH: Clear documentation Appropriate seniority for surgical procedure:

? Yes Rapid escalation to senior staff at start of PPH.

?Yes Consultant anaesthetist present.

Recognition of deteriorating patient: Yes

Delay in return to theatre: NA

Evidence of measured accumulative blood loss: Yes very clear

Time of day

In hours: Yes

Out of hours night

Out of hours day time weekend

Started during hand over

Primary cause of PPH

Traumatic bleeding secondary to broad ligament tear and uterine atony at emergency CS.

Risk factors:

9cm dilated

IOL

Syntocinon augmentation.

Cause: Early rapid bleeding not exacerbated by coagulopathy was rapidly identified.

Notes: Senior clinician took over surgery. No issues with resuscitation. Uterotonics given at appropriate time.

Unusual to give IM syntometric as first line at delivery at caesarean delivery

Measured blood loss

2569mL

Transfusion required 2 units RBC

Evidence of Readiness: Yes

Evidence of Recognition: Yes

Evidence of good Response: Yes

Comments: Overall Good management**.**

Review PG

Background

This was Case I's 3rd pregnancy having had 2 previous vaginal births. Case I booked at 12 weeks and was pregnant with DCDA Twins. Her booking BMI was 25, and has had no significant medical or surgical past history. Case I underwent serial growth scans for the baby and there were no concerns. Case I developed Gestational Hypertension in 3rd Trimester, did not require any treatment. Plan for IOL by consultant on 07.02.2022 (36/40) was made appropriately. EDD = 07.03.2022. Date of delivery = 02.02.2022.

Case I gave birth to both the babies vagianally following the IOL however, there was PPH mainly due to retained placental tissue. Total blood loss was 2471ml. HB 101 (16.12.2021), @ 29+3/40. (28.01.2022)

Pregnancy Summary

31y P2 2 previous SVD

Labour summary & Delivery

07.02.2022 admitted for IOL due to concerns with fetal growth at 36/40. Examination revealed the Cervix suitable for ARM**.** Hence transferred to the labour ward

13:20 On labour ward

14:30 ARM performed. Active management of 3rd stage plan written by the on all obstetrician. Delcined Epidural. Hb 105, this is the

17:40 Syntocinon augmentation due to lack of contractions following ARM and no further progress in cervical dilatation

Good pregress following syntocinon augmentation. Both the babies delivered vaginally

21:30 Cervix fully dilated

21:42 Twin delivered

21:50 Twin 2 delivered

21:59 Syntometrine IM on delivery of the 2nd placenta.

22:00 Syntocinon infusion commenced. Hb 105 This is the first reference we could find in notes about Hb

22:05 MW recognised excess bleeding and called for assistance.

22:16 MBL 788ml

22:16 First Tranexamic acid (TXA) by anaesthetist. Vaginal examination by Obs Reg, suspicion of retained products. Decision to transfer to theatre for EUA(Examination Under Anaesthesia) and removal of possible retained products. Carboprost x 1 prior to transfer to theatre. No evidence of bimanual compression of uterus.

Reg called after MBL 1200ml, who called Consultant asap

22:18 First Carboprost

22:20 MOH call put out, MBL 1421 (further 600ml loss in 4 minutes)

22:26 in **Theatre for EUA and removal of RPOC**. Two Anaesthetist present in theatre.

22:21 1646

22:25 1886

22:32 Spinal Anaesthetic commenced.

22:37 Second Carboprost

Dr [redacted] (trainee O & G) continued with the procedure under supervision of consultant NTC. This is not appropriate considering the amount of on going bleeding.

EUA Findings: 'bits of placenta removed in theatre'. Procedure carried out by the on call Reg. Consultant ([redacted]) present in theatre. Bleeding stopped following removal of remaining bits of placenta.

22:45 2362

23:00 2471

23:07 Third Carboprost

Duration of EUA =40 mins, ? bleeding continued during the procedure, should the Consultant have taken over from the trainee or even performed the procedure themselves in view of MOH

Procedure complete @ 23:15. Misoprostole 800ugM PR.

Post Procedure:

22:30 ROTEM A5 = 19, CT = 42, Lactate = 3.5, Hb = 106

23:00 Hb 92, Lactate 3:10, A5 18, EXTEM CT 42

23:30 Transferred to the recovery

08.02.2022, ?5 untis blood transfusion, Maternal Tachycardia, Hb = 64

PPH summary

MBL 788 MDT in room

22:05 synto infusion

22:06 placental pieces felt

22:20 MOH activated MBL 1421

22:26 theatre blood loss now 2362

Spinal anaesthetic

Manual removal of placenta bleeding stopped MBL 2471 @23:00

ROTEM normal

Syntomatrin X1

Synto infusion

Carboprost X3

Post-op

Needed 5 units blood over 3 days

Otherwise well

Summary

MOH activated appropriate: Yes

Appropriate bloods taken at the correct time

Antenatal: More attention could have been given to iron supplementation

Borderline anaemic at term

Labour:

During PPH: Yes

Risk factors for PPH identified: Yes

Twin pregnancy, IOL

WHO check list for theatre cases: Yes

Plan for uterotonics: Yes (but didn't say in notes which uterotonic although syntometrin was given)

PPH documentation: Yes

OBS Cymru well filled out: Yes

ROTEM taken at appropriate time: Yes

POC lactate and Hb at appropriate time: Yes

Acted upon: ROTEM NAD

Communication during PPH: Good

Appropriate seniority for surgical procedure: yes

Rapid escalation to senior staff at start of PPH.

Yes Consultant anaesthetist present. Yes

Recognition of deteriorating patient: NA

Decision for theatre: Rapid and timely

Delay in return to theatre: NA

Evidence of measured accumulative blood loss: Yes

Time of day

In hours:

Out of hours night Yes

Out of hours day time weekend

Started during hand over

Primary cause of PPH

Retained placental tissue

Risk factors:

Twin pregnancy

Cause:

Additional Notes: Measured blood loss 2471

Transfusion required: Yes 5 units over 3 subsequent days

Evidence of Readiness: Yes

Evidence of Recognition: Yes

Evidence of good Response: Yes

Rapid recognition of retained placenta

Patient declined epidural therefore needed a spinal anaesthetic in theatre

1x use of ergometrine and 3x carboprost

In view of need for 5 units RBC transfusion ? under measurement of blood loss.

Summary

Overall good management in terms of speed with actions taken. High risk delivery and retained placental tissue. Rapid recognition and escalation.

Probably an underestimate of measured blood loss. The consultant obstetrician could have taken over the junior doctor earlier to reduce the duration of the procedure and the amount of bleeding.

Review Case E

Background:

Mother is 20 Yrs, primigravida, MLC booked. Experiences recurrent episodes of RFM. Serial Growth US, showed LGA baby and hence the care was transferred to CLC. A GTT was Negative. EDD 07.01.2022. Hb at 28 weeks 128, Hb at 39+ = 105. SROM at 40+1/40, on 08.01.2022, with pyrexia of 38 ^{o}C, admitted to delivery suite. Found to have COVID with high temperature and fetal tachcardia CRP 23 otherwise no issues

Commenced on Syntocinon to expedite labour. Had a spontaneous vaginal delivery the next day. MOH of 2559ml from atonic uterus.

Labour & delivery summary

08.01.2022

23:40 Admitted to the maternity ward with a history of SROM (at 20:30 hours) and pyrexia of 38^{o}C. SROM was confirmed.

09.01.2022

00:13 Review by on call Reg, noted the history and made a plan for IV access, FBC, CRP, Gp/Save, U&Es, HVS, MSU, IV fluids, IV antibiotics. **Notable practice**

02:00 on delivery suite

On delivery suite, Syntocinon commenced for SROM,

18:55 Cervix fully dilated, M/W requested 50 i.u. syntocinon in 45 ml Normal Saline along with ergometrine requested in anticipation of PPH. **Notable practice**

19:28 SVD, baby in good condition. Wt= 3760g,

19:43 Placenta delivered, gush of blood, 50 units syntocinon in 45ml Normal saline infusion commenced. Atonic uterus, uterus rubbed for contraction whilst awaiting help. Good practice.

19:50 MOH call put out.

19:51 Syntometrine given, Obstetric and anaesthetic team present, including Consultants x2. The on call Reg, gave TXA, obtained 2nd IV access, took some more blood for necessary blood tests including VBG, Rotem, indwelling catheter

19:53 MBL 1685 ml

19:54 Carboprost 250ugm IM

19:55 further 10 units of syntocinon

20:05 MBL 1791ml

20:24 Misoprostol 800ugm PR**20:30** MBL = 2559, Hb = 62 on 10.01.2022, Plt = 84, BP = 97/54, HR = 84

10.01.2022 RBC 2 units transfusion

19:43 placenta and membranes delivered with a significant gush of blood

PPH summary & Uterotonics

Immediate emergency called Uterine

massage whilst help arrived Obs

present immediately

19:50 MOH called Large

MDT at bedside Pulse 143

BP 77/50

19:53 MBL 1685

Blood loss settling

20:05 1791

20:30 stopped @ 2559

Rapid administration of all uterotonics

Urinary catheter placed

ROTEM NAD

2nd degree tear sutured

Post-op

By 22:30 feels well

MEOWS 0

Following day Hb 62 platelets 84 given 2 Units blood transfusion

Home on 11.02.2022

Otherwise uneventful

Summary

MOH activated appropriate: Yes

Appropriate bloods taken at the correct time

Antenatal: Yes Labour: Yes During PPH: Yes

Risk factors for PPH identified

WHO check list for theatre cases: NA

Plan for uterotonics: Yes discussed active third stage with patient.

PPH documentation: Yes / good

OBS Cymru well filled out: Filled out except for MBL. This is filled out on a separate sheet which does not have times on it. The second sheet has been used because it is easier to do the running blood loss calculations but there should be times

ROTEM taken at appropriate time: Yes

POC lactate and Hb at appropriate time: Cant see it documented

Acted upon: ?

Communication during PPH: Well documented and seems good

Appropriate seniority for surgical procedure: Yes

Rapid escalation to senior staff at start of PPH. Yes. It looks like the bleeding settled rapidly and a consultant obstetrician did not attend

A team from ICU also attended but not a consultant anaesthetist

Recognition of deteriorating patient: NA

Delay in return to theatre: NA

Evidence of measured accumulative blood loss: Yes but not on OBS Cymru so time over the accumulation of blood loss not recorded

Time of day

In hours:

Out of hours night Yes

Out of hours day time weekend

Started during hand over

Primary cause of PPH

Atonic PPH

Risk factors:

Augmentation of labour

Cause:

Atonic PPH with secondary degree tear

Additional Notes:

Very rapid bleed which was treated with the usual escalation of care. Although uterine massage and removal of clots from vagina was recorded there is no attempt at bimanual compression of the uterus to help reduce the early part of the haemorrhage as per RCOG guidelines. There was no discussion of transfer to theatre at 1500mL blood loss with ongoing bleeding as per OBS Cymru and we don't know if this was discussed with consultant. The bleeding rapidly settled in this case but these types of delay may have caused harm in other cases

Measured blood loss: 2559

Transfusion required: Yes, 2 RBC

Evidence of Readiness: Yes

Evidence of Recognition: Yes

Evidence of good Response: Yes although may have been improved with bimanual compression of the uterus**.**

Summary

Evidence of rapid identification and escalation of PPH. The patient became rapidly unstable due to the size and rapidity of the blood loss but there was a very comprehensive MDT rapidly at the bedside. It is not clear if a consultant obstetrician was informed of the case. In this case it did not make a difference but lack of senior support if bleeding had not rapidly settled can have a deleterious impact on patient care.

No bimannual uterine massage

No discussion of moving the patient to theatre. The bleeding had settled by 2500mL and in this case did not affect the outcome but discussion and the action of moving the patient to theatre in cases of massive haemorrhage can improve outcome as it makes possible surgical / mechanical techniques for PPH control.

Review Case F

This Mother aged 21 years, with a booking BMI of 29, EDD 8th January 2022. Booked under the care of CLC due to previous vaginal delivery of still born baby @ 36 weeks known congenital abnormalities. Regular serial growth scans due to previous history. Booking Hb was Hb 131. Total blood loss 2018ml.

An IOL was carried out at 37+/40 due to APH. The mother was on anti-depressant due to PTSD from previous pregnancy events. An emergency C/S was carried out at advanced dilatation due non-progress in labour. There was PPH due to uterine atonicity. The final MBL was 2018ml.

The mother fully recovered from this and managed to go home on 26th Janaury 2022.

19.01.2022

Case F was admitted to the maternity ward with a history of small APH. Was appropriately, reviewed by consultant (Mr [redacted]). A lengthy discussion regarding pros and cons of close observations verus an IOL was discussed. AW chose to have an IOL. A vaginal examinations revealed that the cervix was favourable for ARM. Forty eight hours delay in transfer to the Case F for an ARM due to high acuity on the Case F.

Labour summary

22.01.2022 ARM @ 20:50

Plan active management of 3rd stage discussed and recorded

23.01.2022 @ 00:30 Epidural syno augmentation

11:30 8cm

15:35 8cm

17:45 9cm

Decision theatre still not fully dilated @ 21:00 Cat II

Epidural top up ready 21:34

Delivery summary

21:50 waiting for Consultant to attend theatre (busy in A&E)

Knife To Skin 21:56

22:05 birth of a live baby boy, in good condition, IV syntocinon infusion + IM Syntometrine

22:05 TXA by anaesthetist

22:10 MBL 320ml22:10 MBL 720ml

22:15 the mother feeling pain sensation from the surgery under the Regional analgesia, hence a decision for a General Anaesthetic (GA)

22:18 GA given

22:24 1st Carboprost 250ugm IM

22:25 MBL 1169

22:28 Carboprost IM repeated

22:30 MBL 1506

22:30 MOH call put out

22:34 2nd Sytnometrine IM

22:43 3rd carboprost

22:55 MBL 1605

23:00 4th Carboprost

23:15 5th Carboprost

23:20 MBL 1767

22:31 Hb 1.10, Lactate 1.02, A5 = 17, EXTEM CT = 49

23:36 Hb on blood gas machine was 102

23:42 Misoporstol 800ugm PR

23:50 MBL final 2018ml

23:37 Surgical finish, the surgery lasted 1hour and 41 minutes. This is a long time for a CS.

PPH summary

Brisk bleeding after delivery 22:10 MBL already 750ml

Stopped bleeding 23:50

MBL 2018 ml

Tranexamic acid and uterotonics given as per protocol

ROTEM NAD

Post-op

Good recovery

Well observed and followed up

Hb dropped to 75 on day 3. Good documentation RBC transfusion versus IV iron, Patient opted for IV iron and was discharged well.

Summary

MOH activated appropriate: Yes

Appropriate bloods taken at the correct time

Antenatal: Yes

Labour: Yes During

PPH: Yes

Risk factors for PPH identified Yes.

Registrar waited for consultant to attend as recognised possibility of difficult CS WHO check list for theatre cases: Yes

Plan for uterotonics: Yes

PPH documentation: Yes.

OBS Cymru well filled out: Yes very good

ROTEM taken at appropriate time: Yes

POC lactate and Hb at appropriate time: Yes

Acted upon: NA

Communication during PPH: Good

Appropriate seniority for surgical procedure: Yes. Waited for Consultant

Rapid escalation to senior staff at start of PPH. NA

Consultant anaesthetist present. No

Recognition of deteriorating patient: NA

Delay in return to theatre: NA

Evidence of measured accumulative blood loss: Yes

Time of day

In hours:

Out of hours night Yes

Out of hours day time weekend

Started during hand over

Primary cause of PPH

Atony

Risk factors: IOL

Synto augmentation

Prolonged labour with secondary arrest

Cause:

Additional Notes:

PPH well managed.

5 doses of carboprost

No mechanical methods of atonic PPH control

Measured blood loss: 2018

Transfusion required No

Evidence of Readiness: Yes

Evidence of Recognition: Yes

Evidence of good Response: Yes Overall well managed PPH

Summary

Overall good management of PPH.

Good practice to wait for a Consultant Obstetrician to attend in view of high risk procedure

5 doses of carboprost was given. This dosing regime is towards the maximum dose for this drug. No mechanical method of treating an atonic uterus used. In our own practice 2-3 doses of carboprost is usually the maximum given before mechanical methods are used.

Review Case C

Background:

30 years, Primigravida, BMI 27, booked under CLC due to IFV conception, serial growth US no concerns. EDD 26.04.2022. Plan by Obs consultant, IOL at 40/40. Close monitoring of pregnancy. No concerns. Hb at 28 weeks 116.

Labour & Delivery summary

23.04.2022

19:00 Came in to the triage, with 'query labour' due to contractions at 39+4/40

21:40 Registrar on call called to see due to query deceleration on the CTG. The Reg performed a VE as felt the CTG is pathological and performed an ARM. On examination there was frank blood and cervix was 2cms dilated. Reg suspected APH/Abruption. D/W Consultant ([redacted]) a plan for Cat 2 C/S made. Case C consented for the C/S birth. No documentation of routine bloods or cross match.

22:05 Code 11 put out

22:13 in Theatre

22:30 Spinal anaesthetic, uncomplicated

VE in Theatre, Cervix 3cms dilated, frank blood

22:52 Skin incision

22:55 baby delivered in good condition, Wt 3370 g

22:58 placenta delivered, continues to bleed, MOH call put out, MBL 2146

23:30 Consultant [redacted] called, but bleeding stopped by the time he arrived. **Notable Practice call for senior help.**

23:51 Skin closure

00:05 Transferred to recovery

01:30 Obs stable

Post CS Hb 100 and then 86g/dL

APH noted with pathological CTG

Cat 2 Em C/S advised

No documentation of routine bloods and cross match

PPH summary

confirmed abruption

Placenta 22:58

Tranexamic acid given

Rapid bleeding identified already measured at 2146

Consultant called

Bleeding stopped soon after 23:00 after addition uterotonics correctly given

Recorded 23:14 ROTEM A5 13mm EXTEM CT 52 Bleeding **not** exacerbated by coagulopathy although FIBTEM A5 of 13mm may indicate an early coagulopathy associated with abruption which did not develop due to timely intervention of delivery and tranexamic acid

Post-op

1 RBC

Appropriate monitoring and uncomplicated recovery

Summary

MOH activated appropriate: Yes

Appropriate bloods taken at the correct time

Antenatal: No record of re-operative bloods

Clotting and or ROTEM should have been done prior to CS as there was time Cat 2 CS Labour: NA

During PPH: Yes

Risk factors for PPH identified

Yes Em C/S and ? abruption

WHO check list for theatre cases: Yes

Plan for uterotonics: Yes

PPH documentation: Very good

OBS Cymru well filled out: Yes

ROTEM taken at appropriate time: During PPH yes. Should have been done prior to surgery although in this case it did not affect PPH management or outcome

POC lactate and Hb at appropriate time: YesActed upon: NA

Communication during PPH: Good

Appropriate seniority for surgical procedure: Yes

Rapid escalation to senior staff at start of PPH. Yes

Consultant anaesthetist present. Not required

Recognition of deteriorating patient: NA

Delay in return to theatre: NA

Evidence of measured accumulative blood loss: Yes

Time of day

In hours:

Out of hours night Yes

Out of hours day time weekend

Started during hand over

Primary cause of PPH

Uterine atony associated with placental abruption

Risk factors:

Abruption identified and DW consultant on call

Cause: Uterine atony

Additional Notes:

Associated with abruption. ? early coagulopathy FIBTEM A5 13mm . No coagulation products needed , Tranexamic acid given at the correct time

Measured blood loss: 2146

Transfusion required Yes 1 unit RBC post-op

Evidence of Readiness:

Potential issues identified

As there was time there should have been a re-op ROTEM although this did not affect outcome in this case

Evidence of Recognition: Yes

Evidence of good Response: Yes

Summary

Overall impression of case is well managed although it is important that a ROTEM is performed if an abruption is the likely cause of the fetal compromise. In this case it did not make a difference to the outcome and there are many features of good practice.

In other cases an early ROTEM which identifies early coagulopathy can reduce haemorrhage and should be a learning point from this case

Review Case B

Background: Case B is a 34-year lady, in her 5th Pregnancy. The first baby was born by a C/S, followed by 3 normal vaginal births including one BBA (born before arrival to the hospital). All four children were born at term. In the current pregnancy, Case B had Spontaneous Rupture of Membranes (SROM) at 39+5/40, on 14.04.2022. Labour started following the SROM and the baby was born vaginally soon after. Massive Obstetric Haemorrhage (MBL 5031ml) ensued. [redacted] underwent Hysterectomy.

Scope of Investigation:

This investigation report is focused on looking into circumstances requiring Hysterectomy and management of MOH (Massive Obstetric Haemorrhage) in relation to Obs Cymru guidance.

Antenatal care:

Case B was booked under Consultant Led Care due to previous C/S and a history of SGA baby (Small for Gestational Age). Quite appropriately, Case B underwent a serial Ultrasound Growth Scans for the baby. The US showed the baby's growth to be within normal range. The Expected Due date was 16.04.2022. Case B did not have any significant medical or surgical history. Case B's Booking BMI was 29. Caes B's eldest child was born in 2010 and the youngest child was born in 2019.

Case B attended all her antenatal clinic appointments regularly. Her blood biochemistry during the antenatal course was normal with a Hb of 127g/L. Case B was keen on vaginal birth this time. Case B's Antenatal care was appropriate.

14.04.2023 Admission to YGC

01:50 Case B was admitted to the maternity department with a history of SROM at 39+5/40. Plan was to await events.

03:50 Case B arrived on to delivery suite. Case B was admitted to the delivery suite due to Covid Positive status. Case B was well in herself and all the routine checks for fetal well-being showed no concerns. All the maternal observations were normal too. Case B was experiencing mild irregular uterine contractions at the time.

15:00 A vaginal examination revealed her cervix to be 3-4cms dilated.

17:10 An intravenous access was obtained. At the same time a blood test for FBC, CRP, Group and Save was taken quite appropriately.

18:45 Case B started experiencing stronger contractions. However, she was tolerating them well and did not wish for any analgesia.

19:05 Case B ‘felt sudden pressure’ and started ‘pushing’ involuntarily.

19:31 a spontaneous vaginal birth of a healthy baby. The MW in charge gave intramuscular (IM) Syntometrine for prevention of PPH (Post-Partum Haemorrhage). This is a standard practice, in view of high parity and risk of PPH.

A ‘gush of blood’ was seen at the delivery.

19:37 Placenta was delivered, and the MW in-charge noticed another ‘gush of blood’. Hence the MW checked the maternal perinium for any tears and found none.

19:40 2nd Syntometrine was given IM. Sister [redacted] was called.

19:44 MBL = **1062ml** at this stage.

19:45 TXA given. Bimanual compression given. Placenta was checked and found to be complete.

19:46 Anaesthetist SHO present, Carboprost give.

19:47 IV fluids commenced.

19:50 Urinary catheter inserted by the Registrar on call. Pulse 130bpm, difficulty in recording the BP. Pulse = 130bpm

19:51 50 IU syntocinon commenced. **MBL = 1864**. 2nd IV access obtained. MOH protocol activated.

19:55 Misoprostol 800ugm given PR

19:53 2nd anaesthetist present, BP reading attempted.

19:58 2nd Hemabate given.

20:02 MBL – 2021ml, [redacted] present

20:03 Ergometrine given IM, **Decision to go to theatre.**

20:05 further clots ‘expelled’ PV

20:07 Legs Lithotomy, Theatre checklist complete in anticipation and theatre ready.

20:10 2nd dose of TXA given. Attempts to obtain bloods. MBL -2174. Catheter bag changed to Urometer. Pulse 134bpm. PV examination by [redacted] (consultant Obstetrician)

20:14 3rd Hemabate given. Two failed attempts to take bloods. Rotem sample insufficient. SHO attempting to obtain bloods. Mother seems to be quite hypotensive with peripheral shut down

20:19 Bloods for FBC, U & E, LFT, Coagulation, Group and Save and Rotem obtained. MBL 2374ml.

20:23 ‘bleeding stopped’. [redacted] wishing to observe the loss prior to transfer to theatre.

20:28 4th Hemabate given, Pulse 130bpm, no BP.

20:30 Pulse 116 bpm, BP 98/31, 3rd bag of fluid, no blood available yet. VBG results, 'diluted sample'. Anaesthetist to obtain ABG. 'Transfer to theatre not required at the moment'.

20:36 Fibrinogen 4g, 2nd Arterial line. Contact Haematologist.

21:20 as the PV loss not settled with the Uterotonics, a decision for theatre for EUA (Examination Under Anaesthesia), by [redacted].

21:38 EUA, small amount of placental tissue and membranes removed. Insertion of Bakri Balloon for intrauterine Tamponade**. No Issues.**

22:00 Hb = 93, pH 7.1, BE =-13.9. No intra-abdominal bleeding identified on bedside US. A decision to observe. Appropriate. **MBL = 3650ml**

22:10 query Bakri Balloon not in-situ, plan to reposition.

22:40 legs out of lithotomy

22:25 Bakri Balloon now in situ

22:40 legs out of lithotomy

22:50 Central line inserted by the Anaesthetist.

23:10 BP remains low

23:25 low BP persisting, Anaesthetist 'not happy' with the low BP. **Notable practice.**

US abdomen repeated by [redacted] and queried blood seen at fundus. Consultant [redacted] asked to attend.

23:40 Consultant [redacted] present and assisted in correctly placing the Bakri Balloon.

23:44 decision for laparotomy as the repeat US of the abdomen showed a haematoma 10cms x5cms at the left uterine angle, and Case B's condition was haemodynamically unstable requiring vasopressors. **Appropriate decision.**

15.04.2022

00:00 6th Unit of blood.

01:00 Vaginal pack removed

00:10 3rd Consultant [redacted] called to the labour ward as acuity high. Notable practice.

Decision for a Laparotomy whist Case B under GA for EUA**.**

01:15 Rotem, A5 =8, plan for further fibrinogen

Findings at Laparotomy:

Left broad ligament haematoma of 10x5cms identified along with a uterine scar rupture of 1cm and cervical extension of 2cms on the same side. Right ovary and fallopian tube were normal. Left ovary and fallopian tube looked oedematous but appeared normal. No free blood was seen in the abdomen. The uterus was atonic.

A decision to proceed to Hysterectomy. **Appropriate.**

Procedure: Broad ligament haematoma drained. Subtotal Hysterectomy with bilateral ovarian conservation. Third consultant ([redacted]) asked to scrub due to constant oozing from the base of the Broad Ligament following hysterectomy. Sutures taken by [redacted] to achieve haemostasis. Compression applied and Floseal to base of broad ligament applied. Abdomen closed after compression and Floseal application stopped the active bleeding.

Comment: At this stage, a request for vascular surgeon's assistance would have been more appropriate to explore the base of the Broad ligament to identify any bleeding vessels, and if found, can be ligated under direct vision. Had this step been carried out at this early stage; a further laparotomy would have been avoided. There appears to be a lack of recognition of haemodynamic instability.

MBL = 5031ml.

01:45 Transfer to the ITU

01:56 5th Fibrinogen

01:58 Anaesthetist bleeped as Case B 'now unstable'

02:04 8th unit of blood

02:07 6th Fibrinogen

02:18 7th Fibrinogen

02:29 8th and final fibrinogen, Case B 'stabilising'

03:00 Care handed over to ITU Nurse

03:30 [redacted] present to debrief Case B's partner

Transfer to ITU, 01:45 hours.

04:00 Review by [redacted] on ITU. [redacted] notices, adequate urine output, no abdominal distension. The BP was low requiring vasopressors. Suspicion of intra-abdominal bleeding. A decision for re-laparotomy. **Appropriate**.

Vascular surgeon [redacted] (Mr [redacted]) requested to attend. Notable practice.

04:15 Second laparotomy:

Procedure:

Performed jointly by [redacted], [redacted], [redacted] and [redacted].

[redacted] extended the surgical incision on both sides. Explored pelvic side walls and base of broad ligaments.

Findings-

Serosanguinous fluid seen on opening the abdomen. Left ovary and fallopian tube enlarged and infarcted. Left Salpingo-Oopherectomy carried out. This is appropriate action.

04:33 surgical finish, Operative notes from the vascular surgeon [redacted] unavailable. ITU

Transfer post-surgery.

[redacted] debriefed Case B's partner and mum.

Case B Discharged home on 19.04.2022 following administration of parental iron infusion.

Notable Practice:

1. Seeking assistance from a vascular surgeon for deep pelvic bleed.
2. Treatment with parental iron for low Haemoglobin, prior to discharge home on 19.04.2022.
3. Exemplary documentation from midwifery staff with appropriate usage of uterotonics.

PPH summary

19:37 CCT for placenta abnormal bleeding noted

19:40 second syntometrin obs and anaesthetist present

MBL>1000mL

19:44 MBL 1062

19:45 tranexamic acid

19:50 catheter inserted pulse 130 ? BP

19:51 synto infusion

MBL 1850

19:51 ROTEM

19:58 misaprostol

19:58 second anaesthetist

20:00 MBL 2021

20:03 First comment **that patient should go to theatre but DIDN'T**

IM ergometrin given

20:10 second tranexamic acid, pulse 134

ROTEM came back ROTEM A5 10 fibrinogen ordered 4G First dose given at 20:59

OBS Cymru stopped recording MBL 20:01 at 2021ml

Continuing use of uterotonics

20:05 more clots from uterus

20:10 MBL 2174

Pulse 134

20:14 3rd haemabate

20:19 decision for theatre

20:23 decision not to

20:28 4th haemobate pulse 130

20:30 pulse 116 BP 95/31

20:32 bleeding settling decision not to go to theatre MBL 2370mL

By 20:30 a first then second consultant obstetrician arrived (not very clear from notes)

21:15 Consultant Anaesthetist attends

Hb 73 lactate 5.1 4units blood requested

Blood loss now 2789 for theatre

21:22 blood arrives

21:30 GA

21:42 ROTEM NAD

21:45 MBL 3389

? small amount of placenta Bakri balloon scar checked intact more uterotonics

22:00 CVs unstable. No bleeding seen scan requested

Plan ITU and observe

22:10 Bakri replaced

22:23 still unstable ROTEM NAD Consultant Anaesthetist not happy does not want to transfer patient to ICU

23:25 anaesthetist still concerned CVS unstable further scan ? collection noted

23:45 Hb dropped again

23:58 decision for laparotomy

3rd obs consultant

00:22 ROTEM A5 8 plan for further fibrinogen concentrate Left uterine rupture with broad ligament collection Hysterectomy no intraabdominal bleeding noted **Complete by 1:15**

MBL 5031
Transferred to ICU

02:10 BP 64/40

Remained very unstable needing NA

04:10 second laparotomy

Bleeding noted from pelvic side wall oversewn

Left salpingo-Opherectomy

Of note from review of lab clotting samples all clotting screens were normal with a lab fibrinogen >2g/L (lowest fibrinogen 2.2 which triggered another 4 G fibrinogen

Longest APTT 27.9. Longest PT 11.3

Post-op

Went back to ICU no further issues

Summary

MOH activated appropriate: Yes

Appropriate bloods taken at the correct time

Antenatal: Labour:

Yes During PPH:

Yes

Risk factors for PPH identified

Yes P4 venflon and bloods sent in labour

WHO check list for theatre cases: Yes

Plan for uterotonics: Yes

PPH documentation:

Very poor. Once the day time midwife who initially scribed finished their shift there appears to be no further contemporaneous scribing of PPH. The PPH is then very difficult to piece together because it consists of obstetricians and anaesthetists making summary retrospective note entries.

OBS Cymru well filled out: Initially filled out but scribing stopped once the night staff started

ROTEM taken at appropriate time: Yes

There were issues initially taking bloods because the patient was shocked. This improved once a consultant anaesthetist attended but this was nearly 2 hours after the start of the PPH where the patient was found to be severely shocked and anaemic and red cell transfusion had not been started

The ROTEM was taken early with borderline low fibrinogen. 4G fibrinogen ordered and given. Seemed to be an over emphasis on coagulation products rather than RBC and overall management of patient.

POC lactate and Hb at appropriate time: Initially delayed

First Hb and lactate clearly stated in the notes at 21:15 showed the patient to be severely shocked

Acted upon: As above

Communication during PPH: Initially yes but after that it is not clear from the notes

Appropriate seniority for surgical procedure: Rapidly escalated to first second then eventually third consult obstetrician just before decision for hysterectomy which was about 5 hours after start of PPH

Rapid escalation to senior staff at start of PPH. Yes

Consultant anaesthetist present. Yes but there appears to be a delay. It is not clear when they were called but once in attendance realised how shocked the patient was and at this point the patient was moved to theatre

Recognition of deteriorating patient: No. The patient was severely compromised from the outset of the PPH. Pulse never settled 120-130. First RBC arrived 9:20 nearly 2 hours after the start of the PPH

Delay in going to theatre:
There were multiple entries about going to theatre @ 20:03 then 20:30 but went to theatre at 21:20 after consultant anaesthetist arrived and realised how compromised the patient was. MBL at this time was **2789**

Evidence of measured accumulative blood loss: Initially then it was very difficult to see and OBS Cymru was not completed

Delay acting in theatre

21: 45 The patient had a Bakri balloon inserted

US scan no collection seen An EUA was performed and bleeding seemed to settle after insertion of Bakri balloon

Obstetrician wanted to send the patient to ICU for observation but at 22:30 then 23:30 the anaesthetist was clearly unhappy with this action as the patient remained CVS unstable. Hb dropping

23:58 laparotomy when third consultant arrived decision for hysterectomy when blood loss was 5031

Time of day

In hours:

Out of hours night: Yes

Out of hours day time weekend

Started during hand over

Primary cause of PPH

Initially seemed to be uterine atony but uterine rupture with broad ligament extension and hematoma was a major component from the outset.

Risk factors: P4
Previous CS

Additional Notes:

Very prolonged delay in diagnosing uterine rupture 5 hours before decision for laparotomy. There was a failure of recognition of the severity of the CVS throughout the evening, Delay in going to theatre and a further 2 plus hour delay in laparotomy despite ongoing CVS instability. The Consultant Anesthetist was clearly very concerned.

Measured blood loss 5031

Transfusion required: Yes

8G fibrinogen concentrate

? 8 units RBC documentation is very difficult to piece together

Evidence of Readiness: Yes

Evidence of Recognition: No

Evidence of good Response: No

Overall Summary

There were multiple delays in care

Delay in recognizing the severity of cardiovascular compromise

Delay in calling consultant anaesthetist or them attending

It appears from reading the notes there may have been a belief that a ROTEM of 10 indicating a mild coagulopathy was the cause of the bleeding so there was a delay in making a decision for theatre whilst this was corrected. This type of mild coagulopathy may exacerbate but is not the cause of bleeding and therefore this was an inappropriate action

There was a delay in ordering blood. This indicates that there was failure to recognize the severity of the bleeding and interpret the clear cardiovascular instability as a marker of severe on-going bleeding.

The patient received multiple doses of uterotonics with delay in taking an alternative mechanical approaches as recommended by RCOG

Although a significant cause of the bleeding was due to the uterine tear associated with the previous C/S this was diagnosed very late 5 hours after delivery when bleeding was already severe and the patient severely compromised.

It appears that the primary cause of the bleeding was due to an unpredictable uterine tear with an extension into the broad ligament. This was unpredictable and could not have been prevented. The management of the PPH could have been significantly improved with much earlier decision making when it may have been possible to provide surgical interventions rather than hysterectomy to stop the bleeding.

At no point from the ROTEM results and laboratory results did significant coagulopathy contribute to the on-going bleeding.

Review Case A

Scope of investigation: This report focuses on the Indications for IOL, which was followed by an emergency CS, which was followed by Hysterectomy due to coagulopathy with a total blood loss of and 9242ml. It covers events up until Case A is transferred to the ITU from the Theatre following the hysterectomy.

Main Body of the investigation:

1. Background
2. Antenatal care
3. Rationale for Induction of Labour (IOL) at 38/40
4. Description of Key events since admission to YGC
5. Contributory factors
6. PPH Management and its impact
7. Route cause
8. Recommendations
9. References

Background:

Case A is in her first pregnancy age 19 years. Case A's booking BMI was 31. Known to

social services

Smoker

Known substance misuser, cannabis, cocaine and previous history of heron misuse.

Correctly booked in CLC as identified high risk.

Case A was admitted to the Maternity at YGC on 08.04.2023 by a Junior Obstetrician for IOL at 38+4/40.

Case A underwent an IOL (Induction of Labour) at 38^{+6}/40 on 10.04.2023. An emergency CS was performed on 12.04.2022. Case A sustained a major, life-threatening postpartum haemorrhage (PPH). Hysterectomy was undertaken to stem the on-going bleeding. Total blood loss was 9242ml.

Antenatal Care:

Booked with BCUHB at 8 weeks with no significant medical or surgical history. Following this booking, Case A moved elsewhere-outside Wales.

Case A moved back to North Wales at 33/40 to be close to her mum who was her next of kin. Case A was 1st seen by a CMW on 11.03.2022 at 33+4/40, following which regular appointments took place for close monitoring of Case A and her baby. Case A did not have any pre-existing medical or surgical conditions that was a risk factor for MOH (Massive Obstetric Haemorrhage). Serial Ultrasound growth scans for the baby showed no concerns. Case A was a smoker and there was a history of use of recreational drugs.

Case A presented to YGC on numerous occasions with episodes of reduced fetal movements. All the Cardio-Toco Grams (CTGs) undertaken as per UHB's guideline met Dawes Redman (DR) criteria at each visit. At all these visits well-being of the mother and the baby was confirmed too. Case A was admitted at 38+/40 to YGC. The indication for IOL was "[redacted]s anxiety and multiple presentations at the hospital with a history of recurrent reduced fetal movements".

02.04.2022, 17:45 hours. Case A attended MOAU with 3rd episode of DFM, '[redacted] reports 3x previous episodes of DFM in Liverpool also'. DR Criterial met with normal FM. Reviewed by a Junior Obstetricians (Dr [redacted]) who noted the history, reviewed all the observations including the CTG and planned for 'Daily CTG, till further Fetal Growth and Doppler. TCI if any concern'. **Notable Practice**: this is a safe and pragmatic approach and not putting Case A on the 'conveyer belt of IOL'.

28.03.2022, 36/40. Case A was reviewed by a Consultant Obstetrician ([redacted]) in ANC. The Consultant made a plan to carry out IOL at 41/40 if fetal growth on US was normal and no concerns with fetal movements. It was also planned at this visit that if there is reduced fetal movements, IOL to be carried out between 38-40 weeks of gestation. The baby's growth plotted at 19th Centile at 26 weeks, 50th Centile at 30+/40, just above 50th Centile at 34+/40 and just under 50th centile at 37/40. These US findings showed no concerns with the baby's growth.

Admission to YGC for IOL on 08.04.2023 at 37+4/40

Case A was reviewed by a junior obstetrician ([redacted]) in ANC. [redacted] planned for Case A to be admitted due to 'persistent decreased fetal movements'. A CTG recorded on admission was normal and met Dawes Redman criteria. As per the CTG sticker, the box for FM (Fetal Movements) was circled as 'Y'. An examination by the admitting MW on the same day found the baby's head to be 3/5th palpable abdominally, and -2 station on vaginal examination. The cervix was closed and uneffaced. All these findings does mean that the IOL is likely to be a prolonged procedure if not unsuccessful at this stage with also a likelihood of a long-protracted labour, since Case A was a Primigravid mother. The Midwife quite appropriately awaited a review by an Obstetrician following her examination prior to the IOL. A notable practice.

09.04.2022, 37+5/40 @ 09:50 hours:

A review by a Consultant Obstetrician (Mr [redacted]) took place. [redacted] noted Case A's history including normal CTGs, normal Fetal movements, and that there were no abnormal findings. [redacted] did not examine abdominally and did not carry out a vaginal examination. The documentation in the case notes is insufficient at this stage to assess whether [redacted] did a thorough review of Case A and took a holistic approach of the situation. [redacted] planned to re-assess Case A with possible ARM (Artificial Rupture of Membranes) later.

Comments: This was a missed opportunity to have an in-depth discussion with Case A including a change of the course of treatment i.e., IOL. The alternative to IOL at this early stage is to carry out a close monitoring of the mother and the baby and re-assess. This would require an in-depth discussion with Case A and her next of kin, along with the implications of IOL with an unfavourable cervix in presence of normal clinical findings. It is highly likely that Case A did not feel FM due to a combination of factors such as anxiety, increased BMI of 31. If the Placental site was anterior this would add to Case A not feeling adequate FM. We are unable to see any US report in the case notes and hence unable to comment. One of the ways to reassure an anxious mother who may not 'feel' their baby move is by showing them fetal movements on the US. This does not seem to have happened in view that though Case A persistently complained of DFM, all the CTGs showed normal CTGs all the time.

As per reference below, IOL is associated with PPH with some evidence of increase in rate of CS. It appears that there is an ongoing perception of 'reduced fetal movements' by the obstetricians and Case A contrary to the monitoring of the baby by regular CTGs showing adequate fetal movements with all 4 normal features along with normal growth scans.

10.04.2022 at 10:55 hours a review by a junior obstetrician took place who carried out cervical assessment and found 'cervix 1 finger dilated, 3 cms long, thick, and posterior. The doctor planned for a further review in 4 hours and if there were no further cervical changes, Propess Pessary (a Long-acting Prostaglandin used for cervical ripening with a view to perform ARM (Artificial Rupture of Membranes). Same junior doctor reviewed Case A 4 hours later and noted the CTG was normal and advised insertion of Propess Pessary.

Comment: This was another missed opportunity by the junior doctor to discuss the plan with a senior obstetrician when the cervix was unfavourable at 38^{+} of gestation in a primigravida with normal fetal growth and normal CTGs showing adequate fetal movements.

The same junior doctor carried out further reviews of Case A during the same day and there were no concerns with either the mother or the baby. Course of plan of management of IOL was not changed.

11.04.2022, 22:50: Propess, a long-acting prostaglandin pessary was inserted in the vagina by the midwife in charge, as per obstetricians' plan. (This is a standard medication used for IOL especially when the cervix is unfavourable for ARM).

12.04.2022, **13:00**:an ARM Case A was transferred to the labour ward. ARM was performed after transferring Case A on to the labour ward. The cervix was 2 cms dilated and the station was high at-1.

13:24: an Epidural was sited at Case A's request.

17:50: a Vaginal examination (5th VE) took place. This VE revealed the cervix to be 5 cms dilated, fully effaced, station -1 and clear liquor was seen. Four Vaginal Examinations took place prior to arrival on the Labour Ward as documented in the case record.

18:00: a Consultant ([redacted]) ward round took place. A plan was made to perform a blood test due to rising baseline FHR (Fetal Heart Rate). [redacted] also noted reduced urine output. A plan was made to perform a VE in 2 hours and if there was not progress, to have a low threshold for a CS delivery. **Notable practice**.

19:51: [redacted] reviewed Case A again and noted an increased FHR on the CTG between 140-160bpm, with normal variability, no decelerations, and accelerations were present. An abdominal examination was carried out and noted the Fetal head to be 0/5th palpable. A VE (6th VE) was carried out. The cervix was 8cms dilated at this stage with station still high at -1. The blood results were within normal range. A plan was made for IV fluids, and another VE in 2 hours. This is appropriate plan.

20:15: [redacted] reviewed Case A and planned for a VE at 20:50 hours and advised for a Trial of instrumental delivery in theatre if the Cervix became fully dilated. The consultant also noted Case A's temperature to be 38.7C.

20:20: hours, the in-charge Midwife ([redacted]) performed a VE (7th VE), for application of FSE (Fetal Scalp Electrode). At this stage the M/W, found the cervix to be 9 cms dilated.

20:26: hours the same Consultant reviewed Case A once again and advised for blood cultures, and to commence IV antibiotics, and re-iterated for transfer to theatre for a C/S if cervix was not fully dilated at 20:50 hours. **Notable practice.**

Evening Senior Obstetric staff handover

21:10: [redacted], a senior Obstetrician on call for the night, reviewed Case A. [redacted] performed a vaginal assessment (8th VE), and found, 'the cervix had a rim' and commented, 'difficult to assess as patient not comfortable due to pain'. The station of the baby's head was at spines, with caput 1+. A plan was made for adequate pain relief. [redacted] advised repeat cervical assessment at 21:40. [redacted] planned an Examination Under Anaesthesia (EUA) in theatre to be performed and to proceed to C/S if cervix is not fully dilated at the next assessment.

21:40: [redacted] reviewed Case A as planned. A vaginal examination (9th VE) revealed 'cervix to have a rim all around, station at spines and caput 1+'. A plan was made for EUA +/- Trial of instrumental delivery, +/- proceed to C/S.

22:01: ML arrived in theatre.

22:29: A Spinal Anaesthetic was sited as the Epidural analgesia was not working adequately. As the Spinal anaesthetic was not working well, a General Anaesthetic was given. (Initial requested analgesia Diamorphine. Then an epidural. Worked well initially then failed to maintain analgesia. Attempted spinal in theatre for cat 2 C/S not effective. Decision for GA). No immediate issues.

22:50: [redacted] commenced Caesarean section.

22:52: uterine incision made.

22:57: baby delivered in poor condition and handed over to the neonatal team. As per operative notes by [redacted]: "the baby's head was low, impacted. Attempted delivery by breech, but due to 'poor access', re-attempted flexing head and delivered the baby".

As per [redacted]'s notes: "right uterine angle secured. Left uterine angel extension, attempted to secure, but very big bleeder present and significant bleeding". 1st uterine layer closed, 2nd layer closed and bleeding from left angle persistent".

Comments: There was 5 minutes between the uterine incision and delivery of the baby, which reflects the difficulties in disimpacting the baby's head. As per operative notes, an attempt is also made to deliver the baby by breech. All these manoeuvres and multiple failed attempts to deliver the baby's head, appears to have led to excess trauma to an extremely vascular and fragile lower segment of the uterus. As it is well known, the lower segment of the uterus at this late stage of labour is extremely vascular and friable, hence prone to excess trauma and tears.

The vascularity and fragility of the lower uterine segment is increased by prolonged IOL with prostaglandins, which compounded the problem by continued use of Syntocinon after ARM was performed. Bearing these facts in mind, the situation warrants an experienced and skilled obstetrician to disimpact the baby's head with utmost care and diligence to minimise the trauma to the vascular and fragile maternal genital tract tissues.

As delivery was under GA this should have made impacted fetal head easier to manage because of good abdominal relaxation and the tocolytic effect of GA. This effect can make atonic bleeding more difficult to manage but as the primary problem was surgical trauma and not uterine atony this did not have an impact in this case. There does not appear to mindfulness by surgeon that the baby's head may be difficult to deliver or impacted in maternal pelvis. Difficult delivery of the baby almost certainly contributed to the significant uterine extension and subsequent massive blood loss.

The alternative in this situation would have been:

1. Preparedness and prediction of the high likely hood of IFH (Impacted Fetal Head) prior to opening the uterine incision (ideally after a VE was performed in the theatre) and administration of tocolytic drug such as Terbutaline 250ug, stat subcutaneously.

   If IFH was not predicated beforehand and encountered at the 1st attempt to disimpact the baby's head after opening the uterus, tocolytic as above could be given at this stage and wait couple of minutes, simultaneously the operator could call for a senior colleague's help if they do not bear the confidence to disimpact the baby's head safely.

2. The other alternative would have been to ask for an experienced assistance to disimpact the baby's head from the vaginal route **(Ref PROMPT).**

Impacted Fetal Head (IFH) is known to occur at an emergency C/S mostly at full cervical dilatation or at advanced cervical dilatation. Malposition of fetal head such as OP (Occipito-Posterior) or OT (Occipito-Transverse), positions are also risk factors for IFH. Primiparity is also a known risk factor for IFH. Hence, in this case, there were multiple high-risk factors present for IFH to occur at the C/S. There appears a training need for the staff in this challenging situation. There is 32% chance of IFH (Impacted Fetal Head, in such situation (Ref No 5). Primigravida, advanced cervical dilatation, fetal head OT/OP position, syntocinon augmentation and low fetal presenting part; are all known risk factors for IFH.

As per case records, it does not appear that [redacted] was either aware or prepared for IFH after performing a VE in theatre and prior to embarking on C/S. Had [redacted] suspected this complication beforehand, she could have asked for an experienced operator to attend to assist in disimpacting fetal head vaginally. This is an error of judgement.

Maternal complications such as uterine & cervical tears are common with IFH. PPH is also a complication of IFH (**Ref No 6).** Also, [redacted] does not seem to have used tocolysis when she encountered IFH. Tocolysis is a recommended treatment in this situation as per PROMPT Wales.

Further evidence that [redacted] was not aware of the impacted head is the operative notes on the vaginal examination prior to embarking on the C/S does not state how palpable is the baby's head above mother's symphysis pubes on abdomeninal examination and lack of documentation regarding the station of the baby's head on vaginal examination. These are all the important learning points for an operator in this situation so that a better prediction and appropriate preparation for management of IFH can be made in future.

Also, there was lack of realisation by the surgeon ([redacted]) of the extent of uterine tears and lack of identification of surgical anatomy prior to closure of the uterus. It is important that in case of excessive bleeding from cut uterine edges a prompt haemostasis is achieved by suturing but only after identification and securing of all the bleeders ensuring that accurate anatomy is identified and restored prior to continuing suturing to close the uterus. Help from the on call consultant should have been sought earlier.

23:14: [redacted] asked for the on-call consultant [redacted] to attend.

23:24: [redacted] arrived in theatre. On arrival he noticed that the uterus was already closed in 2 layers by [redacted]. The MBL (Measured Blood Loss) was 2000ml. [redacted] noticed that there was a 'flap of tissue separate from uterine suture line'. It was determined to be part of the uterine tissue and it was over-sown and bleeding from the angle appeared to be secured.

Comments: [redacted] appears to have failed to realise and recognise the possibility of and extent of Uterine angle tears and friability of the tissue under these circumstances. Had the extent of uterine angle tear/s been identified and secured appropriately along with the cut/torn uterine edges of the uterus by uterine clamps-Green Armytage, the bleeding could be brought under control whilst awaiting [redacted] to arrive. Uterine compression with abdominal

swabs also could be applied to further stem the bleeding temporarily until further senior help arrives. Continuing to suture during excessive bleeding without recognition and restoration of surgical anatomy seem to have compounded the problem.

A decision not to re-open the uterus when it was already closed in 2 layers by [redacted] and to suture the 'flap of tissue separate from uterine suture' was appropriate step taken by [redacted].

13.04.2023

00:17 abdomen closed, 'surgical finish'.

Comment: And another important learning point is not to close the abdomen prior to ensuring that the bleeding source has been identified and dealt with appropriately.

00:25 Case A in Lithotomy position.

MBL 2500ml. [redacted] swabbed vagina and noticed gushing of blood, a further 1000ml. The source of bleeding was not visualised due to heaviness of the bleeding. An extension of tear into vagina was suspected, and it was thought that there was a cervical/vaginal tear. A suture was placed unsuccessfully. The bleeding continued. [redacted] decided to re-open the abdomen as the bleeding was thought to be from 'uterus'. MBL at this stage was 5044 ml. [redacted] asked for help from [redacted] and [redacted], senior Consultant colleagues' help as he anticipated ligation of uterine artery or internal iliac artery may be required. This is a good practice and Team working at a senior level to enhance patient safety.

01:12: [redacted], (Consultant Obstetrician) arrived into the theatre.

01:17: [redacted], (Consultant Obstetrician) arrived into theatre. [redacted] inserted Bakri Balloon for uterine tamponade. As the bleeding continued, a decision to re-open the abdomen was made.

01:35 MBL 6009ml

Re-Laparotomy as bleeding continues

01:40 Bakri balloon in situ, bleeding continues

01:40: Abdomen opened, uterus was found to be well contracted. There was no free blood in the abdominal cavity.

02:05: Hysterectomy commenced by [redacted] & [redacted], with [redacted] & [redacted] assisting.

02:32: Uterus removed. Bleeding continued from peritoneal edges and left pedicular area. Further sutures were placed.

04:31 [redacted], [redacted], [redacted], [redacted] continue to 'operate'.

05:21 Abdomen was closed after haemostasis achieved by Surgicel and Floseal. A drain was inserted prior to closure of the abdomen.

05:25 Final MBL 9242 ml.

Case A, and her relatives were debriefed appropriately.

Comment: A decision for hysterectomy was jointly made by all the 3 consultants ([redacted], [redacted], [redacted]).

PPH summary

Massive and very rapid blood loss noted. Uterus quickly closed.

Rapid identification of need to escalate

Rapidly identified and MOH initiated.

A sequence of senior Consultant Obstetric and Anaesthetic medical staff rapidly attended

Measured blood loss was documented so the rate and extent of the blood loss could be known by everyone in theatre.

ROTEM used to correctly identify developing coagulopathy. I have compared the ROTEM results with the paired laboratory samples.

Fibrinogen replacement was given as the A5 dropped below 11mm and the paired lab fibrinogen did not dip below our treatment threshold of 2g/L at any point.

The PT and APTT became prolonged for a short period of time at about 2:20 (lab time 2:53). Time noted as this corresponded to a ROTEM result FIBTEM 8 EXTEM CT 66. ML had 4 units FFP and subsequently had 10 G of fibrinogen concentrate

At no point during the PPH did Case A have a significant coagulopathy especially around the time of decision for hysterectomy as her clotting was normal at this time. Around 4:00

We note that the surgeon said bleeding was still difficult to control from the pelvic wall after the hysterectomy indicating that traumatic surgical bleeding was on-going at this time

Post-op

Case A had a very difficult post-operative period complicated by bowel obstructions caused by acute adhesions with a return to theatre, post-operative pain that required high dose opioids, post-operative chest complications further exacerbated by in-hospital acquired COVID and a mild pressure sore on her buttock area most likely caused by poor nutrition and significant immobility. Most of the sequence of events would be expected after such a difficult post-operative cause. The bowel obstruction was managed appropriately and it's unfortunate she contracted COVID but this probably did not have a major impact on her post-operative stay.

Summary of PPH management:

MOH activated appropriate:

Appropriate bloods taken at the correct time

Antenatal: Yes

Labour: Yes During

PPH: Yes

Risk factors for PPH identified

Possibility of impacted fetal head not identified

WHO check list for theatre cases: Not in notes

Plan for uterotonics: Not stated but uterine atony was not a major factor in this

PPH PPH documentation: Very good

OBS Cymru well filled out: Very good

ROTEM taken at appropriate time: Yes

POC lactate and Hb at appropriate time: Yes

Acted upon: Yes

Communication during PPH: Good

Appropriate seniority for surgical procedure: The on-call registrar who is competent to perform out of hours C/S started the C/S

Possibly should have discussed potential difficult as C/S at 9cm

Rapid escalation to senior staff at start of PPH. YES

Consultant anaesthetist present. Called in and appeared to attend

rapidly. Recognition of deteriorating patient: Yes

Delay in return to theatre: NA

Evidence of measured accumulative blood loss: Yes

Time of day

In hours:

Out of hours night. Yes

Primary cause of PPH

Traumatic bleeding during Em C/S

Risk factors:

Late first stage 9cm

Impacted fetal head

RCOG / PROMPT guidance on impacted fetal head not followed

Cause:

Uterine extension and pelvic wall trauma leading to massive PPH and the need for hysterectomy almost certainly secondary to difficult delivery of fetal head. (RCOG guidance not followed)

Additional Notes:

Resuscitation with fluid, RBC and clotting factors was excellent No significant

coagulopathy despite massive transfusion

Measured blood loss: 9242

Transfusion required: Yes

RBC 10 in theatre and addition requirement post-op

FFP 4 units

Fibrinogen concentrate 10G

Evidence of Readiness: Yes

Evidence of Recognition: Yes

Evidence of good Response:

Overall view:

There was an impacted fetal heads at the C/S and guidelines were not followed. This led to severe traumatic bleeding and eventual hysterectomy.

The baby was delivered at 22:57 and very quickly it was noted bleeding was significant and at 1500mL consultant was called who arrived 10 minutes later. By this time the uterus was already closed although uterine tissue not included in the initial suturing was noted and over sewn. The blood loss was 2500mL. We would expect very careful evaluation of adequate hemostasis at this point considering the bleed size and complex surgery. This was not the case as significant vaginal bleeding was rapidly noted.

From the anaesthetic chart the patient had significant cardiovascular instability around this point suggesting continuing bleeding.

There was then a delay between 00:25 and 1:08 whilst vaginal suturing was attempted and before reopening C/S despite another 2000ml PPH during this time. There was very good record keeping of accumulation of blood loss but a different approach to dealing with the bleeding was not taken for 45 minutes by which time the bleed volume had become critical. Blood loss was then already 5000ml .

It appears that there was failure to identify bleeding points at the C/S and with such significant vaginal loss failure to act promptly to reopen the abdomen once inadequate hemostasis was identified. By this time the volume of the blood loss had become critical and the anaesthetic team were dealing with significant cardiovascular instability despite access to all the necessary blood products.

Mild dilutional coagulopathy was correctly treated early with FFP and fibrinogen concentrate and a coagulopathy did not significantly impact on the outcome.

Notable Practice:

The documentation in the case record by both the medical staff and midwifery staff is excellent which has helped greatly in the review of this.

[redacted] diligently and repeatedly reviewed Case A on 12.04.2022 in late stage of the labour, which shows he was concerned with well-being of Case A and her baby.

Low threshold for calling for help from senior colleagues is commendable.

Contributory factors:

1. Reluctance amongst junior Obstetric staff and Midwifery staff to question or challenge decisions made by consultants, especially to continue with the plan of IOL at 38/40 for DFM in a Primigravida, in presence of unfavourable cervix for IOL, high fetal head, normal Fetal movements (as recorded on all the CTG recordings), all the normal CTGs and normal fetal growth scans. Following guidelines as if they were 'protocols & policies', without individualised care plan to suit individual pregnant woman; causes harm as seems to be the case here. The guideline on management of 'Reduced Fetal Movements' are for guidance only. The question 'are we doing more harm' in such situations **(Ref No 3)** has not been asked or discussed in depth.
2. Lack of overall perspective and a holistic approach by a senior Obstetricians for women undergoing prolonged IOL without a clear medical reason and without in- depth discussions of risk associated with such situation. Consultant [redacted], lost this opportunity when he reviewed Case A on the ward round on 09.04.2022 (at 37+/40), following admission of Case A for IOL by a the junior Obstetrician.
3. A lack of willingness to change the course of treatment to include alternative options of management with engagement of women and her family.

Route causes:

1. Inappropriate decision to persevere with IOL in presence of normal fetal/maternal parameters i.e., normal serial growth scans and normal CTGs displaying normal fetal movements in addition to unfavourable cervix. IOL in presence of unfavourablecervical findings in a primigravida is associated with prolonged IOL process and prolonged and protracted labour with high risk of complications. **(Ref: 1& 2).**
2. Lack of anticipation, preparedness, and sub-optimal management of Impacted Fetal Head (IFH).
3. Sub-optimal surgical techniques leading to poor recognition of surgical complications and its inappropriate management at the emergency C/S prior to the arrival of [redacted] in theatre.
4. Different management of the initial delivery and then potentially different surgical management could have prevented this hysterectomy.

Recommendations:

1. Considerations and education of staff regarding appropriateness of IOL for 'recurrent Reduced Fetal Movements' in presence of all objective, normal fetal and maternal parameters as shown by close monitoring, at gestations earlier than 39/40.
2. Considerations of further training in management of Impacted Fetal Head at a C/S, in terms of anticipation, preparation, calling for help and use of Tocolysis such as Terbutaline 250ugm SC. Rducation in RCOG GTG No 73, Management of Impacted Fetal Head at Caesarean Birth, June 2023.
3. Ownership and maintenance of overall perspective of a woman on the wards by a Consultant Obstetrician and making an individualised plan.
4. We as a reviewer of this case, are mindful of the psychological trauma not only to the patient and her family but also to all the staff involved. Our hope is learning and reflecting from this review with psychological support would enable them to move forward.

References:

1. 'Induction of Labor and Risk of Postpartum Hemorrhage in Low-Risk Parturients'. National Library of Medicine. I Khireddine et al, Jan 2013. Online.

2. 'The impact of labor induction practices on the incidence of postpartum haemorrhage and caesarean delivery'. J. Christmas et al, AJOG, Jan 2016.

3. 'Reduced fetal movements: Time to move on?'. BJOG. L. Impey et al, March 2023.
4. 'Prospective cohort study of induction of labor: Indications, outcome and PPH'. EJOM. B Kumar et al, Nov 2021.

5. Management of Impacted Fetal Head, PROMPT Wales, Professor Tim Draycott.

6. 'Impacted fetal head during second stage Caesarean birth: A prospective observational study'. EJOG and Reproductive Biology. NW Jones eta al, December 2022

7. 'Techniques for managing an impacted fetal head at caesarean section: A systematic review'. EJOG and Reproductive Biology, AGQ Peak et al, December 2022.

Review Case G

This aged 29 years mother had 2 previous normal vaginal births at term. Case G underwent Serial growth scans for this baby as one of her previous child was born SGA. Booking BMI was 32. There was a history of Gastric bypass surgery. Case G was on antidepressants. Case G also suffered from anaemia due to Gastric bypass. Hb in labour 105. EDD, 31st January 2022. MBL 2687

Case G had a PPH following birth of the 1st child in 2015. Hb = 90 on 22.11.2021 at 31/40.
??Opportunity for antenatal parental iron infusion missed to boost Hb.

Case G was booked for IOl at 39+/40 on 26.01.2022 due to ‘static growth’. Case G had a spontaneous vaginal delivery and experienced PPH of 2687ml.

Antenatal care:

No concerns with the mum. Baby was noted to have a ‘static growth’. Explicit and clear plan of care by Consultant [redacted] at 22/40 appointment. Case G was on Sertraline tablets due to a history of anxiety and depression. Case G smoked 20 cigarettes per day at booking. Case G was quite appropriately referred to PNMH (PeriNatal Mental Health) Team and smoking cessation M/W. Notable practice. BY 18/40 Case G had stopped smoking.

Low Hb 105 at 30/40, there appears no definite plan of care to improve Hb.

Labour & delivery summary

Case G was admitted as planned on 26th January 2022 for IOL as planned for ‘static growth’. She was 39 weeks at this stage. A Propess pessary (slow release Prostaglandin) was given as per chart at 19:00 hours on the same day. Further Prostaglandin-Prostine was given next day (27th January) at 20:00 hours as the cervix was not dilated enough for an ARM.

29.01.2022

18:00 on labour ward, an ARM performed.

21:30 Syntocinon commenced

30.01.2022

00:30 Cervix 2cms

02:00 Cervix 3cms

03:00 Epidural working well throughout

09:40 Ward round by consultant PB along with the on call SHO, noted detailed history and made a good plan for further examination and pushing. Also advised reduction of syntocinon in view of CTG showing variable decelerations, with all other features being normal. **Notable practice.**

11:07 Spontaneous vaginal delivery, 10 iu syntocinon IM (baby’s weight 2990g)

11:14 placenta delivered, noted to be complete, MBL = 525ml, uterus well contracted.

11:25 The M/W noted significant blood loss and called for help

11:30 Reg and on call & Consultant ([redacted]) arrived in the room, MBL = 1246

11:32 Vaginal examination by the Reg, expelled clots from the uterus, TXA given

11:33 Carboprost 250 ugm Im given, MBL = 1371ml

11:37 ‘Running total’ = 1713ml, Syntocinon infusion commenced, MBL =1713

11:40 BP = 115/75, **Pulse = 159bpm**

11:44 HB =104, Lactate = 1.54, A5 = 17, EXTEM CT = 48

11:48 'Running Total blood loss = 1844ml, 2nd Carboprost given

11:57 arrived in to theatre for an EUA

12:00 'Running Total blood loss = 2387ml

12:04 2nd IV access

12:05 3rd Carboprost given, BP = 117/69. Pulse 83bpm

12:08 Lithotomy position

12:14 EUA by trainee obstetrician.

12:16 Blood loss settled

12:25 Bakri Balloon inserted

12:29 Misoprostol 800ugm PR given following the EUA

12:30 Bakri Balloon 'fell out' Uterus well contracted, blood loss settled.

12:45 Total MBL = 2687

13:00 Transferred to the recovery

13:30 Transferred to the delivery suite

19:35 Hb = 72 (was 105 pre-delivery)

PPH summary Delivery @ 11:07:

11:25 more bleeding noted emergency call and full MDT immediately present

Bloods and ROTEM sent NAD

Clots removed

11:30 1246ml

11:33 1371

11:35 Tranexamic acid and carboprost given

11:37 MBL 1713 urinary catheter

11:44 theatre discussed

11:48 carboprost

11:52 moved to theatre epidural topped up no issues

12:00 MBL 2387

12:05 carboprost

Clots removed ? small amount of placenta

Bakri inserted but fell out and not replaced as bleeding has now stopped

Final blood loss 2689

Post-op

Hb 72 but otherwise well RBC

Versus IV iron discussed Patient

had 2 units RBC and IV iron

Summary

MOH activated appropriate: Yes

Appropriate bloods taken at the correct time

Antenatal: Yes (would have benefited from IV iron as still borderline anaemic at delivery

Labour: ?

During PPH: Yes

Risk factors for PPH identified Yes

Increase BMI

IOL

Synto augmentation

Previous PPH

Active management of third stage discussed but no plan of drug to use. Syntocinon was used despite risk factors and no apparent contraindications.

Ergometrine was not used during PPH ? why

WHO check list for theatre cases: Pre theatre check list in notes but no WHO checklist

Plan for uterotonics:

As above. Ergometric should probably have been the first choice of uterotonics because of risk factors and no contraindication

PPH documentation: Yes

OBS Cymru well filled out:

The risk assessment form is not filled out

The rest of the OBS Cymru form is well filled out

ROTEM taken at appropriate time: Yes

POC lactate and Hb at appropriate time: Yes

Acted upon: NA

Communication during PPH: Yes

Appropriate seniority for surgical procedure: Yes

Rapid escalation to senior staff at start of PPH.

Yes Consultant anaesthetist present.

Recognition of deteriorating patient: NA

Delay in return to theatre: No

Evidence of measured accumulative blood loss: Yes

Time of day

In hours: Yes

Out of hours night

Out of hours day time weekend

Started during hand over

Primary cause of PPH

Atony

Risk factors: Yes

Additional Notes: Ergometrin should have been first line prophylactic uterotonic No bimanual compression of uterus attempted despite large blood loss

Measured blood loss: 2689

Transfusion required: Yes, 2 units RBC

Evidence of Readiness: Yes

Evidence of Recognition: Yes

Evidence of good Response: No

01.02.2022

Ward round by SHO debriefed Case G and had an indepth discussion of various options of management of low Hb including pros and cons of blood transfusion, parenteral iron and oral iron. **Notable practice.**

Summary

Overall good management but syntometrine was not given despite a previous PPH and no apparent contraindications to the drug. Syntometrine is a better uterotonic than syntocinon and should be given in high risk deliveries. The use of this drug MAY have modified or prevented a PPH. It appears there is a lack of awareness amongst the staff

caring for Case G regarding her low Hb and a risk of PPH (due to PPH after previous birth).

Bimanual uterine compression is an effective early mechanical method of controlling PPH which was not used.

A Bakri ballon was inserted unsuccessfully. This is a useful mechanical method of treating atonic PPH. ? further training needs in insertion of Bakri Balloon.

1unit RBC, unclear whether parental iron infusion given antenatally. Case G known to have anaemia in the past due to Gatric Bypass surgery. Antenatally, a closer monitoring of Hb is required.

Review Case K

Twenty six year second time mother having had a previous normal vaginal birth with no issues. Low risk mother apart from late booking at 20/40. BMI = 23. EDD = 18.03.2022. Serial growth scans showed no concerns. Went into spontaneous labour following SROM at 40/40. This was followed by a normal vaginal birth with retained products, requiring EUA and removal of the retained products in theatre. MBL 2257ml. Hb = 112 @ 26+6 (on 16.12.2021), Hb = 107, Ferritin 9 at 34+/40, oral Fe given. (Hb= 104 on 02.03.2022. 0n 18.03.2022, Hb = 115 @ 08:07 prior to delivery.

Post delivery Hb = 73 @ 19:46, Hb = 65g/L @ 09:06 & Hb = 73 @ 19:46

Pregnancy & Delivery Summary

18.03.2022

Admitted with SROM @ 40/40. Spontaneous labour started soon after and had a Vaginal delivery at 06:43.

Syntometrine at delivery as per UHB's guideline. MBL = 330ml, Placenta delivered soon after but retained membranes.

07:25, the in-charge MW has identified 'further membranes delivered but still some in situ' and appropriately planned for NBM, obtained IV access and took a blood sample. **Notable Practice.**

07:34 Bloods, IV access

07:35 IVI Syntocinon infusion commenced

08:45 BP =109/76, Pulse = 84, Sats 99%

09:30 second IV access, bloods for FBC, ROTEM and Venous Gas

09:40 review by Reg ([redacted]), found PV ongoing bleeding =600ml, speuculum examination = placenta, membranes and clots removed from the uterus, Offered analgesia 'declined'. Urinary catheter, TXA and antibiotics. Plan for NBM and close monitoring and review after 4 hours. A plan to review after 4 hours is sub - optimal. The review

should be m o r e frequent such as half an hourly check on PV loss , especially considering the in-charge MW has identified ‘membranes in situ’ earlier on at 07:25

10:50 MBL >1500ml, Reviewed by Consultant ([redacted]), MoH call out

11:00 ‘further gush’. Reviewed by [redacted], need for EUA, Anaesthetist informed.

12:00 into Obstetric Theatre

12:12 GA completed

12:17 Start of the procedure. Second TXA given, Procedure commenced

12:25 Misoprostol 1000ugm given . ? reason for this dosage, standard dose is 80 0u gm

12:30 Two placental cotyledons and membranes removed from the uterus. Procedure complete. Second Syntometrine IM

MBL 2257ml.

13:00 Into Obstetric recovery, after commencing syntocinon infusion, Urometer

All Observations stable throughout.

19.03.2023, Hb = 64, 2units blood transfusion given

Friday out of hours, day team medical staff arrived soon after the delivery.

PPH summary

06:43 300ml (at delivery)

08:40 489ml

08:45 689ml

09:20 877ml

09:26 TXA

09:30 1399ml, blood loss almost double in 10mins

10:30 1545ml,

10:50 reviewed by on call Consultant [redacted] MOH call put out 20 mins delay in review by Obstetric staff

11:00 further gush

11:00 1715ml

11:40 1782ml

12:00 1849ml

12:17 second TXA

12:25 Misoprostol 1000ugm PR

12:30 2257ml, further Syntometrine

13:30 syntocinon infusion

OBS ObsCymru filled out very well

MOH activated appropriately

ROTEM used Normal =20

Hb in theatre 120 lactate 2.97

Tranexamic acid given

P1 previous normal delivery no complications

Booked 18 weeks so for serial scans and CLC care

At term she moved back to MLC care

Hb @ 36 weeks 104 advised iron

UTI diagnosed after presenting with abdo pain. Treated.

Labour summary

@ 40 weeks gestation arrived with SROM

Arrived on delivery suite 10cm dilated

Delivery summary

SVD @ 6:43

IM syntometrin given

07:15 placenta delivered with cord traction but membranes were noted to still be in the uterus

07:25 First medical review. SAS grade ? needs theatre

MBL 300mL uterus contracted

07:25 Synto infusion started

PPH summary

08:40 waiting for further obstetric review

08:45 obs stable

Further 200ml blood loss

09:40 (2 hours after deliver) MBL >800mL seen by Obstetric Reg

Needs EUA declines anaesthetic therefore attempt at removal of membranes in room with entronox.

MBL now 1399

Has ROTEM which is normal and tranexamic acid

[redacted] MBL has now increased to >1500 consultant review needs EUA

[redacted] GA commenced in theatre

Extensive amount of membranes delivered

Total measured blood loss 2257

Post-op

Following day Hb 65

2 units RBC given

Further recovery uneventful

PPH Management:

MOH activated appropriate:

Despite the knowledge that there had been incomplete delivery of placental membranes with on-going blood loss it took until 5 hours post delivery and blood loss >1500mL to administer adequate anaesthesia and stop the bleeding.

After the attempt 3 hours post delivery in the room to remove membranes blood loss did not completely settle. There needed to be a more concerted effort to get the lady to accept anaesthesia and then more rapid escalation when blood loss did not settle.

Appropriate bloods taken at the correct time

Antenatal: Yes

Labour: NA During

PPH: Yes

Risk factors for PPH identified: Retained placenta / membranes is an unpredictable complication of delivery

WHO check list for theatre cases: Yes

Plan for uterotonics: Yes IM syntometrin

PPH documentation: Well filled out on OBS Cymru sheet with clear accumulative blood loss which slowly and steadily increased

OBS Cymru well filled out: Yes

ROTEM taken at appropriate time: Yes (NAD)

POC lactate and Hb at appropriate time: ?Acted upon:

Communication during PPH: There appears to be very slow recognition of potential risks of inadequate or incomplete removal of membranes

It was noted by the midwives that all or most of the membranes were in situ therefore there was very slow escalation by medical staff. It appears that despite recognising retained membranes the problem was not escalated to consultant level until MBL >1500

and then it took another hour to take the patient to theatre and give anaesthesia so the problem could be properly dealt with.

Appropriate seniority for surgical procedure: Yes but very slow escalation from SAS to Obs Reg to Consultant

Recommendations: Rapid escalation to senior staff at start of PPH required. Consultant anaesthetist present. ? Recognition of deteriorating patient: BP remained normal until theatre but accumulative blood loss was not acted on appropriately

Evidence of measured accumulative blood loss: Yes

Time of day

In hours: delivered out of hours but went to theatre in hours

Out of hours night

Out of hours day time weekend

Started during hand over

Primary cause of PPH

Retained placental membranes

Risk factors: NA

Cause:

Additional Notes:

Despite recognition of incomplete delivery of membranes and slow but clear accumulation of blood loss action took place over hours.

Attempting to remove membranes in the room without anaesthesia especially as blood loss did not immediately settle indicated that urgent action is needed.

Patients can be reluctant to have anaesthesia but without clear evidence that the placenta and membranes were complete and blood loss completely settled then more effort should have been placed on explaining the importance of good pain relief to the patient especially as she agreed later to have a GA later.

Measured blood loss: MBL 2257

Transfusion required: Yes Hb dropped to 64 the next day. This probably represents an under estimation of blood loss and she had 2 units RBC

Evidence of Readiness: Yes

Evidence of Recognition: No

Evidence of good Response: No

Home on 20.03.2022

Summary

There was clear evidence almost immediately after delivery that placental tissue had not been delivered.

There was slow but well documented evidence of increasing blood loss despite definitive treatment not having been provided.

First registrar review 2 hours after delivery

It appears that as MBL was under 1500mL urgent action was not given despite the fact that until membranes are completely delivered then bleeding will not settle.

It took 5 hours for definitive treatment to be given.

If she had been taken to theatre once incomplete membranes had been identified with more urgent early review then MOH would have been avoided.

There was under recognition of the seriousness of the problem. Bleeding will not stop until all the membranes are removed. This resulted in delayed treatment.

Case Review J

Background and Pregnancy Summary

Late booker, primigravida, 36 years age, unaware of pregnancy up until attendance at A & E with abdominal pain 0n 21.01.2022. An US revealed liver changes associated with significant alcoholic liver disease, a portal vein thrombosis and a an intrauterine pregnancy at an advanced gestation. Seen by grastro-entrologist and started on 80mg BD celexane. Booked in maternity by midwife @28 weeks on 4/2/22. IUGR baby. Advised to attend OAU if concerns with fetal movements.

Was not seen in consultant clinic until 32/40 (next appointment) despite a very high risk pregnancy. Seen by a junior obstetrician who discussed the case with consultant ([redacted]). No specific concerns highlighted apart from small baby. Arranged 2 week follow-up. Of note there is no high risk full dose Clexane plan.

No monitoring of the baby such as regular CTGs or admission to the unit for closer monitoring in between the two appointments considering the baby has severe growth restriction of 0-minus 1 centile as per ‘customised Gap and Grow Chart’ . This is a missed opportunity.

No note of clotting screen taken on 24/1 which showed normal PT and APTT but an abnormally low fibrinogen of 2g/L. This was probably considered normal by gastro but is abnormally low for pregnancy. This probably relates to her liver disease but is not noted. It reflects the high risk nature of her disease and the need to make a good delivery plan with advice from haematology.

Emergency C/S at 33+4/40 on 13.03.2022 due to SROM and the baby in breech presentation. Baby on NNU. Lapaprotomy, on 14.03.2022 for maternal ‘collapse’ and suspected haemoperitonium, 2419 mL blood clots evacuated from the abdomen . Uneventful recovery following a brief admission to the ITU. FU in Haematology clinic, post natally arranged.

Labour & Delivery summary

13.03.2022

08:15 @ 33+4/40 with SROM and is found to have a very abnormal antenatal CTG. The Cervix was 4 cms dilated and the baby was in a breech presentation.

08:22 a decision for Cat 1 C/S.

08:40 a decision for GA

08:41 GA accomplished

08:40 CS commenced by the on call Registrar (Dr [redacted])

08:43 Baby delivered: minimal liquor, baby born in good condition, Placenta delivered.

Poorly formed lower segment. Vertical extension of the left margin of the incision into the vagina. Uterus exteriorised and repaired by Mr [redacted] Consultant (? Locum). Angles identified and secured. MBL = 200ml

09:09 CS complete

09:30 Case J transferred to recovery.

10:30 back on the Labour Ward, room 2

Note: Clotting taken no reference to fibrinogen of 2g/L at start of surgery (found on Welsh portal)

This lady was on an anticoagulant dose of celexane but only reference to note this is >12h since last dose. It appears from this that the staff thought that anticoagulation would not be a problem but in fact she would have been anticoagulated during the C/S

There is a tick in post-op instructions about a Clexane plan to start 6 hours after surgery but intended dose not found in the notes

We cannot find first post-operative MEOWS chart

No apparent appreciation or plan relating to very high risk nature of recovery period and bleeding risk. Anticoagulated and low fibrinogen

14.03.2022

07:30 M/W bleeped, due to '[redacted] collapse' @ 07:15, BP 82/69, HR – 95bpm, 'no seizures, loss of consciousness during the collapse'. IV access, Bloods, FBC, UE, LFT, blood gas, IV fluids, planned CT/US abdomen, senior review asap. Monday morning, MW handover and then Medical staff handover.

Reviewed by SHO arranged US/CT abdomen, chase bloods, 'senior review asap'.

08:45 Anaesthetic review, noted 'looking pale and unwell' Lactate =5.2, Hb = 76, BP = 85/40

08:55 SB Consultant ([redacted]). Case J looking pale, abdominal distension, suspected intra-abdominal bleeding. Plan for Cat 1 return to theatre-laparotomy. Appropriate plan. However 1 hour 25 minutes delay in medical staff review.

09:20 ROTEM, ordered 6 units blood, 2 units 'O Neg now'.

09:30 Transferred to delivery suite from Celyn Ward to prepare for theatre

09:40 blood transfusion commenced

09:45 Consultant Anaesthetist review. Did ABCDE, Lactate 5.2,

10:00 transferred to theatre

10:17 Arterial line sited.

10:18 Anaesthetic commenced

10:27 laparotomy commenced

Laparotomy Findings: "No obvious bleeding points, clots +++, haemoperitonium, mild ooze from left broad ligament, anterior to peritonium adjacent to left round ligament. No other bleeding point identified. Clots emptied. Haemostatic suture taken on visceral peritoneum on left sided broad ligament anteriorly. Haemostasis achieved. Non-suction 18 drain anteriorly to RIF".

10:30 second unit of blood, Hb =91, lactate – 2.52 on gas.

10:40 BP 70/42, further 4 units of blood requested, 4 unites of FFP requested

10:44 MBL = 1146

10:50 BP 77/32

10:55 MOH call put out, ROTEM not repeated

11:00 Third unit blood commenced

11:07 4th unit blood commenced, decision to site a central line

11:25 bloods from 09:15, Hb = 75, WBC = 12.7, Plt = 255, Fibrinogen = 1.4

11:30 skin closed, BP = 76/31, pulse =77bpm

11:34 first FFP commenced.

11:45 4th FFP complete

11:55 ROTEM + COAG bloods taken

12:30 ROTEM = 10, Extem CT =64

12:30 transfer to ITU

15.03.2022

16:30 return from ITU, Hb =80, Plt = 103

Hb in theatre 114 lactate 5.2

Uterotonics

First line IM syntometric then IV syntocinon 5 units then Synto infusion then carboprost X2 all given rapidly

Blood Products:

RBCs 4 Units, 14.03.2023

FFP 4 Units on 14.03.2022

Croyoprecipitae 1 Unit on 14.03.2023

PPH summary

Found collapsed the following morning on the ward. Hb 78, Lactate 5.2 and Fibrinogen critically low at 1.4g/L.

No MEOWS chart

Rapid decision to return to theatre. Resuscitated with 4 units RBC and 4 FFP No OBS Cymru filled out

Can't see ROTEM results. Although OBS Cymru would suggest fibrinogen concentrate in view of complex situation FFP is a reasonable choice.

The bleeding found was typical of the type seen with generalised bleeding

disorder. The choice of coagulant factors did not affect outcome.

MBL 2500mL in total

Post-op

Admitted to ICU

First note relating to careful restarting of low dose celexane

Clear documentation

Uneventful recovery

Overall Summary

MOH activated appropriate: Yes once PPH the following day had been recognised

Appropriate bloods taken at the correct time

Antenatal: Yes not acted on

Labour: Yes but not acted on.

In addition APTT and PT does not change on LMWH therefore apparent lack of appreciation of anticoagulated patient with critically low fibrinogen for pregnancy and delivery

During PPH: We couldn't see the ROTEM result but there was rapid recognition that the fibrinogen on the lab result was 1.4g/L which in the face of on-going bleeding is critically low. The choice of coagulant factors does not follow the OBS Cymru algorithm but was overall FFP was a good choice because of the complex clinical picture of an anticoagulated patient and chronic liver disease.

Risk factors for PPH identified No

WHO check list for theatre cases: Didn't see one although there was a preop check list

Plan for uterotonics: NA

PPH documentation: OBS Cymru not filled out but reasonable contemporary notes in the record OBS Cymru well filled out: NO ROTEM taken at appropriate time:
POC lactate and Hb at appropriate time:

Acted upon: YES

Communication during PPH: good

Appropriate seniority for surgical procedure:

Rapid escalation to senior staff at start of PPH. Yes once PPH had been recognised

Consultant anaesthetist present. Yes

Recognition of deteriorating patient: No. This lady was found collapsed on the post-natal ward with very significant signs of cardiovascular instability. We couldn't find a MEOWS chart in the notes and there should have been initial attention to the significant risk of bleeding after her initial C/S with close post-operative monitoring.

Delay in return to theatre: Case J had a departmental ultrasound scan which showed abdominal bleeding. With a collapsed patient with abdominal distension this action results in delay to return to theatre.

We think there wasn't a significant delay in this case but taking an unstable patient into an unmonitored area could be deleterious.

Evidence of measured accumulative blood loss: No, although operation notes state that there wasn't significant on-going blood loss after the abdomen was cleared of blood/clots and clotting corrected

Time of day

In hours: Yes

Out of hours night

Out of hours day time weekend

Started during hand over

Primary cause of PPH

Unrecognized coagulopathy caused by LMWH and a low fibrinogen secondary to liver disease

Risk factors: Liver disease and LMWH

Additional Notes:

This lady booked late with a very high risk pregnancy

There appeared to be a month between booking with a midwife and her first antenatal appointment with obstetric staff. This seems a very long time in view of the high risk nature of the pregnancy. A junior Obstetrician saw this lady and discussed her care plan with NTC who advised a further scan in 2 weeks time. It is unclear what exactly the conversation between the 2 Obstetricians was, it appears that salient and high risk factors such as Case J has been on Clexane, has very growth restricted baby might have not been discussed. Had the above risk factors been realised, Case J could be either admitted or monitored very closely such that an optimisation of mother's and baby's condition could be achieved for a safer delivery. In this plan, a review by Haematologists, anaesthetist be undertaken with administration of steroids for fetal lung maturity.

This was a huge missed opportunity. Had these high risk factors been realised the outcome is highly likely to have been different. Overall, there were deficiencies in care. Better antenatal planning, recognition of the significant medical issues and better post-operative monitoring with close observation of clotting, and advise from haematology, is highly likely to have prevented or modified the size of the bleed and risk to the patient and her baby.

Lack of appreciation of impact of liver disease on fibrinogen levels and the impact this may have on bleeding risk, besides risks to the baby being unmonitored for 2 weeks in presence of severe growth restriction which was well below 3rd Centile i.e. it was at the 0 Centile.

Glossary

MOH Massive Obstetric Haemorrhage >1500ml blood loss
EDD Expected Due date of Delivery
Hb Haemoglobin expressed as g/L
MBL Measured Blood Loss
DFM Decreased Fetal Movements IM Intramuscular (injection)
IV Intravenous (injection)
APH Ante Partum Haemorrhage
PPH Post-Partum Haemorrhage
IOL Induction of Labour
SROM Spontaneous Rupture of Membranes
ARM Artificial Rupture of Membranes
FM Fetal Movements
SVD Spontaneous Vaginal delivery
CS Caesarean Section
CMW Community Midwife
VE Vaginal examination
SGA Small for Gestational Age
LGA Large for Gestational Age
Bpm beat per minute (heart rate)
LW Labour ward
GTT Glucose Tolerance Test (to diagnose Gestational diabetes)
DCDA Dichorionic Diamniotic (Twins)
BD Twice a day (Medications