

Peripartum Hysterectomy: Comparison of the Outcome of Caesarean and Postpartum Hysterectomy

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Objective: To compare the risk factors and complications of Caesarean hysterectomy (CH) and postpartum hysterectomy (PH) in a single obstetric unit over the last 15 years.

Methods: A retrospective review was made of 48 cases of peripartum hysterectomy performed from 1999 to 2014 (15 years). Cases were classified as CH or PH group. Epidemiological data, indications for hysterectomy, total blood loss, complications, and re-laparotomy rate were analysed and compared between the two groups.

Results: The Caesarean section rate was 20.2% among the 68,211 deliveries during the study period. The incidence of hysterectomy following Caesarean deliveries was 0.25% (n=35), that following vaginal delivery was 0.023% (n=13). The most common indication for CH was placenta praevia, that for PH was uterine atony. Total blood loss was comparable between the two groups but a significantly higher proportion in the PH group had disseminated intravascular coagulopathy (DIC) [85% vs. 49%] and required more units of blood transfusion compared with the CH group. Within the entire cohort, eight (17%) cases required re-laparotomy due to re-bleeding, and these cases had a significant higher risk of postoperative complications, longer length of intensive care unit stay, and need for ventilatory support.

Conclusion: Uterine atony and placenta praevia were the most common indications for peripartum hysterectomy. There were no major significant differences in the clinical outcome between CH and PH patients, but the incidence of DIC was apparently higher in the PH group compared with the CH group.

Hong Kong J Gynaecol Obstet Midwifery 2016; 16(1):21-8

Keywords: *Cesarean section; Hysterectomy; Postpartum hemorrhage*

Introduction

Peripartum hysterectomy is the definitive procedure for management of intractable postpartum haemorrhage and is often associated with significant maternal morbidity and mortality. The incidence of peripartum hysterectomy has been observed to be increasing over time¹, with reported rates varying from 0.41/1000 in the UK² to 1.3/1000 in Taiwan³. In general, Caesarean hysterectomy (CH) is performed during the same surgery shortly following a Caesarean delivery, while a postpartum hysterectomy (PH) is shortly after a vaginal delivery¹.

Previous studies have shown that the indications for PH have changed over time with intractable uterine atony and placenta accreta becoming more important indications, while the incidence of uterine rupture has decreased significantly over the past decades^{4,5}. The incidence of placenta accreta is closely associated with Caesarean section rate⁶. Similar to the worldwide trend, the overall Caesarean section rate in Hong Kong has increased from 22.5% in 1994⁷ to 36.9% in 2009⁸. It is therefore relevant to evaluate the impact of such an increase in

Caesarean section rate on peripartum hysterectomy rates. The progressive development of conservative surgical management of severe postpartum haemorrhage, including the use of compression sutures, balloon tamponade and radiological embolisation, was also postulated to have an impact on the overall incidence and indications for peripartum hysterectomy^{9,10}. The last review of peripartum hysterectomy in our locality was performed over 15 years ago¹¹. This current retrospective study aimed to evaluate the differences in incidence, indications, risk factors, and complications of CH and PH in the last 10 years.

Methods

A retrospective analysis was performed of all women who underwent emergency peripartum hysterectomy over a period of 15 years in a tertiary regional obstetric unit. A comprehensive obstetric database and the Labour Ward registry were used to search for all women who had emergency peripartum hysterectomy performed

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between July 1999 and June 2014. Emergency peripartum hysterectomy was defined as hysterectomy performed within 72 hours of the time of delivery, and CH was referred to as peripartum hysterectomy following Caesarean section and PH as hysterectomy following vaginal delivery. Cases of elective incidental hysterectomy at the time of Caesarean section, for example that for ovarian or cervical malignancies, were excluded from this analysis. A total of 48 cases were identified according to the above criteria and all were included in the analysis. The complete hospital records of these patients, including clinical notes, operation records, anaesthetic records, laboratory results and blood transfusion records were retrieved and reviewed.

The cases were divided into the CH group versus PH group for comparison. The epidemiological data for maternal age, parity, previous Caesarean section, multiple pregnancies, antepartum haemorrhage, gestational diabetes mellitus, use of prostaglandins, gestation at delivery, birth weight, and mode of delivery were extracted and entered into a specifically designed proforma for major postpartum haemorrhage. In addition, the indications for hysterectomy, use of second-line surgical procedures before hysterectomy, operative blood loss, number of units of blood products transfused, documented disseminated intravascular coagulopathy (DIC), postoperative complications, and re-laparotomy rates were evaluated. Total blood loss was calculated by adding the intraoperative blood loss and the estimated blood loss post-delivery or postoperatively. The total number of units transfused was calculated from the total volume of blood products transfused during the entire delivery episode and DIC was defined as the presence of prolonged prothrombin and activated partial thromboplastin time together with thrombocytopenia based on laboratory haematological results. A secondary comparison was also performed in the same cohort to compare the outcome of those who required re-laparotomy because of bleeding versus those without re-laparotomy. Re-laparotomy was defined as any subsequent surgical exploration for control of haemorrhage during the same delivery episode.

Statistical analysis was performed using the Statistical Package for the Social Sciences Windows version 21.0 (SPSS Inc, Chicago [IL], US). Student's *t* test was used to assess means between groups for continuous variables, while Chi-square test or Fisher's exact test were used for proportions. Clinical significance was set at *p* value of <0.05.

Results

During the study period, there were 68,211 deliveries

in our hospital, of which 13,831 were by Caesarean section, giving an overall Caesarean section rate of 20.2%. There were 48 cases of peripartum hysterectomy in this period that fulfilled our selection criteria, giving an overall incidence of 0.07%. None of the hysterectomies was performed electively for malignancy or other incidental pathology. All decisions for hysterectomy were made in the presence of a consultant. There were 35 CH, constituting 0.25% of all Caesarean sections, and 13 PH, constituting 0.023% of all vaginal deliveries. The incidence of peripartum hysterectomy was significantly lower following vaginal delivery than following Caesarean section (relative risk 10.5, *p*<0.001). There was one case of maternal mortality due to severe postpartum haemorrhage with placenta praevia/accreta in this cohort.

A comparison of the basic pregnancy characteristics between CH and PH groups showed no major differences in the demographic characteristics, including age, parity, number of previous Caesarean sections, or multiple pregnancies (Table 1). Nonetheless there were more women with antepartum haemorrhage, and more delivering preterm with lower birth weight in the CH group than the PH group. This was most likely because all except one of the placenta praevia/accreta cases (*n*=19, 54%) were all clustered in the CH group. Although there was a higher incidence of previous Caesarean section in the CH group compared with the PH group (40% vs. 15%), the difference was not statistically significant probably because of the small number of cases. The two cases of previous Caesarean section in the PH group were both for term singletons in women who opted for a vaginal birth after Caesarean (VBAC). Hysterectomy was performed for uterine atony and amniotic fluid embolism with DIC, respectively. There were no cases with more than one previous Caesarean section in the PH group as we would not offer VBAC to these patients in our unit. More women in the PH group had gestational diabetes mellitus than the CH group (6/13, 46% vs. 3/35, 9%). Of the six cases in the PH group, four had uterine atony, one had placenta accreta, and one had vaginal lacerations. The three women with gestational diabetes in the CH group underwent hysterectomy for placenta praevia (twin pregnancy), placenta abruptio, and uterine atony, respectively. As the indications for peripartum hysterectomy were not directly related to gestational diabetes or its complications in these cases, the association was most likely incidental (Table 1).

Comparison of indications for peripartum hysterectomy revealed that the primary cause of PH was uterine atony (77%) and in the CH group, placenta praevia/

Table 1. Group comparisons of basic pregnancy characteristics*

	CH group (n=35)	PH group (n=13)	p Value; MD; 95% CI
Age (years)	34.5 ± 5.12	35 ± 4	0.77; -0.5; -3.63 to 2.72
Parity			
Nulliparous	16 (46)	8 (62)	0.51
Multiparous	19 (54)	5 (38)	
Previous Caesarean section	14 (40)	2 (15)	0.17
Had ≥2 previous Caesarean sections	6 (17)	0	0.11
Multiple pregnancy	4 (11)	0	0.20
Antepartum haemorrhage	8 (23)	0	0.04
Gestational diabetes mellitus	3 (9)	6 (46)	0.003
Other significant antenatal medical complications	4 (11)	2 (15)	0.71
Gestation at delivery (weeks)	36.2 ± 3.4	39.5 ± 0.9	0.001; -3.3; -5.22 to -1.33
Birth weight (g)	2850 ± 869	3299 ± 309	0.01; -449; -792 to -107
Mode of delivery			
NSD	0	8 (62)	
VE/LF	0	5 (38)	
Elective/emergency LSCS	8/26 (97)	0	
Classical Caesarean section	1 (3)	0	

Abbreviations: CH = Caesarean hysterectomy; CI = confidence interval; LSCS = lower-segment Caesarean section; MD = mean difference; NSD = normal spontaneous delivery; PH = peripartum hysterectomy; VE/LF = vacuum extraction/low forceps

* Data are shown as mean ± standard deviation or No. (%), unless otherwise specified

accreta (54%) was the primary indication. There was one case of placenta accreta in the PH group, in a para 2 patient with no previous Caesarean section. She presented with uterine atony after delivery and the final pathology confirmed the presence of placenta accreta. There were no cases of uterine rupture leading to PH during this study period. All but two peripartum hysterectomies were performed within 24 hours of delivery, the one in the CH group being performed 26 hours after the primary Caesarean section and the one in the PH group performed 29 hours after normal vaginal delivery (Table 2).

The total blood loss and blood loss at decision for hysterectomy were similar for both groups, although a higher proportion of patients in the PH groups suffered from DIC and required transfusion of significantly more blood products. As a large proportion of CH patients had bleeding from a low lying placenta, none underwent subtotal hysterectomy contrary to 31% in the PH group. Overall, over 40% (21/48) of patients had second-line procedures prior to hysterectomy. The use of compression sutures was higher in the CH group (31% vs. 8%) while use

of balloon tamponade was higher in the PH group (15% vs. 9%). There were also no significant differences regarding postoperative complications, or re-laparotomy rates or length of intensive care unit (ICU) stay between the two groups (Table 3). The single case of maternal mortality occurred in a woman with one previous Caesarean section and current unpredicted placenta accreta. She had brisk bleeding of around 4000 ml at the time of emergency Caesarean section followed by cardiac arrest on the table, and succumbed despite intensive advanced resuscitation and immediate resort to hysterectomy.

There were eight women who required re-laparotomy because of re-bleeding, six (75%) following CH. Nonetheless mode of delivery did not appear to have a statistically significant predictive value in discriminating which patients were at risk of re-laparotomy, probably because of the small number of patients involved. Among antenatal risk factors, multiple pregnancy was apparently more common in those who required re-laparotomy, while antepartum haemorrhage, gestational diabetes, or previous Caesarean section were not associated with

Table 2. Group comparisons of operative details at peripartum hysterectomy*

	CH group (n=35)	PH group (n=13)	p Value; MD; 95% CI
Cause of postpartum haemorrhage			
Placenta praevia/accreta	19 (54)	1 (8)	0.001
Uterine atony	16 (46)	10 (77)	
Amniotic fluid embolisation	0	1 (8)	
Vaginal lacerations	0	1 (8)	
Blood loss at decision for hysterectomy (ml)	2448 ± 750	2640 ± 953	0.51; 192; -399 to 783
Total blood loss (ml)	6805 ± 5499	6904 ± 3533	0.95; 100; -3408 to 3209
Type of hysterectomy			
Total	35 (100)	9 (69)	<0.001
Subtotal	0	4 (31)	
Documented DIC	17 (49)	11 (85)	0.02
Transfusion			
Whole blood or packed cells units	10.8 ± 8	16 ± 7	0.02; -5.20; -11.1 to 0.97
Fresh frozen plasma	26 (74) [4-20]	12 (92) [4-24]	0.17
Cryoprecipitate	10 (29) [4-12]	6 (46) [4-22]	0.25
Platelets	22 (63) [2-20]	11 (85) [4-16]	0.14
Factor VIIa	3 (9)	2 (15)	0.49
Delayed hysterectomy >24 hours	1 (3)	1 (8)	0.45
Use of haemabate or other prostaglandins as oxytocics	16 (46)	8 (62)	0.32
Second-line procedures before hysterectomy			
Compression sutures	11 (31)	1 (8)	
Balloon tamponade	3 (9)	2 (15)	0.27
Internal iliac ligation	1 (3)	0	
Radiological uterine embolisation	3 (9)	0	

Abbreviations: CH = Caesarean hysterectomy; CI = confidence interval; DIC = disseminated intravascular coagulopathy; MD = mean difference; PH = peripartum hysterectomy

* Data are shown as No. (%) [range] or mean ± standard deviation, unless otherwise specified

Table 3. Comparison of complications at peripartum hysterectomy*

	CH group (n=35)	PH group (n=13)	p Value; MD; 95% CI
Complications			
Vault/wound haematoma	6 (17)	4 (31)	0.10
Acute renal failure	0	1 (8)	
Peripartum cardiomyopathy	1 (3)	1 (8)	
Bladder injury	3 (9)	0	
Bowel injury/obstruction	0	1 (8)	
Re-laparotomy	6 (17)	2 (15)	0.88
ICU stay (days)	3.05 ± 0.89	2.96 ± 0.77	0.73; 0.09; -0.46 to 0.66
Ventilatory support (days)	1.45 ± 0.92	1.80 ± 0.85	0.23; -0.35; -0.94 to 0.24
Maternal mortality	1 (3)	0	0.53

Abbreviations: CH = Caesarean hysterectomy; CI = confidence interval; ICU = intensive care unit; MD = mean difference; PH = peripartum hysterectomy

* Data are shown as No. (%) or mean ± standard deviation, unless otherwise specified

an increased risk (Table 4). The amount of blood loss at decision for hysterectomy did not differ between the two groups although total amount of blood loss, incidence of DIC, and total units of blood transfused were significantly higher in those who required re-laparotomy. Postoperative complications, including length of ICU stay and the need for ventilatory support, were also higher in the re-laparotomy group (Table 5).

A logistic regression model was constructed and significant factors associated with need for re-laparotomy were entered into the model in a stepwise fashion. None of the factors that were found to be significant on univariate analysis were significant in the regression model, again due to the small number of cases who required re-laparotomy.

Discussion

The incidence of peripartum hysterectomy was 0.7/1000 in our study, and is comparable with other reports across different centres worldwide^{2,3}. Although there were no major significant differences in the clinical outcome for those with CH compared with those with PH, the incidence of DIC was apparently higher in the PH group.

The overall re-laparotomy rate was 17% in this cohort with a significantly increased risk of morbidity. Nonetheless re-laparotomy rate was not significantly higher in the CH group compared with the PH group.

As evident in other studies, placenta praevia has become a progressively more important risk factor for CH than uterine atony². The increasing rates of primary Caesarean section have no doubt led to an increased incidence of previous Caesarean section, and thus placenta praevia/accreta in subsequent pregnancies¹². While placenta praevia is readily recognisable on antenatal ultrasound examination, the risk of CH is greatly increased in the presence of a major previa¹³. On the contrary, uterine atony remains to be the primary risk factor for PH, and evidence from placental pathology has suggested that such intractable uterine atony can be associated with clinical and pathologic findings consistent with acute inflammation and infection¹⁴. There is evidence from population-based surveillance that the incidence of severe postpartum haemorrhage due to uterine atony has been progressively increasing over the last 15 years¹⁵, although the factors associated with this trend could not be clearly identified.

Table 4. Comparison of pregnancy characteristics between those with and without re-laparotomy*

	No re-laparotomy (n=40)	Re-laparotomy (n=8)	p Value; MD; 95% CI
Age (years)	34.4 ± 4.4	35.6 ± 6.80	0.54; 1.2; -2.62 to 4.92
Parity			
Nulliparous	20 (50)	4 (50)	1.0
Multiparous	20 (50)	4 (50)	
Previous CS	12 (30)	4 (50)	0.27
Had ≥2 previous CS	4 (10)	2 (25)	0.24
Multiple pregnancy	2 (5)	2 (25)	0.06
Antepartum haemorrhage	6 (15)	2 (25)	0.61
Gestational diabetes mellitus	7 (18)	2 (25)	0.61
Other significant antenatal medical complications	6 (15)	2 (25)	0.48
Gestation at delivery (weeks)	37.1 ± 3.5	37.2 ± 2.3	0.92; 0.1; -2.46 to 2.71
Birth weight (g)	3026 ± 793	2697 ± 707	0.28; -329; -938 to 279
Mode of delivery			
NSD	6 (15)	2 (25)	0.88
VE/LF	5 (13)	0	
Elective/emergency LSCS	8/20 (70)	0/6 (75)	
Classical CS	1 (3)	0	

Abbreviations: CI = confidence interval; CS = Caesarean section; LSCS = lower-segment Caesarean section; MD = mean difference; NSD = normal spontaneous delivery; VE/LF = vacuum extraction/low forceps

* Data are shown as mean ± standard deviation or No. (%), unless otherwise specified

Table 5. Comparison of operative details at hysterectomy between those with and without re-laparotomy*

	No re-laparotomy (n=40)	Re-laparotomy (n=8)	p Value; MD; 95% CI
Cause of postpartum haemorrhage			
Placenta praevia	17 (43)	2 (25)	0.35
Uterine atony	22 (55)	5 (63)	
Amniotic fluid embolisation with DIC	0	1 (13)	
Vaginal laceration	1 (2)	0	
Blood loss at decision for hysterectomy (ml)	2617 ± 937	2441 ± 710	0.61; -176; -883 to 530
Total blood loss (ml)	6046 ± 4546	10,760 ± 5657	0.01; 4714; 1024-8403
Type of hysterectomy			
Total	37 (92)	7 (88)	0.64
Subtotal	3 (8)	1 (13)	
Duration of operation (mins)	254 ± 244	231 ± 213	0.89; -24; -423 to 368
Documented DIC	20 (50)	8 (100)	0.008
Transfusion (range of units given)			
Whole blood or packed cell units	10.5 ± 6.6	22.2 ± 8.4	0.001; 11.7; 6.28-17.1
Fresh frozen plasma	30 (4-20) [75]	8 (8-24) [100]	0.07
Cryoprecipitate	12 (4-8) [30]	4 (4-20) [50]	<0.001
Platelets	25 (2-16) [63]	8 (2-20) [100]	0.03
Factor VIIa	3 (8)	2 (25)	0.01
Delayed hysterectomy >24 hours	1 (3)	1 (13)	0.19
Prostaglandins as oxytoxics	22 (55)	2 (25)	0.12
Second-line procedures before hysterectomy			
Compression sutures	10 (25)	2 (25)	1
Balloon tamponade	3 (8)	2 (25)	0.89
Internal iliac ligation	1 (3)	0	0.65
Complications			
Vault/wound haematoma	7 (18)	3 (38)	0.01
Acute renal failure	1 (3)	0	
Peripartum cardiomyopathy	1 (3)	1 (13)	
Bladder injury	2 (5)	1 (13)	
Bowel injury/obstruction	0	1 (13)	
ICU stay (days)	2.76 ± 0.64	4.37 ± 0.35	<0.001; 1.61; 1.14-2.08
Ventilatory support (days)	1.36 ± 0.81	2.5 ± 0.75	0.001; 1.14; 0.50-1.76
Maternal mortality	1 (3)	0	0.65

Abbreviations: CI = confidence interval; DIC = disseminated intravascular coagulopathy; ICU = intensive care unit; MD = mean difference

* Data are shown as No. (%) [range] or mean ± standard deviation, unless otherwise specified. Because of rounding, not all percentages total 100

Uterine rupture used to be a more significant indication for peripartum hysterectomy⁴ but no such cases presented during our study period. This may be due to the cautious use of oxytocin, direct Caesarean section in cases with two previous Caesarean sections, and the decreased

number of grand multiparous women (0.45%) in our locality⁸. An overall reduction in the incidence of vaginal birth after previous Caesarean section could also contribute to very low rates of previous Caesarean scar dehiscence in recent cohorts².

With regard to type of hysterectomy to be performed, there was no attempt to control bleeding by subtotal hysterectomy in the CH in this cohort. This is understandable as bleeding in placenta praevia will likely involve the cervix and a total hysterectomy will be required. Nonetheless in PH, the primary risk factor is uterine atony and subtotal hysterectomy alone will control the bleeding. Indeed, it would be technically more difficult to perform a total hysterectomy when the cervix has been fully dilated in a postpartum case. Previous studies showed no differences regarding operating time or blood transfusion rate between the two types of hysterectomy¹¹. In this cohort, the type of hysterectomy was also unrelated to the need for re-exploration. Although there were more bladder injuries in the CH group, such direct trauma was likely due to adhesions from previous Caesarean section or from placenta accreta/percreta rather than the procedure for hysterectomy alone¹⁶.

The rate of DIC in our study was 49% in the CH group and 85% in the PH group. This is significantly higher than the 33.3% quoted in Lau et al¹¹, although the total blood loss quoted appeared to be similar. In addition, in our current cohort, despite a similar total blood loss in the CH and PH group, there was a significantly higher rate of DIC and units of blood transfused in the PH group. Possible explanations included delays in prophylactic transfusion of blood products and coagulation factors during the resuscitation of PH patients compared with patients delivered by Caesarean section for whom earlier input and intervention by an obstetric anaesthetist was likely, who would also more readily initiate earlier transfusion of blood products. There could also be more underestimation of blood loss in the labour ward by midwives in PH patients compared with CH patients where blood loss documentation in the operating theatre might be more precise. An overall higher incidence of DIC in the current cohort than in previous local data¹¹ could indicate more vigilant detection of DIC in current obstetric practice, with more ready resort to urgent laboratory tests to confirm coagulopathy¹⁷.

Second-line procedures to control haemorrhage and avoid peripartum hysterectomy are being increasingly

adopted and are more common in our current postpartum haemorrhage protocols¹⁸⁻²⁰. This was particularly evident when comparing the cases managed in the earlier years within the study period to the more recent cases, when balloon tamponade or compression sutures were more commonly used. The PH group had a lower incidence of second-line procedures before proceeding to direct hysterectomy (3/13, 23%) compared with the CH group (18/35, 52%), although the difference was not statistically significant ($p=0.32$, Fisher's exact test). There was evidence that the appropriate use of such second-line procedures could reduce the need for hysterectomy^{10,21}, thereby decreasing total blood loss and morbidity from associated complications such as DIC²².

The total blood loss in the re-laparotomy group was significantly higher compared with those without need for re-laparotomy. From our data, it was obvious that if haemorrhage could be controlled earlier, the associated morbidity and risks should be correspondingly reduced²³. Nonetheless due to the small number of patients who required re-laparotomy, we were not able to identify any particular risk factors for such re-laparotomy. Early resort to second-line procedures to avoid hysterectomy and to reduce massive blood loss should be a significant factor that reduces the risk of re-laparotomy and associated morbidity.

Our findings confirmed an almost 10-fold increase in the incidence of emergency peripartum hysterectomy in those with Caesarean delivery compared with vaginal delivery^{24,25}. Although the indications for hysterectomy differed significantly in the two groups, as in similar studies in the past, we were unable to find major differences in terms of the operative outcome and associated morbidity^{11,25}. While early recognition of severe postpartum haemorrhage of >1000 ml²⁰ and prompt management with the use of conservative surgical procedures will reduce blood loss, risk of DIC, and the need for hysterectomy, it is clear that peripartum hysterectomy remains a life-threatening obstetric emergency that can be life-saving. At the same time though it is associated with potentially devastating consequences. All major obstetric services should continue to conduct detailed surveillance of the trends in peripartum hysterectomy and associated morbidity.

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