
ORIGINAL ARTICLE

The Value of Arterial Sheath Placement Prior to Caesarean Section for Major Placenta Praevia

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ABSTRACT

Introduction: This study aims to assess the value of non-urgent femoral sheath placement in women with major placenta praevia by analysing its utilisation rate and associated outcome measures.

Methods: We performed a 10-year retrospective cohort analysis of cases of women who underwent elective Caesarean section for major placenta praevia in a single obstetric unit. We compared outcomes between those with preoperative femoral sheath placement to those not receiving a sheath.

Results: One hundred and forty-five women with major placenta praevia were enrolled. Femoral sheaths were placed in 70 cases, and 7.1% experienced successful uterine artery embolisation. The complication rate of femoral sheath placement was low (1.4%). The odds of receiving additional uterotonics were higher in the femoral sheath placement group (odds ratio = 5.44; $p = 0.013$). Femoral sheath placement was not associated with reduced blood loss, need for blood transfusion, operation duration, or the use of additional procedures to abate bleeding. The rate of intensive care unit admissions was comparable in both groups.

Conclusion: The placement of femoral arterial sheath prior to elective Caesarean section in cases of major placenta praevia may not be beneficial. It is time-consuming and does not improve maternal morbidity.

Key Words: Arterial; Caesarean section; Maternal mortality; Placenta praevia

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中文摘要

剖腹產前放置動脈鞘對於嚴重前置胎盤的價值

舒敏欣、黃可澄、陳連偉

簡介：本研究透過分析使用率和相關結果指標，評估非緊急股動脈鞘放置對於嚴重前置胎盤孕產婦的價值。

方法：我們對一間產科因嚴重前置胎盤而接受擇期剖腹產的女性病例進行了10年回顧性隊列分析，並比較術前放置與未放置股動脈鞘患者的結果。

結果：共145名患有嚴重前置胎盤的女性納入研究，70例放置股動脈鞘，7.1%子宮動脈栓塞成功。股動脈鞘置入術的併發症發生率較低（1.4%）。股動脈鞘置入組接受額外子宮收縮劑子宮收縮的機率較高（優勢比 = 5.44； $p = 0.013$ ）。股動脈鞘放置與失血量減少、輸血需求、手術時間或使用其他方案來減少出血無關。兩組的加護病房入院率相若。

結論：對於嚴重前置胎盤的病例，在擇期剖腹產前放置股動脈鞘可能沒有好處。它耗時並且不會改善孕產婦發病率。

INTRODUCTION

The global prevalence of placenta praevia (PP) is approximately 5 per 1,000 pregnancies, with the highest prevalence reported in Asian women (12.2 per 1,000 pregnancies).¹ Delivery by Caesarean section in these cases are 12 times more likely to result in massive haemorrhage than Caesarean sections performed for other reasons.²

Preoperative measures in minimising haemorrhagic morbidities for these women can be achieved by closely liaising with blood bank specialists, haematologists, and interventional radiologists.³ It has been suggested that interventional radiology with uterine artery embolisation (UAE), performed intraoperatively or postoperatively, has reduced the need for hysterectomy when pharmacological measures have failed.^{4,5}

In 2017, Luo et al⁶ advocated prophylactic intraoperative aortic balloon insertion with major PP, irrespective of the presence or absence of abnormal invasive placenta. However, a recent randomised controlled trial showed that prophylactic internal iliac artery balloon occlusion did not reduce postpartum haemorrhage (PPH) or have any effect on maternal or neonatal morbidity in this group of women.⁷

Prophylactic placement of femoral arterial catheters (or sheaths) for PP is becoming more widespread.⁸ In our centre, femoral arterial sheath placement before Caesarean section for major PP is a common practice. We explored the value of femoral sheath placement in the management of PP.

METHODS

This was a 10-year retrospective observational analysis of all women with major PP delivered electively at our centre from January 2010 to December 2020. Anonymous data were collected from the Clinical Data Analysis and Reporting System, a computer-based administration database that records all the diagnostic and procedural coding of admitted patients, and cases were identified based on their diagnostic coding (10th edition of the International Classification of Diseases⁹). Missing data were retrieved manually from hard copies of the patients' records.

Major PP is defined by placenta covering the internal os either partially (grade III) or completely (grade IV).¹⁰ The main bulk of the PP can be anterior, non-anterior, or complete (completely covering the internal os). The type of PP was determined by the most recent transvaginal ultrasound before delivery.

Elective Caesarean section was scheduled between 37 and 38 weeks of gestation by an obstetrician, who would arrange for femoral sheath placement by notifying a dedicated radiographer. A 5-Fr sheath (Lonyi Mediatech, Shenzhen, China) [Figure] was inserted into the right common femoral artery before the elective Caesarean section in the radiology department. Techniques used to insert the sheath were by palpation, under fluoroscopy, or by ultrasonic guidance. Complications were categorised into bleeding, infection, and thrombosis. Femoral sheath placement was not performed when the delivery was urgent or in an emergency setting when the attending radiologist was otherwise occupied.

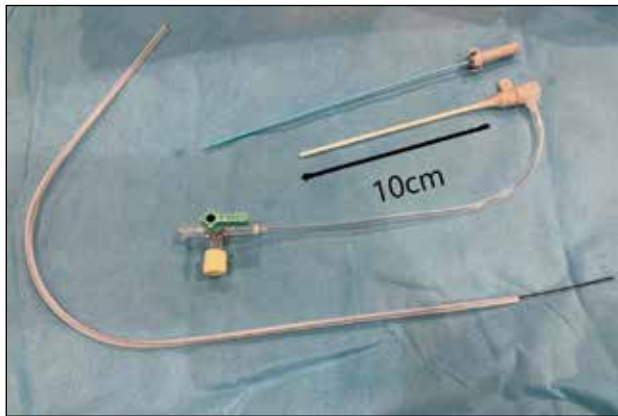


Figure. A 5-Fr femoral sheath set used in our institution.

Cases with major PP were divided into two groups, namely those with femoral sheath placement and those without. The primary outcome was the eventual need for UAE. Technically successful UAE was defined by successful embolisation of both uterine arteries. Secondary outcomes included estimated intraoperative blood loss; need for blood transfusion (units of packed red cells); operation duration; additional procedures to control bleeding, including compression sutures and Bakri balloon insertion; and additional uterotonics administered (medication other than the usual prophylactic oxytocin/ergometrine), including rectal misoprostol 800 to 1,000 mg, intramuscular carboprost 250 mcg, and infusion of concentrated oxytocin. PPH was defined by blood loss > 1,000 mL and the cause was categorised as active bleeding, concomitant placenta accreta, or uterine atony.

Simple differences between the two groups were analysed via Fisher's exact and correlation test for categorical and continuous variables, respectively. Continuous data were expressed as median (interquartile range) and were analysed with the Mann-Whitney *U* test. Multiple linear regression was performed to investigate the effects of femoral sheaths on estimated blood loss, need for blood transfusion, operation duration, and use of uterotonics/additional procedures after adjusting for possible confounders (i.e., age, gestation, parity, emergency Caesarean section, and antepartum haemorrhage). Poisson regression analysis was performed on units of blood transfused, while multiple linear regression analyses were performed to investigate the effects of femoral sheath on estimated blood loss and operation duration. Logistic regression analysis was performed on additional use of uterotonics, additional procedures, intensive care unit admissions, and hysterectomy. Analyses were carried out using R version 3.6.3. A *p* value < 0.05 was considered statistically significant.

RESULTS

One hundred and forty-five cases of major PP were enrolled. All patients were ethnically Chinese. Seventy-one (49%) were nulliparous. Seventy cases underwent Caesarean section with femoral sheath placement and 75 cases underwent Caesarean section without. The patient demographics and outcomes for the two groups are summarised in Table 1. The demographic and obstetric characteristics were similar in both groups, with the exception of the median gestational age at delivery, which was significantly lower in the cases not receiving femoral sheaths (36 vs. 37.1 weeks; *p* < 0.0001). The frequency of antepartum haemorrhage (84% vs. 61.4%) and need for emergency Caesarean section (82.7% vs. 30%) were higher in the group not receiving femoral sheaths %; (both *p* < 0.0001).

The eventual need for UAE was 4.0% for those not receiving femoral sheaths; it was 7.1% for the cases with femoral sheaths (*p* = 0.48). All UAEs were performed successfully in both groups. The majority (62.9%) of the femoral sheaths were inserted by ultrasonic guidance (Table 2). A single complication, a localised 6-cm haematoma, occurred in one case.

The overall incidence of PPH was 40.6%, mostly due to bleeding from the placental bed. The mean estimated intraoperative blood loss appears significantly greater in the cases receiving sheaths electively than in those undergoing emergent UAE (1,287 mL vs. 891 mL; *p* = 0.018) [Table 1]. However, the mean operation duration, blood transfusion rate, and use of additional procedures were comparable in both groups after adjusting for confounders (Table 3). Logistic regression analysis shows that the odds ratio for receiving additional uterotonics was higher in those receiving elective femoral sheaths (5.44, 95% confidence interval = 1.53-23.01; *p* = 0.013).

DISCUSSION

The current definition of PP is limited to placentas that cover the internal os.¹⁰ Nonetheless, minor (grade I and II) and major (grade III and IV) PP are still in use to date.¹⁰ The prevalence of PP in this study was 13.1 per 1,000 deliveries, higher than the rate of 5.2 per 1,000 pregnancies previously reported in 2013.¹ This can be contributed by raised awareness and screening of PP increasingly becoming a part of standard obstetric care. Iyasu et al¹¹ found that Asian women are twice more likely to develop PP compared to other ethnicities, hinting a genetic predisposition. All patients in this study are of Chinese ethnicity, which may have also contributed to the higher prevalence.

Table 1. Patient demographics and outcomes (n = 145).*

	Elective sheath (n = 70)	No elective sheath (n = 75)	p Value
Median age, y	34.9 (33.9-35.9)	35.2 (34.4-36.1)	0.66
Median parity	0 (0-1.0)	1 (0-1.0)	0.30
Twin pregnancy	4 (5.7%)	5 (6.7%)	1.0
Previous delivery method			0.079
Nulliparous	37 (52.9%)	34 (45.3%)	
Previous CS	22 (31.4%)	17 (22.7%)	
Previous vaginal delivery	11 (15.7%)	24 (32.0%)	
Median gestational age at delivery, wk	37.0 (37-38)	36.0 (33.5-37.0)	< 0.0001
Median gestation weight at delivery, g	2,902 (2,748-3,173)	2,675 (2,095-2,925)	< 0.0001
Major placenta praevia			0.69
Anterior	23 (32.9%)	25 (33.3%)	
Non-anterior	36 (51.4%)	42 (56.0%)	
Complete	11 (15.7%)	8 (10.7%)	
Antepartum haemorrhage	43 (61.4%)	63 (84.0%)	< 0.0001
Emergency CS	21 (30.0%)	62 (82.7%)	< 0.0001
UAE performed	5 (7.1%)	3 (4.0%)	0.48
PPH	34 (48.6%)	27 (36.0%)	0.177
Accreta	4 (5.7%)	3 (4.0%)	
Uterine atony	6 (8.6%)	9 (12.0%)	
Bleeders	23 (32.9%)	14 (18.7%)	
Unknown cause	1 (1.4%)	1 (1.3%)	
Mean estimated intraoperative blood loss, mL	1,287 ± 300	891 ± 141	0.018
Mean blood transfusion units	1.3 ± 0.6	0.79 ± 0.46	0.17
Mean operation duration, min	51.7 ± 4.4	46.5 ± 3.5	0.07
Additional procedures	14 (20.0%)	10 (13.3%)	0.38
Additional uterotonics	36 (51.4%)	19 (25.3%)	0.0019
ICU admission	7 (10.0%)	2 (2.7%)	0.089
Hysterectomy	2 (2.9%)	0	0.231

Abbreviations: CS = Caesarean section; ICU = intensive care unit; PPH = postpartum haemorrhage; UAE = uterine artery embolisation.

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

Table 2. Techniques and complications of preoperative femoral sheath placement in placenta praevia (n = 70).*

Femoral sheath placement complication	1 (1.4%)
Haematoma	1 (1.4%)
Thrombosis	0
Infection	0
Techniques	
By palpation	17 (24.3%)
Under fluoroscopy	9 (12.9%)
By ultrasonic guidance	44 (62.9%)

* Data are shown as No. (%).

Unlike invasive coronary angiography in interventional cardiology,¹² to the best of our knowledge, femoral sheath placement in PP has not been previously studied. Femoral access can be technically difficult when circulation is compromised. Also, there is considerable variation in the anatomy of the femoral artery,¹³ and its pulse may be nonpalpable in pregnant women with physiological oedema. Therefore, it was postulated that elective femoral arterial access prior to the procedure could facilitate UAE and reduce vascular complications when UAE is eventually needed. In this study, most

of the femoral sheaths were inserted under ultrasonic guidance. Ultrasonic guidance is the preferred method by radiologists, with a success rate of 98.5% and reduced number of re-attempts.¹⁴ Fluoroscopy, although safe, is the least preferred method because of concerns with radiation.¹⁵

The majority of the femoral sheaths were not used and were removed 24 hours postoperatively. Haematoma formation occurred in one case (1.4%) with preoperative femoral sheath insertion. Significant local haematoma can occur in 2% to 3% of the femoral sheath procedures, but these figures were derived from non-obstetric studies.^{13,14} Thrombosis, potentiated by the inherent thrombogenic effect of pregnancy, was not observed in this study.

Other studies have shown that increased birth weight and greater gestational age were associated with more bleeding in major PP.^{16,17} The cases receiving the sheath electively delivered at a greater gestational age, which was associated with more blood loss. Increased blood loss should not be attributed to the femoral sheath alone, as shown by multivariate analysis, which found that the

Table 3. Multiple regression analyses performed on outcome variables.

Factor	Coefficient level estimate	p Value	Odds ratio	95% Confidence interval
Estimated intraoperative blood loss	683.5	0.583	-	-19.8 to 517.97
Blood transfusion	0.21	0.28	1.23	0.85-1.79
Operative duration	4.39	0.144	-	1.52-10.30
Additional uterotonics	1.69	0.013	5.44	1.53-23.01
Additional procedures	0.12	0.84	1.13	0.35-3.71

femoral sheath is not associated with poorer outcome. The need for additional uterotonics was found in the cases receiving the sheath electively, however.

A large proportion of emergency Caesarean sections were performed without elective femoral sheath placement, because transport to the radiology department can be time-consuming and the radiologist may not be available. When UAE was needed in this group of women, the femoral access was uncomplicated, further arguing against the need for routine placement.

Limitations

Potential limitations of this study are due to its retrospective nature. Intraoperative blood loss was estimated since calibrated drapes and weighing of gauzes were not introduced yet at the time of this study. Long-term complications such as femoral artery aneurysm or arteriovenous fistula were not documented. In addition, explicit criteria were not applied when deciding which patients should receive a femoral sheath prior to delivery. This study also did not examine the role of femoral sheath in the placenta accreta spectrum, a rarer but significant cause of intractable intraoperative blood loss.

CONCLUSION

This 10-year retrospective analysis, focusing on the use of elective femoral sheath placement in cases of PP undergoing Caesarean section, did not confirm its theoretical advantage of facilitating subsequent UAE due to low usage. Furthermore, it may expose patients to unnecessary risks and discomfort. Future research should prioritise investigating the prophylactic use of femoral sheath in cases where UAE is more likely to be employed, such as placenta accreta spectrum.

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