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ORIGINAL ARTICLE

Outcomes of Uterine Artery Ligation Versus Internal Iliac Artery Ligation in Controlling Intractable Postpartum Hemorrhage

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ABSTRACT

Background: Postpartum hemorrhage (PPH) remains a leading cause of maternal morbidity and mortality worldwide, particularly in low-resource settings.

Objective: To compare the outcomes of uterine artery ligation and internal iliac artery ligation in controlling intractable postpartum hemorrhage for surgical effectiveness, operative parameters, and complication rates.

Methodology: This was a retrospective comparative study conducted at Department of Obstetrics and Gynaecology, Saidu Group of Teaching Hospitals, Swat, and Sahiwal Teaching Hospital, Sahiwal from December 2022 to May 2023. A total of 109 patients diagnosed with intractable postpartum hemorrhage unresponsive to medical management were included in the study. Patients were retrospectively categorized into two groups based on the surgical intervention performed.

Results: UAL had a significantly shorter operative time (55 ± 12 vs. 80 ± 15 minutes; $p < 0.001$) and lower blood loss (950 ± 220 vs. 1200 ± 270 mL; $p = 0.001$). Hemorrhage was successfully controlled in 90.6% of UAL cases and 95.5% of IIAL cases ($p = 0.31$). Emergency hysterectomy was required in 6.3% of UAL and 4.4% of IIAL patients ($p = 0.69$). The rate of postoperative complications was higher in the IIAL group (20.0% vs. 12.5%), though not statistically significant. The average hospital stay was significantly shorter in the UAL group (4.2 ± 1.1 vs. 5.6 ± 1.3 days; $p = 0.003$).

Conclusion: Both uterine artery ligation and internal iliac artery ligation are effective in controlling intractable postpartum hemorrhage. UAL is associated with shorter operative time, reduced blood loss, fewer complications, and shorter hospital stay, making it a preferred first-line surgical option. IIAL remains valuable for refractory cases or when broader pelvic vascular control is needed.

Keywords: Postpartum hemorrhage, uterine artery ligation, internal iliac artery ligation, obstetric emergency, maternal morbidity.

INTRODUCTION

Postpartum hemorrhage (PPH) is a major global cause of maternal morbidity and mortality, particularly in low- and middle-income countries. It is defined as blood loss of more than 500 mL following vaginal delivery or more than 1000 mL after cesarean section[1]. Severe cases of PPH can escalate rapidly to hypovolemic shock, disseminated intravascular coagulation (DIC), multi-organ failure, or death if not promptly addressed. Despite advancements in obstetric care, PPH continues to account for approximately 27% of maternal deaths globally, with higher incidence rates reported in resource-constrained healthcare systems where timely access to emergency interventions is often limited[2]. Initial management of PPH involves conservative and medical measures such as uterotonic agents (e.g., oxytocin, misoprostol), uterine massage, bimanual compression, and intrauterine balloon tamponade[3]. While these measures are effective in the majority of cases, a subset of patients develop intractable PPH, defined as bleeding unresponsive to medical therapy. In these critical situations, surgical intervention becomes essential to control hemorrhage and prevent life-threatening complications[4].

Among the commonly used surgical interventions, uterine artery ligation (UAL) and internal iliac artery ligation (IIAL) are two procedures designed to reduce uterine perfusion and facilitate hemostasis. UAL is generally preferred as a first-line surgical option due to its relative technical simplicity, shorter operative time, and minimal anatomical dissection. It involves ligation of the ascending branches of the uterine arteries, thereby decreasing blood flow to the uterus and reducing bleeding in cases of uterine atony or localized haemorrhage[5]. It is commonly administered in the instances of cesarean sections and can be entailed in the operation without implying further exposures. Internal iliac artery ligation, on the other hand, is more complex and a more generalized procedure in that the objective is to decrease blood supply to the whole pelvis[6]. Through ligature of the anterior division of internal iliac arteries, the flow of blood can be decreased, which can be approximately 85 percent in the pelvic region, nearly halving the pulse pressure in the arteries and enabling hemostasis not only in the uterus but also in the surrounding structures of the pelvis. The method is very helpful in such situations where there is diffuse bleeding, coagulopathy, and even placental complications like the placenta accreta spectrum[7].

It is very common that the decision to perform uterine artery ligation or internal iliac artery ligation is to be made based on clinical expertise, surgical skill, the etiological cause of hemorrhage, and operative conditions. Although uterine artery ligation can be effective in most instances of uterine atony, it can hardly be effective in more difficult or unusual cases, so that the ligation of the internal iliac artery becomes necessary[8]. In contrast, the technical difficulty and higher risk of complications, including ureteric injury, pelvic hematoma, or venous laceration that accompany IIAL would explain why it is less frequently done despite its theoretically higher levels of effectiveness in some cases[9]. There have been multiple studies assessing the individual results of these procedures, but there is a lack of direct comparative results[10]. There is little evidence regarding other parameters like intraoperative loss of blood, achievement of hemostasis, reduction in hysterectomy, operating time, and other complications after surgery, including hospitalization, and effect on future fertility. Such ambiguity may result in the diversity of clinical practice and confusion in surgical judgement, especially in places with little training of obstetric surgery or poor infrastructure[11].

Objective: To compare the outcomes of uterine artery ligation and internal iliac artery ligation in controlling intractable postpartum hemorrhage for surgical effectiveness, operative parameters, and complication rates.

METHODOLOGY

This was a retrospective comparative study conducted at the Department of Obstetrics and Gynaecology, Saidu Group of

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Teaching Hospitals, Swat, and Sahiwal Teaching Hospital, Sahiwal from December 2022 to May 2023. A total of 109 patients diagnosed with intractable postpartum hemorrhage unresponsive to medical management were included in the study. Non-probability purposive sampling was used to select eligible patients from medical records.

Inclusion Criteria:

- Women aged 18–45 years
- Diagnosed with primary postpartum hemorrhage unresponsive to medical treatment
- Underwent either uterine artery ligation or internal iliac artery ligation
- Complete operative and postoperative records available

Exclusion Criteria:

- Patients with known coagulation disorders
- PPH due to genital tract trauma requiring repair
- Cases where both procedures (UAL + IIAL) were performed together
- Incomplete or missing data

Data Collection: Patients were retrospectively categorized into two groups based on the surgical intervention performed. Group A consisted of patients who underwent uterine artery ligation, while Group B included those who received internal iliac artery ligation as the primary surgical approach for hemorrhage control. Data were collected using a structured proforma developed specifically for the study. Variables included demographic details, parity, cause of hemorrhage, type of delivery, timing and type of surgery, estimated intraoperative blood loss, operative duration, postoperative complications (such as infection, fever, or injury to adjacent structures), need for additional interventions like hysterectomy, and total hospital stay. The primary outcome measure was the successful control of hemorrhage without the requirement for hysterectomy. Secondary outcomes included total estimated intraoperative blood loss, operative time in minutes, occurrence of intraoperative or postoperative complications, and length of hospital stay in days.

Data Analysis: All collected data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS), version 17. Continuous variables were assessed for normality and presented as mean with standard deviation or as median with interquartile range, depending on data distribution. Categorical variables were summarized using frequencies and percentages. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Data were collected from 109 patients, 64 were managed with uterine artery ligation (UAL) and 45 with internal iliac artery ligation (IIAL). The mean age was comparable between groups (30.5 ± 4.2 vs. 31.1 ± 3.9 years, p = 0.42). Most patients were multiparous—76.6% in UAL and 75.5% in IIAL (p = 0.88). Cesarean delivery rates were similar (59.4% vs. 57.8%, p = 0.87). However, IIAL was associated with significantly longer operative times (80 ± 15 vs. 55 ± 12 minutes, p < 0.001) and higher estimated blood loss (1200 ± 270 mL vs. 950 ± 220 mL, p = 0.001). Blood transfusion was more common in the IIAL group (73.3% vs. 60.9%), though the difference was not statistically significant (p = 0.08).

Table 1: Baseline Demographic and Clinical Characteristics of Patients (n = 109)

Variable	UAL Group (n = 64)	IIAL Group (n = 45)	p-value
Age (years), mean ± SD	30.5 ± 4.2	31.1 ± 3.9	0.42
Multiparity, n (%)	49 (76.6%)	34 (75.5%)	0.88
Cesarean delivery, n (%)	38 (59.4%)	26 (57.8%)	0.87
Intra-operative parameters			
Operative time (minutes), mean ± SD	55 ± 12	80 ± 15	<0.001
Estimated blood loss (mL), mean ± SD	950 ± 220	1200 ± 270	0.001
Blood transfusion required, n (%)	39 (60.9%)	33 (73.3%)	0.08

Hemorrhage control was successful in both groups, with slightly higher rates in IIAL (95.5%) compared to UAL (90.6%), though not statistically significant (p = 0.31). Emergency hysterectomy occurred in 6.3% of UAL and 4.4% of IIAL patients (p = 0.69). The mean hospital stay was significantly longer in the IIAL group (5.6 ± 1.3 days vs. 4.2 ± 1.1 days, p = 0.003).

Table 2: Hemorrhage Control and Surgical Outcomes

Variable	UAL Group (n = 64)	IIAL Group (n = 45)	p-value
Hemorrhage controlled, n (%)	58 (90.6%)	43 (95.5%)	0.31
Emergency hysterectomy, n (%)	4 (6.3%)	2 (4.4%)	0.69
Hospital stay (days), mean ± SD	4.2 ± 1.1	5.6 ± 1.3	0.003

Febrile morbidity occurred in 4.7% of UAL and 8.9% of IIAL patients (p = 0.45). Pelvic hematoma was seen in 3.1% vs. 6.7% (p = 0.39), wound infection in 3.1% vs. 2.2% (p = 0.79), and ureteric injury occurred in only one IIAL case (2.2%, p = 0.41). Overall complication rates were slightly higher in the IIAL group (20.0%) compared to UAL (12.5%), but the difference was not statistically significant (p = 0.26), suggesting comparable safety profiles for both procedures

Table 3: Postoperative Complications

Complication	UAL Group (n = 64)	IIAL Group (n = 45)	p-value
Febrile morbidity, n (%)	3 (4.7%)	4 (8.9%)	0.45
Pelvic hematoma, n (%)	2 (3.1%)	3 (6.7%)	0.39
Wound infection, n (%)	2 (3.1%)	1 (2.2%)	0.79
Ureteric injury, n (%)	0 (0.0%)	1 (2.2%)	0.41
Any complication, n (%)	8 (12.5%)	9 (20.0%)	0.26

DISCUSSION

This study compared the clinical outcomes of uterine artery ligation (UAL) and internal iliac artery ligation (IIAL) in the management of intractable postpartum hemorrhage (PPH), focusing on the effectiveness of hemorrhage control, operative metrics, and complication rates. The findings demonstrate that both procedures were effective in achieving hemostasis, with slightly higher success in the IIAL group; however, UAL was associated with shorter operative time, less blood loss, and fewer complications, making it a favorable first-line surgical option in many clinical scenarios[12]. The success rate of hemorrhage control without the need for hysterectomy was 90.6% in the UAL group and 95.5% in the IIAL group. While this difference was not statistically significant, it highlights the efficacy of both procedures in managing severe PPH. Previous research by Joshi et al. reported similar control rates for UAL, suggesting that it remains a viable option in most cases of uterine atony and localized bleeding[13]. IIAL, on the other hand, has traditionally been reserved for cases involving diffuse or uncontrollable hemorrhage, consistent with our observation of its slightly superior control rate[14]. Operative time was significantly longer in the IIAL group (80 ± 15 minutes) compared to the UAL group (55 ± 12 minutes), likely due to the anatomical complexity and technical demands of pelvic dissection required for internal iliac artery exposure. These findings are in line with earlier reports which emphasized that IIAL, while effective, is best performed by experienced surgeons with detailed knowledge of pelvic vasculature[15].

Despite the fact that the difference in transfusion requirement was not statistically significant, there was a tendency in the IIAL group to have a higher rate of transfusion. Such tendencies are also described by Chattopadhyay et al., indicating that the use of timely UAL can significantly decrease the requirements of massive transfusion protocols in obstetric hemorrhage. Regarding complications, the IIAL group had an increased risk of an overall complication rate (20.0% vs. 12.5%) and in isolated cases, ureteric injury and pelvic hematoma occurred[16]. Although this difference was not found to be

statistically significant, the elevated risk profile of IIAL reinstates the significance of surgical expertise[17]. There was no maternal mortality in either of the groups, and this stresses that both procedures can be safe when handled by trained obstetricians and done on time. The UAL group spent significantly fewer days (4.2k011.1) in the hospital before being discharged than the IIAL group[18]. This may have been because of fewer postoperative complications and surgical trauma in the former. This has significant consequences on the costs incurred and the bed occupancies, especially in high volume maternity units. This study did not determine long-term effects on reproductive outcome, but past research has exhibited good fertility preservation after UAL with negligible influence on menstrual or obstetric outcomes. IIAL, in general, is more comprehensive, and it can have increased risks on ischemic complications, but there is not enough data[19]. The direct comparison of two common surgical interventions in the active treatment of PPH, which is conducted in a real clinical environment, should be regarded as one of the strengths of this study. The study however has its limitations. Since it is always retrospective in nature, there will be selection bias and incomplete documentation of the same. It's fairly small sample size could have underpowered some of the options to find the significant differences in the outcomes. Moreover, when going through UAL or IIAL was determined at the discretion of the surgeon with clinical urgency this may have confounding factors.

CONCLUSION

It is concluded that both uterine artery ligation and internal iliac artery ligation are effective surgical techniques for controlling intractable postpartum hemorrhage. Uterine artery ligation offers the advantages of shorter operative time, lower estimated blood loss, fewer complications, and reduced hospital stay, making it a favorable first-line option, especially in settings with limited surgical expertise or time-sensitive emergencies. Internal iliac artery ligation, although technically more demanding, demonstrated a slightly higher hemorrhage control rate and remains a valuable alternative when uterine artery ligation fails or in cases involving diffuse pelvic bleeding.

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