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EFFICACY OF EMERGENCY INTERNAL ILIAC ARTERY LIGATION IN CONTROLLING POST PARTUM HEMORRHAGE

Pakeeza Afzal[*1], Nadia Arif[2], Anum Fareed[3], Maria Younas[4], Kanwal Noreen[5], Khadija Aslam[6]

[*1,2,3,4,5] *CMH Kharian*
[6]*Cantonment General Hospital Rawalpindi*

[*1]pakizagondal@yahoo.com

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Corresponding Author: *
Pakeeza Afzal

Abstract

Objective:
To evaluate the efficacy of emergency bilateral internal iliac artery ligation (BIIAL) in controlling severe postpartum hemorrhage (PPH) refractory to medical management.

Methods:
This prospective, single-center interventional case series enrolled 150 women with severe PPH over six months. All patients underwent emergency BIIAL after the failure of standard conservative measures. The primary outcome was successful control of hemorrhage without the need for further major surgical intervention (hysterectomy or embolization) within 24 hours.

Results:
*BIIAL successfully controlled hemorrhage in **142 of 150 patients**, yielding a **success rate of 94.7%**. In 8 cases (5.3%), the procedure failed, necessitating an emergency peripartum hysterectomy. The maternal mortality rate was 1.3%. Procedure-related complications occurred in 3.3% of cases. Subgroup analysis revealed no significant difference in success rates based on the mode of delivery (cesarean vs. vaginal) or the timing of the ligation. Multivariate analysis identified **placenta accreta spectrum** as a significant independent predictor of procedure failure (Adjusted Odds Ratio = 4.8; 95% CI: 1.2 - 19.5; p=0.03).*

Conclusion:
Emergency bilateral internal iliac artery ligation is a highly effective and fertility-preserving surgical intervention for controlling refractory postpartum hemorrhage, with a high success rate and an acceptable safety profile. It serves as a critical life-saving procedure, especially in settings where interventional radiology is unavailable.

INTRODUCTION

An estimated 303 000 maternal deaths occurred globally in 2015, yielding an overall MMR of 216 maternal deaths per 100 000 live births. Out of which, Nigeria and India account for over one third of all estimated global maternal deaths in 2015, with an approximate 58,000 maternal deaths (19%) and 45,000 maternal deaths (15%) respectively. [1] Obstetric pelvic haemorrhage remains to be the leading cause of maternal mortality and morbidity globally. [2] Although various modalities like medical management, compression suture, stepwise devascularisation and hysterectomy are available to manage, Internal iliac

artery ligation remains the choice for some condition like supralevator hematoma, torn retracted uterine vessels, refractory PPH and in pelvic haemorrhages where definitive bleeding point cannot be found. Howard Kelly first pioneered the internal iliac (hypogastric) artery ligation (IIAL) in the treatment of intraoperative bleeding from cervical cancer prior to this technique being applied to postpartum hemorrhage. [3] Bilateral internal iliac artery ligation (BIIAL) controls haemorrhage by abolishing the trip-hammer effect of arterial pulsations and reduces pelvic flow by 49%, pulse pressure by 85% resulting in venous pressures in the arterial circulation.[4] The reported success rate of IIAL in controlling pelvic haemorrhage varies from 42 to 100%, and it averts radical procedures like hysterectomy in substantial number of cases.[5] The success of IIAL in obstetric practice is further corroborated by a retrospective study conducted over 10 years, which involved 11 cases of severe obstetric and pelvic hemorrhage. The study found that IIAL was effective in 10 out of 11 cases, with only one patient requiring an emergency hysterectomy due to the failure of the procedure [6]. Moreover, the role of IIAL extends beyond obstetric cases to include severe pelvic hemorrhages resulting from gynecological surgeries. For example, Sivalingam and Rajesvaran reported a rare case of coital injury leading to life-threatening hemorrhage, which was successfully managed with bilateral internal iliac artery ligation [7]. Notably, studies have shown that IIAL does not adversely affect pelvic organ function or fertility, with patients successfully achieving pregnancies post-procedure [8,9].

Methodology

This was a prospective, single-center interventional case series conducted over six months to evaluate the efficacy of emergency internal iliac artery ligation (IIAL) for control of severe postpartum hemorrhage (PPH). Consecutive women who developed PPH unresponsive to standard medical management and required surgical haemorrhage control were enrolled until a total sample of 150 patients was reached.

Participants were women ≥18 years who experienced PPH (blood loss ≥1000 mL or hemodynamic instability) after vaginal delivery or cesarean section and in whom uterotonics, uterine massage, and conservative measures had failed. Exclusion criteria included known bleeding disorders, contraindication to surgery or anesthesia, retained placenta requiring specific removal procedures only, or refusal of consent when possible. In emergency cases where immediate intervention was required, consent followed institutional emergency-consent procedures.

All enrolled patients underwent bilateral internal iliac artery ligation performed by senior obstetric surgeons following a standardized operative protocol. Perioperative care (resuscitation, transfusion thresholds, use of uterotonics, and postoperative monitoring) followed institutional guidelines and was recorded. The primary outcome was successful control of haemorrhage, defined as cessation of active bleeding without need for further major surgical intervention (hysterectomy or pelvic arterial embolization) within 24 hours. Secondary outcomes included estimated intraoperative/postoperative blood loss, number of blood product units transfused, need for intensive care admission, procedure-related complications, length of hospital stay, and maternal mortality.

Data were collected prospectively on a standardized case report form and entered into a secure database. Continuous variables were summarized as mean ± standard deviation or median (IQR) as appropriate; categorical variables were presented as counts and percentages. The primary outcome proportion and its 95% confidence interval were reported. Comparisons between subgroups (e.g., vaginal vs cesarean PPH, timing of ligation relative to onset) used χ^2 or Fisher's exact test for categorical variables and t-test or Mann-Whitney U test for continuous variables. Logistic regression was used to explore independent predictors of failure to control bleeding, adjusting for clinically relevant covariates. A two-sided p-value <0.05 was considered statistically significant.

Ethical approval was obtained from the institutional review board prior to study commencement. Given the emergency setting, enrollment followed local emergency-consent policies; when feasible, written informed consent was obtained postoperatively for data collection. All patient identifiers were removed from the analytic dataset to preserve confidentiality.

Results

A total of 150 women with severe postpartum hemorrhage (PPH) refractory to medical management were enrolled and underwent emergency bilateral internal iliac artery ligation (BIIAL) during the six-month study period.

Primary Outcome: Efficacy of IIAL

The primary outcome—successful control of hemorrhage without the need for further major surgical intervention (hysterectomy or pelvic arterial embolization) within 24 hours—was achieved in **142 out of 150 patients**. This corresponds to a **success rate of 94.7%** (95% Confidence Interval [CI]: 89.9% - 97.5%). In 8 cases (5.3%), BIIAL failed to control the bleeding, necessitating an emergency peripartum hysterectomy.

Table 1: Primary and Secondary Outcomes of Internal Iliac Artery Ligation (N=150)

Outcome Measure	Result
Primary Outcome	
Successful Hemorrhage Control	142 (94.7%)
Failure (Required Hysterectomy)	8 (5.3%)
Secondary Outcomes	
Maternal Mortality	2 (1.3%)
Admission to Intensive Care Unit (ICU)	28 (18.7%)
Procedure-Related Complications*	5 (3.3%)
Clinical Metrics	
Estimated Intraoperative Blood Loss (mL), Mean (±SD)	1850 ± 450
Total Units of Blood Products Transfused, Median (IQR)	6 (4 - 8)
Postoperative Hospital Stay (days), Median (IQR)	5 (4 - 7)
*Complications included ureteric injury (n=1), common iliac vein laceration (n=1), and localized wound infection (n=3).	

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Subgroup Analysis

The efficacy of IIAL was analyzed across key patient subgroups. The success rate was not significantly different between women who delivered via cesarean section and those who delivered vaginally (p=0.42). Furthermore, the timing of the ligation (as a primary procedure versus after failure of other surgical measures like compression sutures) did not show a statistically significant impact on the likelihood of success (p=0.61).

Table 2: Success Rate of IIAL by Patient and Procedure Characteristics

Characteristic	Subgroup	Number of Patients (n)	Success Rate, n (%)	p-value
Mode of Delivery	Cesarean Section	98	94 (95.9%)	0.42
	Vaginal Delivery	52	48 (92.3%)	
Timing of Ligation	Primary Procedure	112	107 (95.5%)	0.61
	After Other Failed Surgical Measures	38	35 (92.1%)	
Placental Status	No Abnormality	118	113 (95.8%)	0.27
	Placenta Previa/Accreta	32	29 (90.6%)	

Predictors of Procedure Failure

A multivariate logistic regression analysis was performed to identify independent predictors for the failure of IIAL to control hemorrhage. After adjusting for clinically relevant covariates such as maternal age, parity, and preoperative hemodynamic status, the presence of **placenta accreta spectrum** was identified as a significant independent predictor of failure (Adjusted Odds Ratio [aOR] = 4.8; 95% CI: 1.2 - 19.5; p=0.03).

Table 3: Multivariate Logistic Regression Analysis of Predictors for IIAL Failure

Predictor Variable	Adjusted Odds Ratio (aOR)	95% Confidence Interval	p-value
Placenta Accreta Spectrum	4.8	1.2 - 19.5	**0.03**
Preoperative Shock Index >0.9	2.5	0.6 - 10.1	0.19
Coagulopathy at Time of Surgery	3.1	0.7 - 13.8	0.14
Multiparity (≥3)	1.4	0.3 - 5.9	0.65

Discussion:

Emergency internal iliac artery ligation (IIAL) has proven to be a highly effective, fertility-preserving, and life-saving surgical procedure for managing refractory postpartum hemorrhage (PPH), particularly in cases where conservative measures such as uterotonics and uterine compression sutures fail. The success rate observed in our study (94.7%) underscores the reliability of IIAL as a critical intervention for achieving hemostasis while preserving reproductive potential. This aligns with previous evidence supporting IIAL as an essential skill for obstetric surgeons to reduce maternal morbidity and mortality, especially in resource-limited settings where interventional radiology may not be readily available.[10]

Our findings demonstrated an overall success rate of 94.7%, a hysterectomy rate of 5.3%, and a low complication rate of 3.3%, with a median hospital stay of 5 days. These outcomes are consistent with prior studies that reported similar maternal survival rates, comparable efficacy in hemorrhage control, and a strong trend toward uterine preservation. A comparative analysis showed that hemorrhage control was achieved in 95.5% of patients, hysterectomy was required in 4.4%, and the complication profile was minimal—findings that are in close agreement with our results, thereby reinforcing the efficacy and safety of IIAL [11].

Furthermore, our success rate was notably higher yet in accordance with a previous report that documented uterine salvagability in 62% of cases, confirming the effectiveness of IIAL in controlling life-threatening PPH. The superior success observed in our cohort suggests potential benefits from surgical expertise, timely intervention, and improved perioperative management, which could explain the markedly greater efficacy observed in our series [12].

Overall, our findings corroborate the results of several comparative studies that emphasize the role of bilateral internal iliac artery ligation as a safe and reliable measure to control intractable postpartum hemorrhage. The high hemostatic success rate, minimal complications, and low mortality observed across studies highlight IIAL's clinical value as both a life-saving and fertility-preserving option in modern obstetric practice [13,14]. Continued surgical training and awareness of this technique are therefore crucial to enhancing maternal outcomes and preventing avoidable deaths due to postpartum hemorrhage.

Conclusion:

Based on the findings of this prospective study, emergency bilateral internal iliac artery ligation (BIIAL) proves to be a highly effective and reliable fertility-preserving surgical intervention for controlling refractory postpartum hemorrhage, demonstrating a 94.7% success rate in achieving hemostasis and avoiding hysterectomy. With a low associated complication rate and minimal maternal mortality, BIIAL serves as a critical life-saving procedure, particularly in settings where interventional radiology is unavailable, underscoring the importance of its continued inclusion in surgical

training to improve maternal outcomes in severe PPH cases.

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