

## Original Research Article

# Stepwise uterine devascularisation and/or internal iliac artery ligation: an alternative to obstetric hysterectomy in the management of intractable postpartum haemorrhage

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## ABSTRACT

**Background:** Objectives of the study was to estimate the effectiveness and safety of stepwise uterine devascularisation and/or internal iliac artery ligation as alternative to obstetric hysterectomy in the management of uncontrollable postpartum haemorrhage.

**Methods:** We conducted a retrospective cohort study at a university affiliated tertiary obstetric referral hospital in the year 2020-2021 at the department of obstetrics and gynaecology, government medical college, Amritsar. Stepwise uterine devascularisation and/or hypogastric artery ligation were performed in 35 of the 335 patients (10.45%) who had intractable postpartum haemorrhage after caesarean deliveries not responding to classic management. This technique entails 'three' successive procedures of bilateral vascular ligations performed in step-by-step fashion until bleeding stops. The steps were as follows: (1) Bilateral uterine artery ligation. (2) If bleeding did not stop, bilateral ovarian artery ligation was performed. (3) Additionally, bilateral ligation of the anterior division of internal iliac artery was done in a few cases in which bleeding failed to stop. After each procedure, assessment of bleeding was done before proceeding to the next step.

**Results:** Of the 35 women who were primarily treated with stepwise uterine devascularisation, the success rate to preserve the uterus was 100%. None of the patients required hysterectomy. The postpartum period was uneventful. There were no complications and the survival rate was 100%. Among the patients followed up, normal menstruation and pregnancy occurred.

**Conclusions:** Stepwise uterine devascularisation is an effective and safe alternative to hysterectomy for management of intractable postpartum haemorrhage.

**Keywords:** Postpartum haemorrhage, Stepwise devascularisation, Internal iliac Artery ligation

## INTRODUCTION

Obstetric haemorrhage, especially postpartum haemorrhage (PPH), is an important cause of maternal morbidity and mortality throughout the world.<sup>1-3</sup> PPH is defined as cumulative blood loss of about 1000 ml or more, or bleeding leading to clinical features of hypovolaemia within 24 hrs of birth regardless of delivery route.<sup>4</sup> In 2015, an estimated 8.7 million

pregnancies were complicated by obstetric haemorrhage worldwide. The WHO systematic analysis accounted for 27.1% maternal deaths due to PPH during 2003-2009, amounting to about 480000 deaths, equivalent to eight deaths every hour.<sup>3</sup> Overall the estimated prevalence was 10.8% with a wide regional variation ranging from 7.2% to 25.7%. Uterine atony is the most common cause of PPH and accounts for 80% of the cases. Other causes include lower genital tract laceration, placenta praevia,

abruption placenta, uterine rupture, retained placental bits and obstetric coagulopathy.

Key to management of PPH is early recognition of its cause, immediate control of the bleeding source by medical, mechanical, invasive-non-surgical and surgical procedures, rapid stabilization of the mother's condition, and a multidisciplinary approach. Most women with PPH are treated by manual exploration of the uterus, fundal uterine massage and use of uterotonic agents such as oxytocin or/and prostaglandin analogues. When these noninvasive first line measures fail to arrest bleeding and PPH continues, other treatments required. These include repair of genital tract trauma, evacuating retained placental bits, uterine balloon tamponade, uterine compression sutures, stepwise pelvic devascularisation and/or ligation of anterior division of internal artery, radiological embolization of pelvic arteries (uterine, ovarian/internal iliac arteries) and subtotal/ total hysterectomy. However, conservative management such as stepwise uterine devascularisation and/ or internal iliac artery ligation, selective pelvic arterial embolization, prostaglandin/ methotrexate administration, and argon-beam coagulation are very effective alternatives to haemostatic hysterectomy.<sup>6-9</sup> Procedures don't seem to impair subsequent fertility and pregnancy outcomes.<sup>10</sup>

## METHODS

The study was conducted from January 2020 to December 2021 at Bebe Nanki mother and child care centre (BNMCCC), department of obstetrics and gynaecology, government medical college, Amritsar which is a tertiary obstetric referral hospital. We retrospectively analyzed all cases of stepwise pelvic arterial ligation for postpartum haemorrhage performed in the department. A total of 6276 deliveries occurred in the department during this period with 2936 babies getting delivered by caesarean section. Primary postpartum haemorrhage was reported in about 335 patients on whom caesarean section was performed. First line management of PPH included uterotonic medications (IM/IV oxytocin, IM carboprost or IV carbetocin), uterine massage and bimanual uterine compression. The failure of this first line of treatment prompted the selection of second line interventions surgically by stepwise uterine devascularisation and/or hypogastric artery ligation. This was performed in the study group of 35 patients.

Because of the emergent nature of PPH, a chart review was the only feasible research design. The following relevant data were recorded: maternal characteristics such as age, parity, previous caesarean delivery, events of previous delivery, previous history of curettage, history of prior PPH, ultrasonographic findings, gestational age at delivery, associated maternal complications and mode of delivery. We also recorded the following data: causes and extent of postpartum haemorrhage, volume of blood transfusion, shock index (heart rate/systolic blood pressure), details and outcome of surgical intervention,

perioperative and postpartum complications, length of hospital stay, whether admission to the HDU/ICU was essential for close monitoring and maternal death if any.

All surgical interventions were performed within the first 24 hrs in the study group of 35 patients. The inclusion criteria of my study included women who delivered by caesarean section and had primary PPH due to uterine atony, placenta praevia, abruptio placenta and uterine rupture. All women who delivered vaginally and had PPH were excluded from the study. Among the patients who delivered by caesarean section, the exclusion criteria were women with primary PPH who were treated with haemostatic sutures, women with primary PPH who responded to medical management alone and all cases with morbid adhesions of the placenta. Incidentally, no woman with vaginal delivery with primary PPH in the study period needed surgical intervention by laparotomy to control the bleeding. There were no other exclusion criteria.

Stepwise uterine devascularisation was performed following the protocol of 'three' successive procedures of vascular ligations done in step-by-step fashion until bleeding stops. The steps were (1) bilateral uterine artery ligation. (2) If bleeding does not stop, followed by bilateral ovarian artery ligation. (3) Additionally, bilateral ligation of the anterior division of internal iliac artery in a few cases where bleeding fails to stop. After each procedure, assessment of bleeding was done before proceeding to the next step.

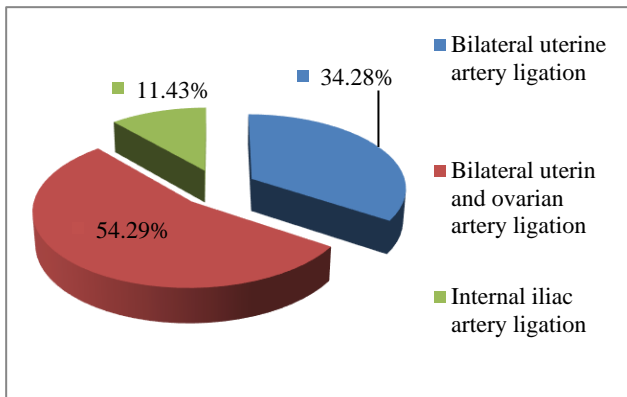
## RESULTS

During the two-year study period, there were a total of 6276 deliveries out of which 3340 delivered vaginally and 2936 babies were delivered by caesarean section in our tertiary centre. Primary PPH occurred in 244 (7.30%) cases of vaginal delivery and 335 (11.41%) cases of caesarean section.

The median age of the study group was 28 years and 20 (57.14%) of the women were primiparous. Fifteen women (42.86%) had multiple pregnancies. Our study group included all patients (100%) who were delivered by caesarean section. The most frequent indication for caesarean section was the presence of uterine scar (22.86%) and placenta praevia (22.86%). The most common primary cause of PPH was uterine atony (74.29%) followed by placenta praevia (14.29%).

Regarding the incidence of vascular ligations during the stepwise uterine devascularisation, 12(34.28%) women had bilateral uterine ligation. In 19 (54.29%) patients, bilateral uterine ligation was followed by bilateral ovarian artery ligation. Four (11.43%) patients needed additional internal iliac artery ligation (anterior division) which was necessary to control persistent haemorrhage despite bilateral ovarian and uterine arterial ligation procedure. Ultrasonographic Doppler evaluation was performed on the third postoperative day in all these four

patients. Normal flow velocity waveforms in both the femoral arteries was thereafter reported.



**Figure 1: The type of vascular ligation done in the management of intractable postpartum haemorrhage.**

**Table 1: The demographic and obstetric data of the study group, (n=35).**

Characteristics	N (%)
<b>Age (Years)</b>	
<20	2 (5.71)
20-25	14 (40)
26-30	16 (45.72)
>30	3 (8.57)
<b>Parity</b>	
Primigravida	20 (57.14)
Multigravida	15 (42.86)
History of prior PPH	8 (22.86)
Mean body mass index (kg/m <sup>2</sup> )	23.4±5.1 (21-32)
<b>Gestational age at delivery (weeks)</b>	
<32	2 (5.71)
32-36	8 (22.86)
36-38	12 (34.29)
>38	13 (37.14)
<b>Mode of caesarean delivery</b>	
Elective caesarean delivery	9 (25.71)
Emergency caesarean delivery	26 (74.29)
<b>Indications for caesarean delivery</b>	
Presence of uterine scar	8 (22.86)
Placenta praevia	8 (22.86)
Arrest of labour	8 (22.86)
Non reassuring foetal status	3 (8.57)
Multiple pregnancy	4 (11.43)
Placental abruption	2 (5.71)
Others	2 (5.71)
<b>Primary cause of PPH</b>	
Uterine atony	26 (74.29)
Placenta praevia	5 (14.29)
Uterine rupture	3 (8.57)
Placental abruption	1 (2.86)

**Table 2: Details of surgical management, estimated blood loss, transfusion of blood products and maternal outcome in the study of stepwise pelvic devascularisation and/or internal iliac artery ligation, (n=35).**

Characteristics	Descriptive statistics, n (%)
<b>Estimated blood loss (L)</b>	
<2	14 (40)
2-3	17 (48.57)
>3	4 (11.43)
<b>Mean packed red cell (units)</b>	3.1±2.5 (1-6)*
<b>Mean FFP (units)</b>	5.2±4.1 (0-12)*
<b>Platelet (units)</b>	2.2±1.4 (0-6)*
<b>DIC</b>	1 (2.86)
<b>Admission to HDU/ICU</b>	29 (82.86)
<b>Days in ICU</b>	4.1±4.5 (1-10)*
<b>Duration of hospital stay</b>	10±3.5 (8-13)
<b>Shock index (heart rate/SBP)</b>	1.51±0.35 (1.0-2.19)*
<b>SBP (Systolic blood pressure)</b>	76.1±7.2
<b>Relaparotomy/ subsequent hysterectomy</b>	0
<b>Near miss mortality</b>	0
<b>Maternal heath</b>	0

Data are presented as (%) or \*means ± SD (min-max); DIC-Disseminated intravascular coagulation; SBP-Systolic blood pressure

After definitive control of bleeding with internal iliac artery ligation, no woman required hysterectomy or relaparotomy in the postoperative period. In our cases, there were no internal iliac vein lacerations, ligation of the external iliac arteries, ureteral injuries, bladder and bowel ischaemia and buttock claudication and necrosis. The average estimated blood loss was 1250 ml. All patients required blood transfusion primarily to compensate the blood loss due to PPH and not necessarily due to the surgical procedure itself. Sixteen patients required more than two units of blood.

The 18 (51.43%) women followed up for at least one year and were subsequently lost to further follow up. Menstruation occurred 45 to 60 days after surgery in 10 (28.57%) women who didn't breast feed. In 8 (22.86%) women who breastfed, it resumed after 60-90 days of surgery. In majority of the women, the duration and amount of bleeding was normal. These women did not want another pregnancy in the one year they came for follow up. Later, they did not turn up for systemic follow-up for fertility results after IIA ligation.

**DISCUSSION**

Postpartum haemorrhage is one of the most commonly encountered and ominous obstetric emergencies requiring immediate control of the bleeding source by medical,

mechanical, invasive-non-surgical and surgical procedures to minimize the maternal morbidity and mortality. PPH can cause maternal death due to a delay in performing surgical intervention once conservative measures have failed. In the present study, stepwise uterine devascularisation and/or IIA ligation was performed as a lifesaving procedure in cases of severe intractable PPH due to uterine atony, placenta praevia and uterine rupture. In our experience, stepwise uterine devascularisation may represent the first line procedure to control severe intractable PPH despite use of uterotonic agents like oxytocin, carbetocin and prostaglandin perfusion during a caesarean section. In a study by AbdRabbo,<sup>8</sup> the technique was effective in 100% cases as he performed stepwise uterine devascularisation rather than only single arterial ligation. Similarly, our study showed 100% success as we followed stepwise uterine devascularisation with IIAL in four cases of persistent haemorrhage in spite of bilateral uterine and ovarian artery ligation.

O'Leary et al reported the bilateral ligation of the uterine arteries in a large series of 265 cases to be highly successful especially in the absence of abnormal placentation and afibrinogenemia.<sup>10</sup> Ledee et al in a series of 61 cases of obstetric intractable postpartum haemorrhage, reported that the time between delivery and surgery appears to be the main prognostic factor. Bilateral uterine and/or ovarian arterial ligation is a useful procedure for uterine conservation in patients with uterine atony or placenta praevia.<sup>11</sup> In pathologic hypervascularized conditions like major degree placenta praevia, the ovarian artery is frequently involved in persistent haemorrhage. Each ovarian artery usually anastomoses with the corresponding terminal branches of the uterine artery and may contribute to persistent, uncontrollable haemorrhage despite bilateral uterine ligation. Hence, multiple bilateral arterial ligation and/or IIAL obtains an optimal uterine devascularisation and control of PPH.

Yildirim et al reported 90% success rate of IIA ligation for intractable PPH. Studies by Clark et al, Shreshta et al, Selcuk and Das et al showed almost 100% success rate in hypogastric artery ligation which is in concordance with our studies were also it was 100% in all cases of IIA ligation in intractable PPH following stepwise uterine devascularisation.<sup>13-17</sup> In complete placenta praevia, the placental site also gets blood flow from the descending cervical branch of the uterine artery and the vaginal artery. Hence, stepwise uterine devascularisation alone does not control bleeding in this region as well as that IIA ligation considerably diminishes the blood flow in these vessels.<sup>10</sup>

Selective arterial embolization is an alternative method used to manage PPH. Hansch et al reported a higher success rate with selective embolization of the uterine arteries as compared to IIA ligation.<sup>19</sup> However, such a procedure requires a haemodynamically stable patient

which may not be there in cases of intractable PPH, and the availability of trained personnel and resources which are not there in our centre also. However, complications like uterine and bladder necrosis are known after uterine artery embolization for postpartum haemorrhage.<sup>20,21</sup>

Complications of IIA ligation like buttock claudication and necrosis, ischaemia of the bladder and bowel are commonly related to ligation proximal to the posterior division branch. However, Bleich et al reported a significant decrease in these complications by a careful study of the IIA anatomy and ligating the IIA at least 4-5 cm beyond the bifurcation of the common iliac arteries.<sup>22</sup> In our series, there were no intraoperative and postoperative complications related to the IIA ligation.

Nizard et al reported normal pregnancy outcomes in his follow up study of patients with IIA ligation for intractable postpartum haemorrhage.<sup>23</sup> None of his patients suffered infertility and pregnancy was achieved in less than twelve months once planned. In our study, there is no significant data to suggest that subsequent fertility and pregnancy is altered following stepwise uterine devascularisation and/or hypogastric artery ligation as the patients did not turn up for follow up after one year.

## CONCLUSION

From the results of our study and review of literature, it can be safely concluded that stepwise devascularisation and/or IIA ligation may be the first line procedure among the spectrum of operative procedures adopted to control life threatening intractable postpartum haemorrhage as it is lifesaving, safe and a fertility preserving procedure. It does not result in complete blockage but causes significant decrease in blood supply to the female pelvic organs which is very effective to control the bleeding. It is a reliable and effective alternative to haemostatic hysterectomy. This safe and effective procedure should be taught during obstetric and gynaecologic training.

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