



Blood, Sweat & Tears - Internal Artery Ligation – Life Saving Procedure

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Abstract

Hemorrhage in any surgical case can play havoc and can be life threatening. Especially in women, surgical procedures in pelvic area involve close proximity to various major vessels. Pelvic hemorrhage is potentially lethal complication in either obstetrics or gynecological surgeries. Obstetric hemorrhage remains the leading cause of maternal mortality worldwide with an estimated global maternal mortality ratio of 211 deaths per 100,000 live births. In gynecological cases to the torrential bleed can prove devastating.

One of the effective methods of controlling severe pelvic hemorrhage is ligation of hypogastric or internal iliac arteries (BIIAL) as it is the major blood supply to the pelvic viscera. This article emphasis the indications routes, potential benefits and risks BIIAL. This review article will hopefully instigate young obstetricians to master this life saving technique in their formative years.

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Introduction

A 28 years G3 P1L1A1 with previous lower segment caesarean section done 2 years back and previous evacuation done for missed abortion having placenta previa (anterior) came with pain lower abdomen with bleeding in emergency and was taken up for LSCS in the operation theater with a team of obstetrician, anesthetist, assistants and all staff. The caesarean section revealed thinning of myometrium overlying the placenta. After the delivery of a live baby what followed was torrential hemorrhage from the site of placental bed with uterus becoming flabby as a bag. The next thirty minutes were probably the longest

and worst for the team as they found themselves in an escalating nightmare. The whole abdomen was full of blood, patient sinking, the sight was grim with suction being done to clear and search the bleeder. The patient's tachycardia and falling blood pressure and plummeting saturation was making the scenario grim in the operating room. The blood components were being given and more arranged to no relief. An atonic uterus with placenta accrete profuse bleed – Obstetricians nightmare! Saving the situation was an experienced Obstetrician who performed internal artery ligation before the situation could turn from bad to worse.

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Hemorrhage in any surgical case is a nightmare increasing to stress of surgical team, anesthetist and every member of operative team. In women, surgical procedures involving the pelvic area involve close proximity to various major vessels. Pelvic hemorrhage is potentially lethal complication in either obstetrics or gynecological surgeries. Obstetric hemorrhage remains the leading cause of maternal mortality worldwide with an estimated global maternal mortality ratio being 211 per of 100,000 live births [1]. In gynecological cases also the torrential bleed can prove devastating.

One of the effective methods of controlling severe pelvic hemorrhage is ligation of both hypogastric and internal iliac arteries (BIIAL) as it is the major blood supply to the pelvic viscera. The role of IIA to control intractable pelvic hemorrhage was described in 1893 by Sir Kelly [2] for a case of cervical carcinoma. The procedure was later introduced by Mengert et al in 1969 and extensively investigated by Burchell [3] in 1968. Subsequently it was used as a life saving procedure during peripartum bleeding [4,5]. In selected cases, ligation of IIA became an option during intraperitoneal bleeding where the exact location could not be ascertained [6]. This was done with the knowledge that Internal Iliac Artery (IIA) is the main blood supply of the pelvic viscera. Studies have shown that bilateral ligation of internal artery reduces the pelvic arterial blood flow by 49 % and pulse pressure by 85 % performed during massive pelvic hemorrhage or peripartum bleed [3].

Anatomical considerations

The pelvic vasculature is designed by nature to create ample collateral circulation [7]. The common iliac artery bifurcates into two main branches – the external artery and the internal iliac or hypogastric artery. The level of bifurcation of common iliac artery is constant with easily identifiable guides – the sacral promontory and a line drawn between both anterior superior iliac spines, serves as an important landmark.

The internal iliac artery divides into the anterior and posterior branches. (Table -1).

Table 1: Branches of internal iliac artery.

Iliolumbar artery	Posterior division of internal iliac artery
Lateral sacral artery	Posterior division of internal iliac artery
Superior gluteal artery	Posterior division of internal iliac artery
Inferior gluteal artery	Anterior division of internal iliac artery
Internal pudendal artery	Anterior division of internal iliac artery
Inferior vesicle artery	Anterior division of internal iliac artery
Middle rectal artery	Anterior division of internal iliac artery
Vaginal artery	Anterior division of internal iliac artery
Obturator artery	Anterior division of internal iliac artery
Umbilical artery	Anterior division of internal iliac artery
Uterine artery	Anterior division of internal iliac artery

The important anatomical relations of the internal iliac (Hypogastric) artery include –

- 1) Anterior medial – covered by peritoneum (Internal iliac is entirely extraperitoneal)
- 2) Anterior – the ureter (retroperitoneal and attached to the peritoneum)

- 3) Posterolateral – External iliac vein and Obturator nerve
- 4) Posteromedial – Internal iliac vein
- 5) Lateral – the psoas major and minor muscles.

Indications for internal artery ligation

Active Life threatening hemorrhage

- Intraperitoneal hemorrhage in the immediate postoperative period following loss of ligature around the uterine artery or severed artery retracted in a hematoma.
- Conisation of cervix – Postoperative infection or failure to the use of lateral hemostatic sutures
- Laceration of cervix, lower uterine segment and upper vagina
- Uterine atony especially involving the lower uterine segment which fails to retract.
- Placenta Previa
- Rupture of Uterus
- Advanced endometrial Carcinoma
- Late Stage carcinoma of Cervix
- Hemorrhage from vaginal angles during or after vaginal hysterectomy
- Vault bleeding after vaginal hysterectomy
- Placenta Accreta
- Abdominal Pregnancy with placental implantation in broad ligament
- Fracture pelvis, gunshot wounds, spontaneous rupture of pelvic veins associated with pregnancy.

Prophylactic – intervention indicated to save time and provide relatively dry field for surgery

- Abruptio Placentae with atony or Couvelaire uterus
- Intraligamentous pregnancy
- Intraligamentous Myoma
- Pelvic inflammatory Diseases
- Extensive endometriosis
- Wertheim’s Hysterectomy
- Multiple Myoma
- Bleeding , necrotic rectovaginal fistula
- Myomectomy

Therapeutic ligation may become necessary

- Before or after hysterectomy for postpartum hemorrhage
- Where bleeding continues from the base of the broad ligament
- Where there is bleeding from the pelvic sidewalls
- Where there is bleeding from the angle of the vagina
- Where areas of diffuse bleeding are present without a

clearly identifiable vascular bed

- In case of rupture uterus in which the uterine artery may be torn at the site of its origin from the internal iliac artery
- Atony of uterus where other methods have failed
- Where extensive lacerations of cervix have occurred following instrumental delivery
- Where there is significant bleeding from the lower part of broad ligament, in such circumstances, hysterectomy alone may not be sufficient to control the hemorrhage. Internal iliac artery ligation may be the necessary step and should not be delayed in such life threatening situations.

Surgical technique

- Midline or transverse abdominal incision with adequate exposure
- Transverse incision preferred in obese patients
- Routes – Transabdominal & Extraperitoneal

Transabdominal Approach

A longitudinal incision is made into posterior parietal peritoneum. If the uterus is present, this incision can be started in the peritoneum on the posterior surface of the round ligament, at the junction of the middle and medial thirds. The incision is extended proximally for about 10 cm. If the uterus is absent, the incision can be started over the external iliac artery and carried proximally to the level of bifurcation. The incision is extended distally resulting in formation of a medial and lateral peritoneal flap. The ureter is beneath the medial flap which is protected and reflected. The ureter normally crosses the common iliac artery from lateral to medial at a point just proximal to the bifurcation. The loose areolar tissue over the iliacs is separated by blunt dissection in the direction of the vessels. The bifurcation looks like an inverted Y. The branch coming off at right angle is the internal iliac artery. It courses medially and inferiorly. The continuing branch is the external iliac artery. It goes laterally and superiorly over the psoas muscle to the leg and becomes the femoral artery.

The common and internal iliac arteries are often adherent to the underlying veins which can be difficult to see. This is the most hazardous part of the operation. Good retraction of the pelvic contents and displacement of the arteries are needed to visualize the veins. Meticulous dissection with scissors is required to separate the internal iliac vein from the artery if they are adherent. The plane between artery and vein once created, a right angle forceps or Mixer or the forceps designed by Reich and colleagues [7] are gently introduced between them. The internal iliac artery is ligated almost 1 inch below the bifurcation of the common iliac vessels to avoid ligating the posterior division of internal iliac. The right angle haemostat forceps is passed from lateral to medial side beneath the internal iliac artery and ligated with vicryl 1-0 delayed absorbable sutures. This prevents injury to external iliac vein. Before ligating, femoral pulse are palpated in order to be sure that only the internal iliacs have been ligated and avoid inadvertent ischaemia and gangrene to external iliac ligation.

Operative Complications during ligation of internal iliac Artery

- Injury to External iliac vein

- Injury to Internal iliac Vein
- Ligation or laceration of the external Iliac artery
- Injury to Internal Iliac artery
- Ligation or laceration of the Ureter

Discussion

Uterine Artery Ligation (UAL) is inadvertently an easy and promising technique in management of Post Partum Hemorrhage (PPH) as the occlusion of uterine artery reduces 90% of the blood flow. It is useful in uterine atony but in uterine trauma, when the avulsed uterine artery retracts into the broad ligament forming haematoma, it is difficult to do uterine artery ligation. Internal Artery Ligation (IIAL) in such situation is helpful as the pressure and the flow of circulation decreases distal to the ligation and facilitating the location of bleeder and ligate it securely.

Similarly in cases of deep forniceal tears and haematoma, uterine artery ligation or even hysterectomy does not stop the hemorrhage. In such cases, blood loss could be arrested after IAL as vaginal artery is the direct branch of anterior division of internal iliac artery [8]. In case of complete placenta previa, the placental site receives a significant proportion of the arterial supply from the descending cervical and vaginal arteries. These arteries continue to profusely bleed in the lower segment in spite of uterine artery ligation, which fails to control hemorrhage [9]. In these circumstances, Internal Iliac Ligation (IIAL) is more effective in diminishing blood flow in the uterine, cervical and the vaginal vessels.

Burchell [2] discussed the possible mechanism responsible for controlling pelvic hemorrhage following ligation of Internal Iliac artery without compromising blood supply. He observed that blood flowed freely from a severed uterine artery even after Bilateral Internal Iliac Artery Ligation (BIIAL). The ligation of internal iliacs greatly dampens the pulse pressure and transforms the pelvic arterial system into the venous like system with slow and sluggish blood flow. The "trip hammer effect" of the arterial pulsation is lost. In his study, he suggested that the blood clots, which were formed distal to ligation remained in place and allowed for identification of remaining individual bleeders for ligation, which would otherwise be difficult to tackle [10].

Burchell [2] also proved that with BIIAL, there is drop in the pulse pressure by 85% whereas with unilateral ligation it was 77% on the same side and 14% on the opposite site. The mean arterial pressure decreased to 24% with BIIAL and with unilateral ligation the decrease was 22% on the same side and 10% on the opposite site. The rate of blood flow dropped to about 48% on the same side after ligation.

Internal artery ligation alters the circulation pattern. The parts supplied by the internal iliac artery would be carried on by the anastomosis of (a) Uterine and Ovarian arteries; (b) the middle and the superior vesical arteries; (c) the Iliolumbar with the last Lumbar and (d) the Lateral Sacral with the Middle Sacral arteries. The deep femoral artery has been found to be the principal vascular supply to provide re-vascularization to the IIA. Anastomosis between the medial femoral circumflex and obturator artery, and the lateral femoral circumflex and superior gluteal artery are the main connection areas.

Another important aspect that needs to be highlighted is that most cases of IIAL are performed on young patients. IIAL

does preserve the uterus for future fertility which is major satisfaction for the young patient. However, studies have shown that the uterine and ovarian blood flow was not found to be compromised in patients with Internal Artery Ligation (IUAL). It also highlighted that IUAL did not have negative effect on ovarian reserve [11].

In a study, absorbable suture material like Vicryl was used and the recanalization rate of uterine artery was found to be high at 6 months after BIIAL. The reevaluation was done at 6 months after surgery because vicryl theoretically undergoes complete resorption within 6 months. The result is important for young women who require future pregnancies, because it is widely known that uterine blood flow is essential for promoting a receptive endometrium, embryo implantation, trophoblast invasion and successful pregnancy [12].

Pitfalls and failures

The major pitfall associated with ligation of the hypogastric artery is delay. When hemorrhagic shock is irreversible, this procedure may not overcome it. Inadequate transfusion is another pitfall in the therapy of patients with severe hemorrhage. Blood loss is often seriously underestimated. It is important to remember that pituitary necrosis (Sheehan's Syndrome) as a result of massive hemorrhage especially if the blood replacement has been delayed or inadequate can affect the ability to reproduce.

The ligation of Internal Iliac artery may occasionally fail to stem hemorrhage [12] on account of a) massive necrosis after infection with destruction of vessels; b) the presence of large, aberrant branches feeding blood to the area; c) dislodgement of clots when blood pressure rises; d) concomitant severe venous bleeding, although chances are rare.

The reported success rate of IUAL varies from 40 % to 100% [13] and procedure averts hysterectomy in only 50 % of cases [14].

Conclusion

Bilateral Internal Artery Ligation (BIIAL) is a life saving method which every pelvic surgeon and obstetrician should know to combat obstetric hemorrhage. It is effective, safe and fast method which requires proper training and experience to be used in obstetric practice. It hardly takes 5-7 minutes and is an efficient technique for preserving uterus and preserving fertility in young patients. Hence, exposure to this technique is a must for all obstetricians.

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