Circumferential vault excision and reconstruction: technical description of management of intractable secondary vault hemorrhage following hysterectomy in resource limited settings

Dipak Limbachiya M.D. , Mangirish Kenkre M.S. ,
Siddharth Shah M.S. , Rashmi Kumari M.S.

PII: S1553-4650(18)31320-7
DOI: https://doi.org/10.1016/j.jmig.2018.10.015
Reference: JMIG 3667

To appear in: *The Journal of Minimally Invasive Gynecology*

Received date: 8 September 2018
Revised date: 16 October 2018
Accepted date: 16 October 2018

TITLE PAGE

INSTRUMENTS AND TECHNIQUES

Circumferential vault excision and reconstruction: technical description of management of intractable secondary vault hemorrhage following hysterectomy in resource limited settings

Dipak Limbachiya M.D., Mangirish Kenkre M.S., Siddharth Shah M.S., Rashmi Kumari M.S.

From the Department Gynecological Endoscopy, Eva women's hospital, Neelkanth Park 2, Ghoda camp road, Shahibaug, Ahmedabad - 380004.

Corresponding author: Mangirish Kenkre M.S., Department Gynecological Endoscopy, Eva women's hospital, Neelkanth Park 2, Ghoda camp road, Shahibaug, Ahmedabad - 380004.

E-mail: mangirish.kenkre@gmail.com

Disclosure statement: The authors declare that they have no conflicts of interest and nothing to disclose.

Precis: Laparoscopic Management of intractable secondary vault hemorrhage following hysterectomy using circumferential vault excision and reconstruction.

Circumferential vault excision and reconstruction: technical description of management of intractable secondary vault hemorrhage following hysterectomy in resource limited settings

Abstract

Hemorrhage following gynecological surgery is an infrequent complication. It can be divided based on time of onset into primary and secondary. Secondary hemorrhage is a life threatening complication with a reported incidence of 0.17-0.45%. When the etiology cannot be ascertained and when the hemorrhage does not respond to conservative management it is aptly labeled as intractable hemorrhage. Numerous techniques have been employed in order to manage secondary hemorrhage including vaginal exploration and securing of the bleeding vessels, laparotomy and ligation of uterine and internal iliac arteries and transarterial embolisation of uterine or internal iliac vessels using interventional radiologic modalities. Circumferential vault excision and reconstruction is a methodical technique to effectively control this condition with a total laparoscopic route with systematic and easily replicable steps.

Introduction

Hemorrhage after hysterectomy is a grave complication which can be divided into reactionary and secondary hemorrhage based on the time of onset. Secondary hemorrhage usually follows due to a variety of causes including early resumption of sexual activity, infection, excessive use of thermal energy at primary surgery and improper vault closure technique. Incidence of secondary hemorrhage after hysterectomy ranges from 0.17 to 0.45%. When the etiology cannot be ascertained and when the hemorrhage does not respond to conservative management it is aptly labeled as intractable hemorrhage. It is may usually be due to sub acute infection of the vaginal vault. Secondary hemorrhage can be a warning sign of vaginal cuff dehiscence [1, 2, 3].

Numerous techniques have been employed in order to manage secondary hemorrhage including vaginal exploration and securing of the bleeding vessels, laparotomy and ligation of uterine and internal iliac arteries and transarterial embolisation of uterine or internal iliac vessels using interventional radiologic modalities.

However, due to unavailability of interventional radiologic facilities in developing countries and the excessive morbidities associated with laparotomic exploration the need for effective method to control intractable hemorrhage yet preserving the benefits of minimal invasive surgery arises. We describe a methodical technique to effectively control this condition with a laparoscopic route with systematic and easily replicable steps.

Materials and methods

A retrospective chart review was conducted at our institute and 4 cases of intractable secondary vault hemorrhage were noted from 2011 to 2018. Of these 4 patients, 3 patients were operated at another institute and were later referred to us and 1 patient was registered at our institute and had undergone primary surgery in our institute. All patients underwent total laparoscopic hysterectomy with or without bilateral salphingo-oophorectomy and the vault was primarily sutured with intracorporeal suturing technique. Table 1 provides the demographic and surgical details of the patients. One patient, who underwent primary surgery at our institute, had undergone total laparoscopic hysterectomy with opportunistic salpingectomy for abnormal uterine bleeding with fibroid uterus. The surgery was uneventful with primary energy source being bipolar for vessel sealing. The colpotomy was done using bipolar energy and scissors and vault was closed with continuous non locking polyglactin 910 suture materials. The remaining three patients had undergone a total laparoscopic hysterectomy at a private hospital for abnormal uterine bleeding and fibroid uterus respectively. Bipolar energy was used for vessel sealing and colpotomy was done with monopolar hook. Vault closure was done using continuous non locking polyglactin 910 suture materials. All patients received preoperative and postoperative antibiotics and were advised abstinence for a period of 3 months.

All four patients presented with bleeding per vaginum and reported to the hospital of their primary surgery. The clinical course of the patients at presentation is mentioned in table 2. 31-42 days were the average duration between primary surgery and development of secondary hemorrhage respectively. There were no clinical, hematological or microbiological findings of infection in either of the patients. None of the patients had vault dehiscence. There was no intraperitoneal free fluid or localized collection on radiological imaging. None of the patients reported with history of coitus. All patients were anemic (8.2-9 gm/dl) at admission yet were hemodynamically stable. All patients required transfusion of packed red cells to rectify the blood loss. Initially all patients were treated with intravenous anti-fibrinolytic agent and tight vaginal packing which was placed in situ for a duration of 24 -48 hours. One patient was explored vaginally and the vault was re-sutured vaginally by the referring surgeon. Despite the above measures, hemorrhage continued and decision was taken to explore the patients laparoscopically.

Under general anesthesia, patient (A) is placed in modified Lloyd Davis position at 30 degrees angle with the horizontal. Foleys catheter is inserted into urinary bladder. One primary 10mm port is placed 2cm above the upper border of the umbilicus and three ancillary 5mm ports are placed of which two are ipsilateral and one contralateral. It is a protocol at our institute to insert the primary port 2cm supra-umbilically unless the prior surgery has a vertical scar extending above the umbilicus in which case alternative entry points such as Palmers point may be chosen. Abdomen is insufflated with CO_2 gas and maintained at a pressure of 12-14mm Hg.

Step 1: Adhesiolysis

With the surgeon on the left side, atraumatic grasper and Harmonic Shear (Ethicon Endo-Surgery, Inc., Cincinnati, OH) is introduced through the two ipsilateral ports respectively. The assistant inserts a traumatic forceps via the contralateral port.

Adhesiolysis begins by grasping the epiploic appendage of the large bowel and putting it under traction while simultaneously cutting the adhesions between the anti-mesenteric border of the large bowel and vault and pelvic sidewall as in figure 1(a). On completion of adhesiolysis, the large bowel is then mobilized out of the pelvis and placed into the abdomen thereby facilitating the inspection of the vault.

The first step is variable as not all patients would present with pelvic adhesions. Hence, it can be omitted in cases where the vault is readily visible without any adhesions.

Step 2: Retro-peritoneal space dissection

In order to secure the ureter and identify the internal iliac artery we decided to dissect the retro peritoneal space of left side. Retro-peritoneal space dissection begins by putting the previously cut end of the round ligament under traction medially by using atraumatic grasper. Using Harmonic shear round ligament is divided laterally to allow the CO_2 gas to dissect within the areolar tissue of the retroperitoneal space as seen in figure 1(b).

Keeping the ureter under vision, peritoneum over the lateral border of the infundibulopelvic ligament is incised and the cut is extended in a cranial direction up to the pelvic brim. Lateral edge of the cut peritoneum is held by the assistant using traumatic grasper and retracted laterally while the entire infundibulopelvic ligament is gently held by the surgeon using the atraumatic forceps and gently pulled medially. Keeping the ureter under vision, the loose areolar tissue within this region is cut using Harmonic shear to expose the pararectal space as shown in figure 1(c). The pararectal space contains the internal iliac artery from which the uterine artery originates.

Step 3: Internal iliac artery clipping

To arrest pelvic hemorrhage, ligating the uterine artery is not sufficient as the hemorrhage may be due to the descending cervical artery or the vaginal artery. Hence to arrest the hemorrhage due to these vessels, internal iliac artery ligation is attempted.

Using the atraumatic grasper, the sheath of the left internal iliac artery is grasped and the internal iliac artery is skeletonised using the Harmonic shear. Skeletonisation is done to identify the anterior division of the internal iliac artery. The fibro fatty tissue overlying and surrounding the internal iliac artery is dissected off in a cranio-caudal direction up to the origin of the internal iliac artery from the common iliac artery. An entire segment of the internal iliac artery has to be visualized wherein its division into anterior and posterior branches can be appreciated.

The anterior division of the internal iliac artery is then clipped taking care to safely avoid the posterior division as depicted in figure 1(d).

The above steps are repeated on the opposite side and bilateral internal iliac artery clipping is completed. Steps 2 and 3 are essentially the method to ligate the anterior division of the internal iliac artery. If the operating surgeon is well versed with the technique of laparoscopic internal iliac artery ligation we do not object to any modifications in these steps, however for surgeons who are not routinely trained to access the retroperitoneal structures we strongly recommend implementing the above steps.

After 15 minutes, the vaginal pack is removed and per speculum examination is performed by the vaginal assistant using a Sim’s speculum. The vault is examined for active bleeding. In all our cases the bleeding continued and the vagina contained clots which were subsequently evacuated. Hence despite bilateral internal iliac artery clipping the hemorrhage continued. The vault was packed with gauze again and the procedure continued.

Step 4: Ureterolysis

In order to achieve a successful circumferential vault excision, it is mandatory to secure the safety of the ureter near the angle of the vaginal vault. Applying the principles of gynecologic oncologic surgery, the ureter is lateralized from its peritoneal attachments preserving its vascular adventitia intact.

Mesoureter is held under gentle traction by the surgeon using atraumatic grasper and the ureter is separated and lateralized by cutting its peritoneal attachment using the Harmonic shear. The dissection is proceeded in a cranio-caudal direction and the ureter is traced from its medial surface up to its entire length up to the tunnel of Wertheim as shown in figure 2(a).

This step is repeated on the opposite side.

Step 5: Rectovaginal space dissection

Keeping the rectum under traction using bowel grasper, the peritoneum in the pouch of Douglas is incised using the Harmonic shear. The areolar tissue within this space is cut and to expose the posterior vaginal wall as seen in figure 2(b). The cut is extended laterally up to bilateral uterosacral ligaments to detach their apical suspensory effects over the vaginal vault.

Step 6: Transverse incision over the apex of the vault.

The gauze pack is removed by the vaginal assistant and the vaginal probe is introduced. This helps to delineate the reflection of the bladder peritoneum. Using the active blade of the Harmonic shear, a transverse incision is placed over the vault which extends from the left to the right angle of the vaginal vault. Upon incising the vault the collected blood clots within the vagina as seen in figure 2(c) are evacuated. The vault edges are inspected for any active bleeding vessels and signs of infection such as necrosed and sloughed tissue.

Step 7: Vescico-vaginal space dissection.

The anterior edge of the vaginal vault is grasped using atraumatic forceps and is pulled inferiorly while the assistant lifts the peritoneum over the bladder. This step facilitates the identification of the plane between the bladder and vagina. Using sharp dissection, the plane is developed and the bladder is separated from the anterior vaginal wall as shown in figure 2(d). The plane is then extended laterally taking care not to injure the ureters. The lateral extension of the plane is limited by the ureteric tunnel.

Step 8: Ureteric tunnel dissection

The roof of the tunnel of Wertheim comprising of the dense fibers of the vescico vaginal tissue is identified by applying upward and lateral traction over the bladder peritoneum. Using scissors the left ureteric tunnel is de-roofed and the ureter lateralized to expose the lateral margin of the left angle of the vaginal vault as seen in figure 3(a). Care should be taken not to injudiciously use the delivery of thermal or ultrasonic energy in this region as it can compromise the vascularity of the ureter and lead to uretero- vaginal fistula.

Similar steps are repeated on the opposite side.

Step 9: Vault excision.

Beginning from the left angle of the vaginal vault, nearly 0.5 – 1cm below the edge, vault excision is commenced using the Harmonic shear and the cut is extended anteriorly keeping the bladder retracted superiorly. The cut is then extended in a clock wise manner to achieve a circumference of the vaginal vault as in figure 3(b). Hemostasis is achieved using ultrasonic energy. The excised vault is then examined as in figure 3(c) and delivered out vaginally. The rationale behind excising a 0.5 – 1cm of vaginal cuff is to freshen the edges and to remove any necrotic and inflamed tissue which may have been the etiology for vaginal bleeding in the first place.

Step 10: Vault closure using barbed sutures

Beginning from either end (we prefer the right) of the newly created vault, the needle is passed though this end incorporating the uterosacral ligament and the vault is closed in a continuous non locking manner. V-Loc^{TM} Absorbable Wound Closure Device product line (Covidien, Mansfield, MA, USA) sutures are used in our institute

The vault is then examined and hemostasis is confirmed as in figure 3(d). The vault is examined externally from the vaginal end using a Sim's speculum and hemostasis is confirmed.

The vagina is not packed and patient is administered injectable antibiotics. The Foleys catheter is kept in situ for 24 hours and patient is discharged after passing urine.

Results

All patients were managed using our technique. The total duration of the surgical procedure ranged from 64-92 minutes as depicted in table 3. Estimated blood loss including the clots evacuated from the vagina during the procedure was in the range of 190-250 ml. We did not notice an active bleeding vessel, hematoma or an intra-peritoneal collection in any of our cases. None of the patients required blood transfusion postoperatively. There was no major intra or postoperative complications. Foleys catheter was kept in situ for 24 hours and removed thereafter. None of the patients experienced any postoperative voiding difficulties. All patients resumed preoperative oral diet 6 hours after surgery. All patients were discharged after 48 hours. Patients were followed up over a period of 6-18 months. At follow up per speculum examination was done to inspect the vault for evidence of vaginal cuff cellulitis, infection or granuloma formation. Three of the four patients had resumed sexual intercourse at the time of this study, and none of them complained of dysparunia.

Discussion

Hemorrhage following gynecological surgery is an infrequent complication. It can be divided based on time of onset into primary and secondary. Secondary hemorrhage is a life threatening complication with a reported incidence of 0.17-0.45% [1, 2, and 3]. However, due to universal use of antibiotics, better energy sources, improved suture materials and technical improvements amongst the surgeons have led to the decline of this complication in recent times.

The reported causes of secondary vault hemorrhage can be an actively bleeding vessel, hematoma, traumatic laceration of the vaginal / vault after sexual intercourse, vaginal cuff cellulitis and impending vaginal cuff dehiscence [4]. But occasionally on evaluation if no cause is found and conservative management fails to arrest the vaginal bleeding it is labeled as intractable vaginal/vault hemorrhage. We hypothesis the cause of this intractable bleeding due to either infection or disruption of necrosed coagulum due to excessive use of thermal energy.

Conservative management includes resuscitation of the patient with crystalloids and blood products to replenish intravascular volume. Packing the vagina with sterile gauze with or without anesthesia is the initial approach for vaginal bleeding after hysterectomy. Application of thrombin gel over the gauze is recommended. According to Paul et al vaginal packing was successfully employed as a means to control secondary vault hemorrhage. Pack was kept in situ for 24 hours with simultaneous antibiotic cover [4]. In the current case series all patients were subjected to initial conservative management using vaginal packing with thrombin gel and pack was left in situ for a period of 24-48 hours. However, the vaginal hemorrhage was unresponsive to this modality of treatment.

Vaginal exploration and suture ligation of has been employed in various series to control secondary hemorrhage from vault unresponsive to vaginal packing. An active bleeding vessel usually vaginal or descending cervical artery may be the cause of hemorrhage [5]. Occasionally an impending vaginal cuff dehiscence may present with an imminent sign in the form of vaginal bleeding. In the current series, one patient underwent vaginal exploration with suture ligation but unfortunately vaginal bleeding was not controlled and the patient was referred to our center.

If the bleeding persists vaginally and the source of bleeding cannot be determined transcatheter arterial embolisation followed by angiography has been proven effective to arrest hemorrhagic gynecologic conditions. The procedure avoids the morbidity of laparoscopic/ laparotomic exploration. As reported in literature, using a 5-Fr catheter angiographic localization and subsequent embolisation of bleeding vessel has curtailed vaginal hemorrhage successfully. Repeat angiography to confirm the arrest of extravasation of the dye is recommended. Although minimally invasive transcatheter embolisation has its own demerits. Post-embolisation syndrome comprising of pelvic pain, rise in temperature, vomiting and anorexia has been noted following the procedure. Although rare, cases of vescical gangrene and buttock necrosis have been documented as adverse effects of the procedure [6].

Transcatheter arterial embolisation requires expertise along with angiographic equipment which is not readily available in developing countries. So was the case with our series wherein facilities for transcatheter arterial embolisation were unavailable. Hence we proceeded with laparoscopic exploration.

Laparoscopy has been well documented as a feasible alternative to control secondary hemorrhage. A highly magnified view and energy sources enable the surgeon to achieve effective hemostasis with relative ease [5]. However in our case series there was no definite evidence of intraperitoneal collection, hematoma or active bleeding vessel despite which vaginal bleeding persisted.

An integral component of our technique is the ligation of the anterior division of both internal iliac arteries. As the uterine/ descending cervical/ vaginal arteries arise from the anterior division of the internal iliac artery, ligation of the same would result in reduction of pulse pressure and blood flow, hence would be able to arrest hemorrhage as already been proven in cases of postpartum hemorrhage even after obstetric hysterectomy [7].Using oncologic principles, we performed retroperitoneal dissection to identify and clip the anterior division of internal iliac artery bilaterally. However despite bilateral clipping, hemorrhage continued despite observing for a period of 15 minutes.

We sought to employ our technique of circumferential excision of vaginal vault with a margin of 0.5-1 cm. To successfully achieve circumferential excision it is of prime importance to secure the safety of both ureters. Hence ureterolysis and ureteric tunnel dissection to lateralize the ureters from the vaginal vault angle is needed.

Monopolar energy was used in 3 of the 4 cases for colpotomy. Excessive thermal energy over the vagina during colpotomy has been reported induce more damage to the vault and has been reported as a cause for secondary hemorrhage. Excessive thermal energy causes charring and necrosis, and may result in disruption of superficial coagulum over the vessels leading to secondary hemorrhage.

However not statistically significant, use of unidirectional barbed sutures resulted in fewer cases of postoperative bleeding compared to polyglactin sutures according to a study. Unidirectional barbed sutures have been proven to be superior as compared to polyglactin in terms of shorter operating time, blood loss and granuloma formation.

The unique aspect of this technique arises in the management of a rare complication of hysterectomy which despite conservative management would not resolve. In the absence of interventional radiological facilities this technique would be of immense use in managing delayed vaginal bleeding following hysterectomy. The systematic, methodical and easily replicable nature of our technique is a highlighting feature.

In all our cases excision of the vaginal vault was carried out using ultrasonic energy and the newly created margins were sutured using unidirectional barbed sutures.

As described in the results, all cases were successfully managed using this technique. Amongst the patients having long term follow up (>6 months), there were no cases of repeat vaginal bleeding, granuloma formation or dysparunia.

An important limitation of our study is the absence of records of histopathological or microbiological analysis of the excised vault which the authors accept and regret. This has limited the conversion of our etiological hypothesis to a definite documented cause.

Small sample size and retrospective nature of the study are acknowledged limitations of our study and we propose large scale prospective studies to demonstrate and validate this technique.

Conclusion

Circumferential vault excision and reconstruction for the management of secondary vault hemorrhage is a technique that has proven its efficacy in all our cases. Although the sample size is small, this technique can be employed in a setting wherein secondary hemorrhage is usually unresponsive to conservative management or vaginal repair and in circumstances where facilities for interventional radiology are unavailable.

IRB/Ethics Committee approved this study.

We have obtained the written permission of patients for publication of this article.

Disclosure statement: The authors declare that they have no conflicts of interest and nothing to disclose.

Funding: N/A

Contribution to authorship: D. Limbachiya was the operating surgeon. M.Kenkre was the assisting surgeon. Conception and planning of the study was done by D. Limbachiya and written work was done by M.Kenkre, R. Kumari and S.Shah.

References

1.Wilke I, Merker A, Schneider A. Laparoscopic treatment of hemorrhage after vaginal hysterectomy or laparoscopically assisted vaginal hysterectomy (LAVH) Surg Endosc.2001;15:1144–1146.

2. Miranda CS, Carvajal AR. Complications of operative gynecological laparoscopy.JSLS.2003;7:53–58

3. Bhattacharya MS, Shinde SD, Narwekar MR. Complications of vaginal hysterectomy (analysis of 1105cases).J Postgrad Med.1978;24:221–225.

4. Paul PG, Prathap T, Kaur H, Shabnam K, Kandhari D, Chopade G. Secondary hemorrhage after total laparoscopic hysterectomy.JSLS. 2014 Jul-Sep;18(3)

5. Holub Z, Jabor A. Laparoscopic management of bleeding after laparoscopic or vaginal hysterectomy.JSLS.2004;8:235–238.

6. Yong Jae Lee, Man Deuk Kim, Jung-Yun Lee, Sang Wun Kim, Sung Hoon Kim, Young Tae Kim, Eun Ji Nam. Transcatheter Arterial Embolization for Severe Secondary hemorrhage after Hysterectomy. J Minim Invasive Gynecol. 2018 Jan;25(1):180-185

7. Joshi VM, Otiv SR, Majumder R, Nikam YA, Shrivastava M.Internal iliac artery ligation for arresting postpartum haemorrhage. BJOG. 2007 Mar;114(3):356-61.

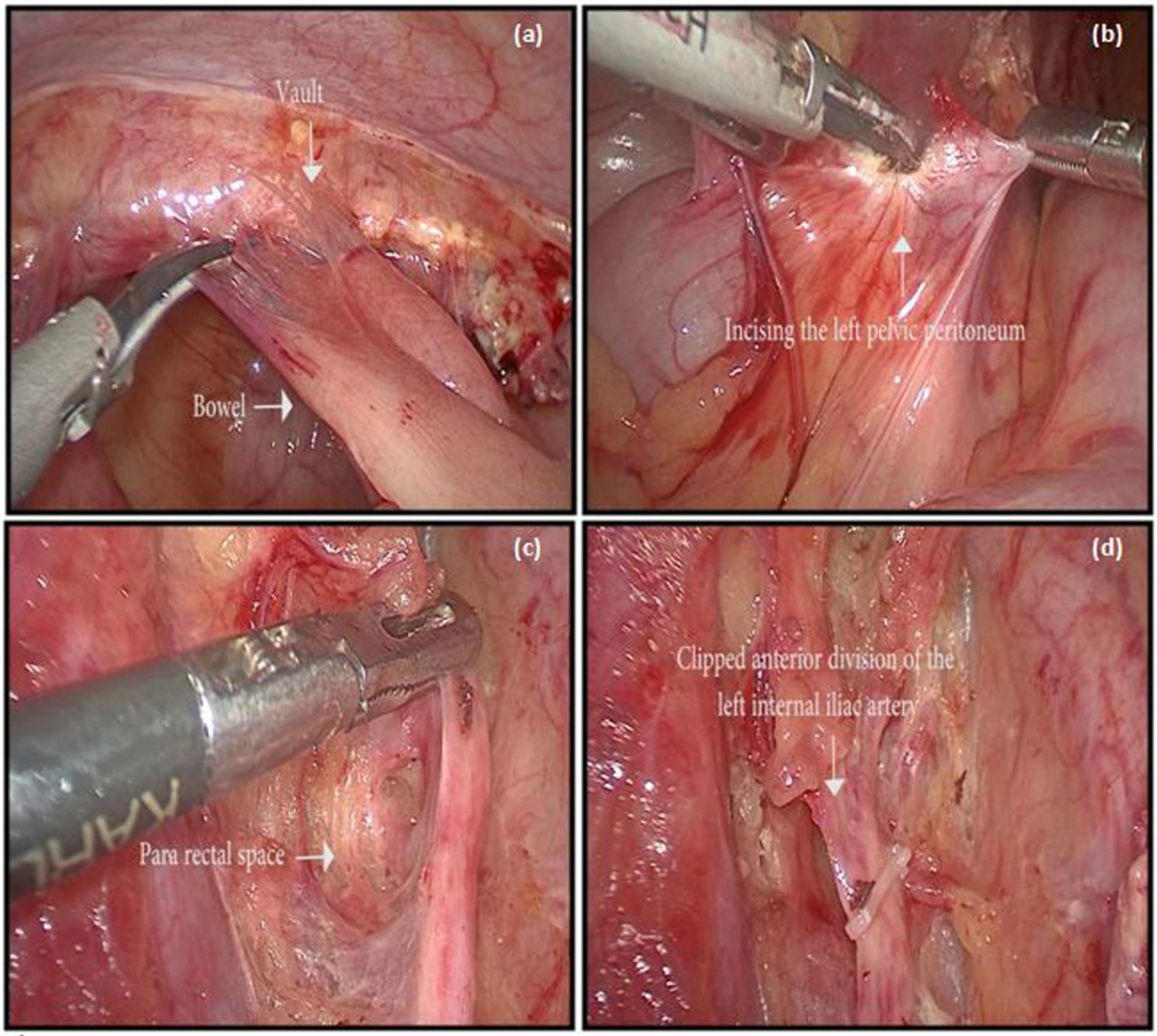

FIGURE 1- (a)Adhesiolysis -Separating the bowel from the vaginal vault (b) Opening of the retroperitoneal space of the left side(c) Left Para rectal space(d) Clipping the anterior division of the left internal iliac artery

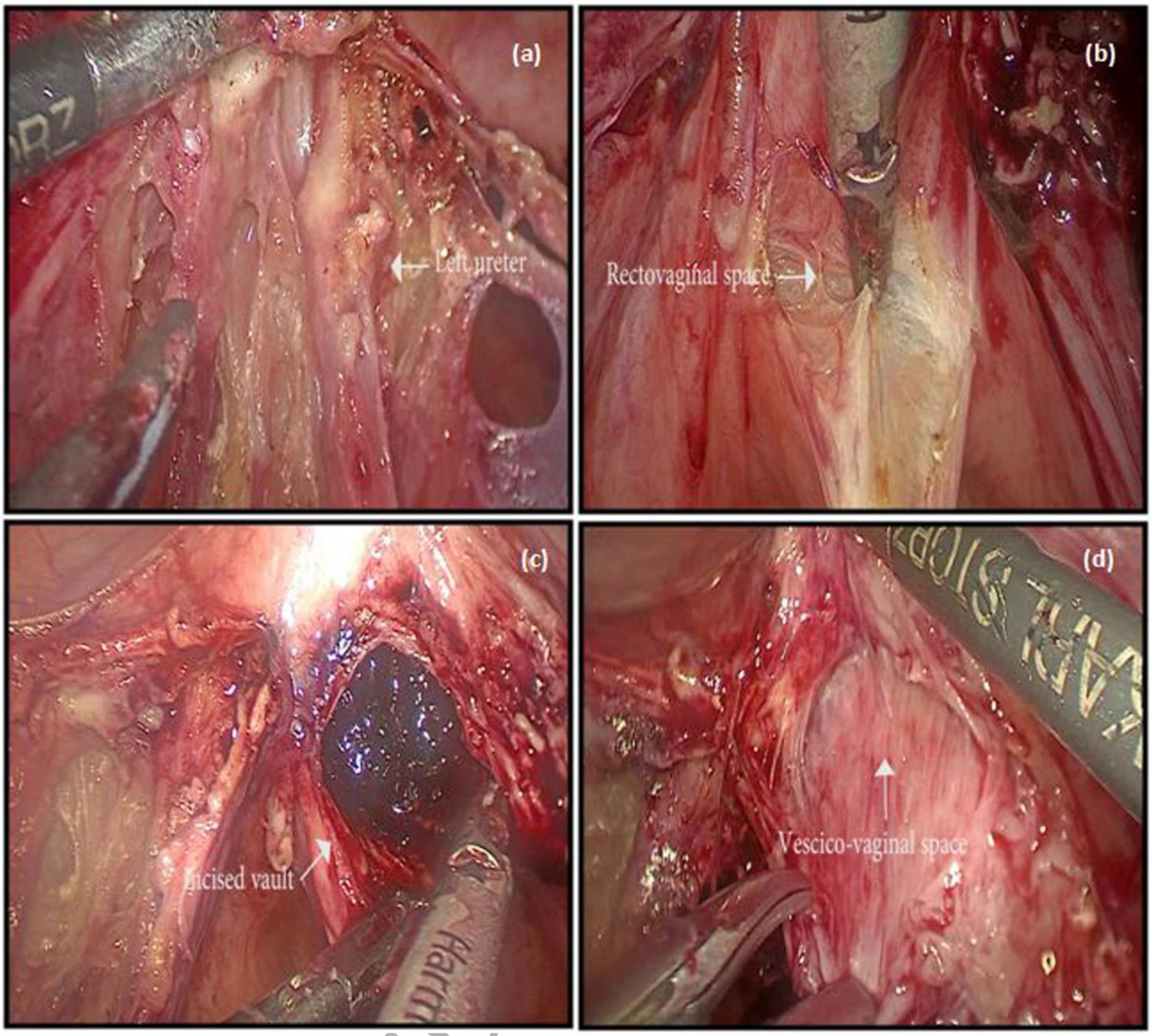

FIGURE 2- (a) Ureterolysis of the left ureter(b) Rectovaginal space dissection(c) Transverse incision over the apex of the vault(d) Vescico-vaginal space dissection

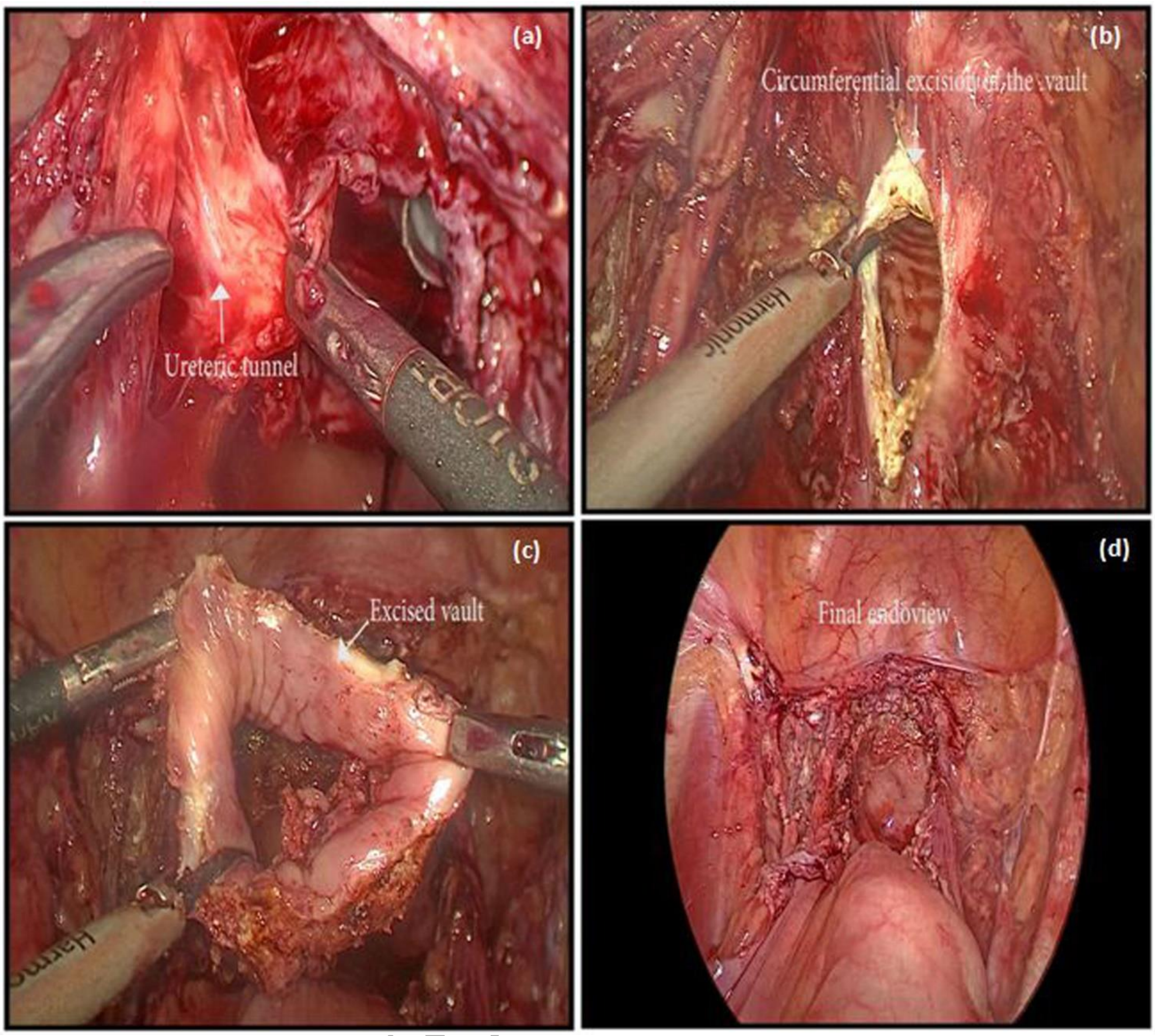

FIGURE 3- (a)De-roofing of the left tunnel of Wertheim(b) Circumferential excision of the vaginal vault(c) Examination of the excised vault(d) Newly constructed vault

TABLE 1- Demographic and primary surgical details

Patient	Location of Primary surgery	Year	Indication	Surgery type	Vessel sealing device	Colpotomy	Vault closure suture	Vault closure technique
A	Author's institute	2018	AUB Fibroid	TLH + BS	Bipolar	Bipolar	Polyglactin 910	continuous non locking
B	Private hospital	2018	Diffuse Adenomyosis	TLH	Bipolar	Monopolar	Polyglactin 910	continuous non locking
C	Private hospital	2011	Fibroid	TLH	Bipolar	Monopolar	Polyglactin 910	continuous non locking
D	Private hospital	2012	Fibroid	TLH	Bipolar	Monopolar	Polyglactin 910	continuous non locking

TABLE 2- Clinical course at presentation

Patient	Interval(days)	Conservative management	Vaginal re-suturing	Hemoglobin level at admission(gm/dl)	Blood transfusion (units)	Duration of vaginal packing(hours)
A	42	Yes	No	9	1	24
B	31	Yes	No	8.6	2	24
C	34	Yes	Yes	8.2	2	48
D	32	Yes	No	8.6	2	24

TABLE 3-Results

Patient	Operative time(min)	Blood loss(ml)	Follow up period(months)	Intraoperative finding-active bleeder or collection	Major intraoperative/postoperative complications
A	64	200	6	Nil	Nil
B	92	250	6	Nil	Nil
C	90	190	18	Nil	Nil
D	88	250	18	Nil	Nil