

Vaginal Vault Closure Following Total Laparoscopic Hysterectomy: Laparoscopic versus Conventional Technique – A Comparative Study

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Abstract

Objectives: Vault closure is the final step to hysterectomy, protecting the abdominal cavity from the exterior environment. Thus, closure becomes crucial in preventing ascend of infection to the peritoneal cavity. Our study aims to compare vault closure between laparoscopic and vaginal routes, their operating time, and postoperative complications.

Materials and Methods: The ambispective comparative study was done in a tertiary care teaching center from June 2016 to December 2022. Three hundred and forty-four patients were included in the study that underwent a total laparoscopic hysterectomy. Interventions – Patients who had laparoscopic vault closure were in Group 1 ($N = 198$) and those who had vaginal closure were in Group 2 ($N = 146$). The results were compared. It included age, body mass index of the patient, the indication of surgery, intraoperative blood loss, size of the uterus, time taken during vault closure, and postoperative complications.

Results: The time taken by laparoscopic vault repair was significantly less than vaginal repair (19.7 ± 13.3 min vs. 30.1 ± 6.6 min, $P < 0.001$). There was postoperative vault infection (2.7%), vault hematoma (1.3%), and no vault prolapse seen in vaginal repair. The organisms isolated were mainly *Pseudomonas aeruginosa*, *Escherichia coli*, and *Klebsiella*.

Conclusion: Laparoscopic vault closure has shown significantly improved results compared to vaginal route repair.

Keywords: Complications, endo suturing, vault closure

INTRODUCTION

Hysterectomy is the most common gynecological procedure irrespective of the route; laparoscopic, vaginal, and abdominal. The indications have, however, remained the same over the years.^[1] The country's hysterectomy prevalence varies between 1.7% and 9.8%.^[2] This is, however, considerably lower than higher-income countries such as the United States (26.4%), Australia (25%), and Singapore (7.5%).^[3-5] With the advent of minimally invasive surgery, laparoscopic surgeries are the preferred choice. The technical challenges faced during laparoscopic surgery may deter competent surgeons from conventional methods. The surgeons are

postulant from the initial step of port placement to the final step of vault closure in total laparoscopic hysterectomy. However, once proficiency in techniques is gained, it leads to established advantages in laparoscopic surgeries over conventional methods.

The vaginal cuff is the upper portion of the vagina that opens up into the peritoneum following a hysterectomy. In a non-hysterectomies woman, it is located posterior and superior to the cervix. The vaginal cuff is created by suturing together the edges of the surgical site where the cervix was attached

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to the vagina. This is accomplished by bringing the edges of the vagina together and suturing them together and to the uterosacral ligaments to provide support. After a hysterectomy, the scar site assumes the position of the vaginal apex or vault.

Study objective

The aim of this study is to compare vault closure between laparoscopic and vaginal routes, their operating time, and postoperative complications.

MATERIALS AND METHODS

The study was done in a tertiary care teaching institute over a period from June 2016 to December 2022. All patients who underwent total laparoscopic hysterectomy performed electively, in a single unit were taken into consideration. All patients undergoing hysterectomy for malignancy, with a previous history of radiation and allergy to sutures, were excluded from the study. The patients were admitted 2 days before OR dates. Bowel preparation was done using two tablets of dulcolax and simethicone. In patients with previous surgeries, 2 g ampicillin with 2 g Tinidazole was additionally given. All surgeries were performed through the ipsilateral left port placement technique having a single primary port (at the umbilicus), two secondary ports to the left (2 cm above and medial to anterior to anterior superior iliac spine and other is 4 finger breadth above and right to first), and a third port was placed for the assistant on the right. A total laparoscopic hysterectomy was done using colpotomizer for uterine manipulation, and the specimen was retrieved vaginally with or without intramyometrial coring depending on the uterine size. All patients were blinded to the type of vault repair and divided into two groups. The patients who underwent laparoscopic vault repair were kept under Group 1 and those with vaginal vault repair were in Group 2. Preoperative patient preparation, surgical methods, and postoperative patient care were comparable. Their descriptive medical records and thorough patient details in their personal files were maintained. In Group 1 with laparoscopic vault closure, intracorporeal method of vault suturing was done. The time taken was calculated from the point of insertion of suture material equipped with a needle holder into the abdominal cavity to the cutting of the knot with scissors after the final ligature. During vaginal repair, the cervical defect, along with anterior and posterior fascia, was approximated by suturing through the full thickness of the vaginal epithelium. The suture materials used were the same polyglactin 910 for both procedures. All patients were discharged under stable conditions on the postoperative days 1 or 2. At the time of discharge, the patients were advised to avoid coitus for 2 weeks and heavy weight lift for 6 weeks, respectively. Associated risk factors such as foul-smelling vaginal discharge, bleeding, fever, and lower abdomen pain were explained. The patients were asked to follow-up 1 week,

one monthly, and thereafter three monthly, if no indication. The patients were followed up on an outpatient department basis. It included age, body mass index (BMI) of the patient, the indication of surgery, intraoperative blood loss, and size of the uterus. Furthermore, the time taken in vault suturing, the level of difficulties faced, and postoperative complications such as vault hematoma, infection, cuff dehiscence, and prolapse were studied. A meticulous follow-up was done following surgery. Records were maintained. All data analysis was done by IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp., Armonk, NY, USA). All the continuous variables were presented as mean and standard deviation and categorical data as frequency and percentage. Continuous data were analyzed using the Student's *t*-test, and categorical data were analyzed using the Chi-square test (95% confidence interval [CI]; $P < 0.05$ was considered statistically significant). The study conformed to the ethical norms and standards in the Declaration of Helsinki, including the local ethics committee approval statement, registration number and informed consent statement, and the local Institutional Ethics Committee, All India Institute of Medical Science, India (ref no. AIIMS/Pat/IEC/2021/879).

RESULTS

A total of 344 patients were enrolled in the study, of which 198 had laparoscopic vault closure (group 1) and 146 had vaginal vault closure (Group 2). All patients had undergone total laparoscopic hysterectomy. The baseline demographics of patients were similar for both groups. The age, BMI, previous surgeries, indication of surgeries, intraoperative blood loss, and time taken during total laparoscopic surgery were comparable for both groups. The time taken during vaginal repair was found to be significantly more (30.1 ± 6.6 min) with laparoscopic vault repair (19.7 ± 13.3 min, $P < 0.001$) [Table 1].

It was seen in postoperative vault infection (2.7%), vault hematoma (1.3%), and vault prolapse (none) in vaginal repair; however, cuff dehiscence in 0.5% in laparoscopic vault repair [Table 2].

The pie chart [Figure 1] of cultural sensitivity depicts common organisms affecting vault infection, namely, *Pseudomonas aeruginosa*, *Escherichia coli*, and *Klebsiella* contributing to it.

DISCUSSION

The basic tenets of cuff closure are similar for conventional and laparoscopic repair, only the visual perceptible and magnification changes. The goal of vaginal cuff closure at the time of laparoscopic hysterectomy is to re-approximate the apex in the vagina and to provide adequate hemostasis.

Table 1: Demographic characteristics of the patients

Parameters	Mean±SD		P
	Laparoscopic vault repairs (N=198)	Vaginal vault repairs (N=146)	
	Group 1	Group 2	
Age (years)	47.4±3.95	48.6±4.91	0.080
BMI (kg/m ²)	26.7±1.76	25.6±2.12	0.455
Previous 1 LSCS (%)	36 (18.1)	19 (13.0)	
Previous 2 or more LSCS (%)	27 (13.6)	15 (10.2)	
Uterine size (weeks)	16±5.56	13±4.60	0.051
Indications of surgery, frequency (%)			
Adenomyosis	62 (31)	46 (32)	
Abnormal uterine bleeding	24 (12)	20 (14)	
Endometriosis	5 (2)	2 (1)	
Fibroid	89 (45)	68 (46)	
Hyperplasia	18 (9)	10 (7)	
Intra-operative blood loss (mL)	110±30	118±25	0.189
Time taken (min)	19.7±13.3	30.1±6.6	0.001

P<0.05: Significant. N: Total number of patients included in the study, BMI: Body mass index, LSCS: Lower segment cesarean section, SD: Standard deviation

Table 2: Postoperative complications

Complications	Group 1 (N=198) laparoscopic vault repair	Group 2 (N=146) vaginal vault repair
Vault infection (n)	0	4
Vault hematoma (n)	0	2
Cuff dehiscence (n)	1	0
Vault prolapse (n)	0	0

N1- Total number of patients who underwent laparoscopic vault repair;
N2- Total number of patients who underwent vaginal vault closure.

It also forms access to the peritoneal cavity from the external environment. Laparoscopic vault closure is difficult and time-consuming and hence requires great effort and endurance. In the present study, time taken in vaginal repair was significantly more than laparoscopic repair (30.1 ± 6.6 min. vs. 19.7 ± 13.3 min, P < 0.001). In the early period of our study, the conversion rate of laparoscopic vault suture into vaginal suture was high as the technique was difficult and time-consuming for learners in laparoscopy. However, it was seen that, with time and mastery of the skill, the time consumed by laparoscopic vault repair reduced significantly (range: 8–50 min, P < 0.001). Also, the vaginal vault repair time was seen to be increased in few cases due to vaginal tear repair secondary to retrieval of specimen, vaginally.^[6,7]

Inadequate closure may result in postoperative complications that include cuff dehiscence, bleeding, hematoma, or infection. Vaginal cuff dehiscence ranges from 1% to 5% at the time of laparoscopic hysterectomy, which has been seen to have 4-fold higher risk as compared to transvaginal vault closure.^[8] Though rare, it can lead to a potentially morbid sequel. Hence, the estimation of the prevalence of vaginal cuff dehiscence is

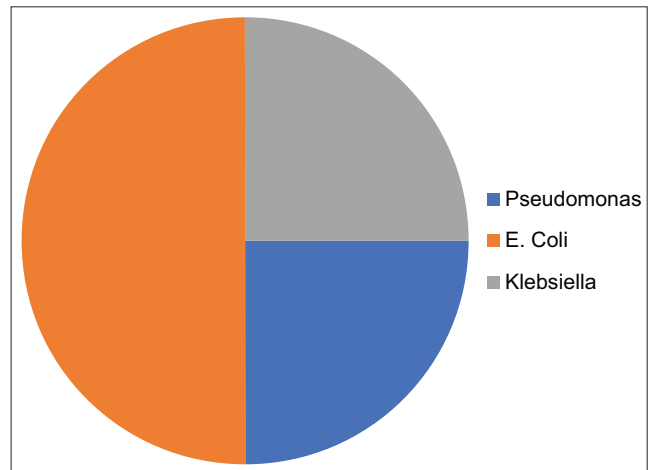


Figure 1: Culture-sensitivity of vault infections

difficult to assess due to the presence of only case studies and anecdotal reports.^[9] If the vaginal cuff is compromised, vaginal evisceration can occur with the small intestine protruding out through the vagina, the incidence being 0.032–1.2%.^[9] It is a surgical emergency, if left untreated, can lead to peritonitis, bowel strangulation, and necrosis. In the present study, one case of partial vaginal cuff dehiscence was observed following laparoscopic vault repair 20-day postoperative. She, however, had no prolapse and was managed conservatively. During laparoscopic cuff closure to mitigate dehiscence, it is important to have approximation, not strangulation of tissue, minimizing thermal energy use during colpotomy and incorporation of healthy tissue in the suture line. In a study done in 2016, the perioperative outcomes following laparoscopic hysterectomy using different energy sources were studied that detailed its cautious use to avoid unintended thermal damage to the surrounding tissues.^[10]

The use of barbed sutures over conventional has shown significant results in operative time and technicality with reduced postoperative complications.^[11] In a study done by Siedhoff *et al.*, suture material used for vault closure was compared, which showed an increased rate of cellulitis and dehiscence up to 3.1% using braided sutures over monofilament.^[12] Suture selection for pelvic reconstruction has changed with the realization that surgeries done to correct prolapse are really a series of herniorrhaphies. In our study, this variable was omitted; thus, uniformity was perpetuated. With the use of monofilament, the double knot technique needs expertise along with a secured angle has procured established advantages over braided sutures.^[12]

A study done by Kanupriya Singh found that in the laparoscopic technique; sutures are inverted and not subjected to vaginal bacteria; thus, there is a lesser possibility of postoperative vault infection and less possibility of vault dehiscence.^[13] In a study done in India, 600 patients underwent hysterectomies, both laparoscopic and abdominal route. It was observed none of them had postoperative vault infection. However, in the present study, four cases of vault infection were observed through vaginal route repair indicating exposure to endogenous genital tract flora increases the risk of infection. The commonly isolated organisms were pseudomonas (0.6%), Coli (1.3%), and Klebsiella (0.6%). In a study done in Ukraine, a total of 12.6% of women after hysterectomy had vaginal cuff infections. Of these cases, 20.3% after abdominal, 15.5% vaginal, and 4.1% laparoscopic hysterectomy were identified. The predominant pathogens were *E. coli* (18.6%), *Enterobacter* spp.(12.4%), *Staphylococcus aureus* (10.8%), *Streptococcus* spp.(9.7%), *Klebsiella pneumonia* (8.2%), *P. aeruginosa* (7.6%), *Enterococcus faecalis* (7.0%), and *Proteus* spp.(7.0%). Methicillin resistance was observed in 12.9% of *S. aureus* and 9.7% CoNS. Carbapenem resistance was identified in 7.3% of *P. aeruginosa* isolates.^[14] Surgical instruments, when manipulated through the vaginal route during vaginal hysterectomy/vaginal cuff closure/vNOTES, increase the risk of ascending secondary infection of vaginal polymicrobial flora of aerobes and anaerobes to the open peritoneal cavity with pelvic hematoma.^[15,16]

Vault prolapse is a long-term complication. One of the risk factors usually responsible is when the uterosacral ligaments at pericervical ring are not included during cuff closure.^[17] In our study, no incidences of vault prolapse were found following vaginal or laparoscopic repair. In a study done in Iran, the surgical procedure of the rectovaginal fascia attachment to the pericervical ring in posterior vaginal wall prolapse repair seems an effective surgical intervention to prevent vault prolapse.^[18] The use of colpotomizer for tissue delineation during colpotomy prevented postoperative complications of cuff dehiscence and prolapse.^[19]

Reabsorption of sutures takes almost 3-month time to heal following which the type of cuff closure and sutures cannot be differentiated. The complications usually occur within 2 months of postoperative time. The use of delayed absorbable sutures is recommended. The various risk factors that can compromise the vaginal cuff are sexual intercourse, chronic constipation, asthma, chronic obstructive pulmonary disease, and anything that can increase intra-abdominal pressure. This structure is prone to infection, hematoma, and other postoperative complications. Furthermore, factors that are thought to affect wound healing are radiation treatments, age, and pelvic organ prolapse, the use of steroids, an immunocompromised state, and concurrent malignancy.^[20]

CONCLUSION

This study suggests that, with time endosuturing, once expertise has established advantages over the vaginal route by reducing operative time and postoperative complications. Vault closure is a crucial step in protecting the peritoneal cavity from the exterior; therefore, a better-sealed vault reduces postoperative morbidity in patients.

Limitation

This study was a single institutional study with a small sample size.

Data availability statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Conflicts of interest

There are no conflicts of interest.

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