

Barbed Suture in Total Laparoscopic Hysterectomy: A Comparative Study of the Safety in Vaginal Cuff Closure with that of Polyglactin 910 Suture

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Abstract

Objectives: To evaluate whether the use of barbed sutures during laparoscopic hysterectomy for vaginal cuff closure has reduced the surgical difficulty and incidence of post-operative complications as compared to polyglactin 910 suture.

Materials and Methods: This is a randomized comparative study conducted at a tertiary care hospital and research institute where 100 patients were divided into two groups (50 each) and underwent vault closure using barbed suture/Polyglactin 910. Data collected include demographic details, indication for surgery, mean suturing time, degree of surgeon difficulty, and the incidence of postoperative complications when followed up to 12 weeks and were compared statistically using Chi square test and Independent-*t* test.

Results: The use of barbed suture has significantly reduced the suturing time (5.39 min vs. 6.9 min, $P < 0.0001$) and surgical difficulty. The incidence of minor complications is similar to that of polyglactin 910. There were no cases of vaginal cuff dehiscence or bowel obstruction reported in our study.

Conclusion: With the advantages of reduced suturing time and technical difficulty, and incidence of complications similar to conventional suture material, barbed sutures are to be considered as an excellent alternative to conventional suture materials.

Keywords: Barbed suture, cuff dehiscence, polyglactin 910, total laparoscopic hysterectomy, vault closure

INTRODUCTION

Hysterectomy is one of the most frequently performed surgical procedures in gynecological practice.^[1] There are three approaches in hysterectomy-abdominal, vaginal and laparoscopic. Although there are numerous benefits of vaginal over abdominal hysterectomy including lower morbidity and more rapid postoperative recovery,^[2] 70%–80% of all hysterectomies are performed abdominally.^[3]

The first laparoscopic hysterectomy was performed by Harry Reich in 1988 in Pennsylvania.^[4] Since then, laparoscopic hysterectomy has proven to be a safer option than conventional surgery for benign gynecological conditions as it upholds

superiority in shorter hospital stay, faster resumption of routine activities, and reduced morbidity.^[5] There are several approaches for vaginal cuff closure using different techniques and different suture materials.

According to literature, the rate of complications associated with vaginal cuff closure postlaparoscopic hysterectomy as compared to abdominal and vaginal hysterectomy ranges from 0% to 5%,^[6] the most common being-vaginal bleeding, vaginal cuff infection, and dehiscence.

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Amongst many strategies that have been undertaken, the introduction of barbed sutures has been a paradigm in laparoscopic suturing. These sutures have tiny barbs evenly distributed that yield more consistent wound apposition without the need for tying knots. It has demonstrated a lower technical difficulty as well as surgical duration, intraoperative complications, and lower incidence of suture dehiscence.^[7,8]

These results suggest that barbed suture has the potential to become a valuable asset in various gynecological surgeries. The aim of this study is to evaluate whether the use of barbed suture for vaginal cuff closure is related to decreased postoperative complications compared with cuff closure with polyglactin 910 in patients undergoing total laparoscopic hysterectomy at our hospital.

MATERIALS AND METHODS

The present study included 100 women who underwent TLH at the department of Obstetrics and Gynaecology at a tertiary care hospital and research center during 12 months. Considering 1-year statistics at our hospital for laparoscopic hysterectomies, i.e., 147 and compensating dropouts, 100 was taken as the sample size, with 50 in each group.

$$S = Z^2 pq / d^2$$

$$= 1.96 \times 1.96 \times 0.08 \times 0.92 / 0.05 \times 0.05$$

$$= 113$$

After attaining institutional ethics committee approval (JSS/MC/PG/4623/2018-19) and informed consent, patients with benign gynecological conditions were included in this study and those with infected masses, malignancies, and immunocompromised status were excluded. The patients were selected and divided into two groups (50 in each group) by simple random sampling in order to avoid bias. Total laparoscopic hysterectomy was carried out by the same surgeon by the standard surgical technique in both groups. Following specimen retrieval vaginally, cuff closure was done laparoscopically using polyglactin 910 in one group (Group A) and using barbed suture in another (Group B). Hemostasis was achieved intraoperatively.

Mean suturing time defined as the time taken from the beginning of the first stitch to the cutting of the last stitch for vaginal cuff closure was recorded. The difficulty perceived by the surgeon in performing the procedure was graded using a visual analog scale (VAS) ranging from 1 (low difficulty) to 10 (high difficulty). All the patients were examined in the first 48 h and during follow-up visits at 1 week, 6 weeks, and 12 weeks postoperatively for bleeding, leucorrhoea, vault cuff inflammation, vault dehiscence, and bowel obstruction.

Descriptive analysis was done by measuring proportion, mean and standard deviation (SD). Inferential statistics was done using the Chi-square test and Independent-*t*-test. All measurements were done by SPSS 21.0 software (IBM Corp, Armonk, NY). $P \leq 0.05$ were considered significant.

RESULTS

Of a total of 100 patients who underwent laparoscopic hysterectomy, 50 vault closures (Group A) were done using Polyglactin 910 and another 50 (Group B) using barbed sutures. Demographic characteristics and the indication for hysterectomy were comparable between the two groups [Tables 1 and 2 respectively].

The mean age of women was 45.74 years (SD = 4.96 years) in the polyglactin 910 group and that in the barbed group was 44 years (SD = 6.29 years) without significant differences in age. No significant difference in BMI between the two groups was noted. The most common indication for surgery in both groups was the fibroid uterus.

Among the subjects in polyglactin 910 group 5 (10%) and among the barbed suture group 7 (14%) had medical comorbidities with no statistical difference between the groups. Seventeen (34%) subjects in the polyglactin 910 group and 10 (20%) subjects in the barbed suture group had undergone abdominal surgery in the past but no statistical significance was observed between the groups.

Significant reduction in mean suturing time of vaginal vault was observed while using barbed suture for cuff closure (5.39 min,

Table 1: Demographic and clinical details of 100 patients

	Polyglactin-910 group (n=50)	Barbed group (n=50)	P
Age (y), mean (SD)	45.74 (4.96)	44 (6.29)	0.12
BMI (kg/m ²), mean (SD)	26.77 (2.20)	26.45 (2.02)	0.44
Medical comorbidity, n (%)	5 (10)	7 (14)	0.5
Previous abdominal surgery, n (%)	17 (34)	10 (20)	0.1

SD: Standard deviation

Table 2: Indication for hysterectomy

	Polyglactin - 910 group (n=50), n (%)	Barbed group (n=50), n (%)
Fibroid uterus	26 (52)	20 (40)
Endometrial hyperplasia	10 (20)	6 (12)
Adenomyosis	7 (14)	6 (12)
Endometrial polyp	2 (4)	12 (24)
Endometriosis	3 (6)	4 (8)
PID	0	2 (4)
Fibroid with endometriosis	1 (2)	0
Chronic cervicitis	1 (2)	0

PID: Pelvic inflammatory disease

SD = 0.76 vs. 6.91 min, SD = 1.27). The degree of surgical difficulty was lower in the group (VAS of 3.5 vs. 8; $P < 0.001$) using barbed suture for cuff closure.

Postoperative complications in the two groups of patients are presented in Table 3. Vaginal bleeding was reported in 6 cases (12%) using polyglactin 910 while in 5 cases (10%) using barbed suture for cuff closure with no statistical significance between the groups. The incidence of leucorrhoea was about 4% in the barbed group as compared to 12% in the polyglactin 910 group ($P = 0.1$). 5 cases having cuff closure done using polyglactin 910 presented with cuff inflammation whereas 1 case ($P = 0.09$) reported from the barbed group with no statistical significance noted between the groups. No cases of vault dehiscence or bowel obstruction were reported among patients followed up to 12 weeks postsurgery.

DISCUSSION

Hysterectomy being the second most common surgical procedure following cesarean section around the world is performed in 20%–30% of women under the age of 60.^[9] Based on the route of the procedure, hysterectomies can be divided into transabdominal (TAH), vaginal (VH), and laparoscopic hysterectomy (LH). In recent years, single port laparoscopic hysterectomy and robot-assisted laparoscopy have been developed.

Though several advantages of laparoscopic hysterectomy are proven such as shorter hospitalization, earlier resumption of routine activities and lesser morbidity, the incidence of postoperative vaginal cuff complications are reported in the literature as 0%–5% after laparoscopic hysterectomy.^[6] In a retrospective analysis of patients who underwent laparoscopic hysterectomy between 2004 and 2011 done by Medina *et al.*, an incidence of 5.4% was noted having vaginal cuff complications.^[10]

The introduction of barbed sutures has brought about a dramatic change in laparoscopic hysterectomy. These sutures provide a more uniform distribution of tension all across the suture line than conventional suture, yielding more consistent

wound apposition. With the use of conventional sutures, there might seem closed appearance of the wound but, there is a tension gradient across the suture line which may interfere with uniform healing and remodeling.^[11]

Vaginal bleeding remains the main reason of concern among patients for consultation in the postoperative period. Large uterine size, excessive use of thermal energy for uterine arteries, and culdotomy may be responsible for secondary hemorrhage.^[12] We have documented no significant difference in the incidence of vaginal bleeding between the two groups. Neubauer *et al.* were of the same opinion.^[13] They did not find the statistically significant difference when comparing postoperative vaginal bleeding in patients who underwent robotic hysterectomies where cuff closure was done using monofilament and barbed sutures. Incidence of vaginal bleeding occurred in 1.7% and 2.6% of patients with cuff closure using monofilament and barbed sutures, respectively. Few studies such as that by Medina *et al.*^[10] have reported a significant reduction of almost 43% in the proportion of patients presenting with postoperative vaginal bleeding ($P < 0.03$) while using barbed suture for vaginal cuff closure. Similar results were also observed by Siedhoff *et al.* who reported more patients with postoperative vaginal bleeding when comparing vaginal vault closure using braided suture versus barbed suture (odds ratio 2.3, 95% confidence interval, 1.3–3.9).^[14]

Vaginal cuff closure remains a biomechanically complex procedure. Bacterial contamination from the vaginal vault is a major cause of fever, vaginal cuff inflammation, and leucorrhoea. The vaginal cuff is prone to granulation tissue which also presents with leucorrhoea even in the absence of infection.^[11] Given these complications, an ideal suture for vaginal cuff closure should minimize bacterial growth, elicit minimal tissue reactivity and maintain reasonable tension across the suture line. Studies have proven that barbed sutures have such characteristics as compared to conventional sutures.

With respect to leucorrhoea inflammation and granulation tissue, we did not observe significant differences between the groups. Similar results were observed by Medina *et al.*

Table 3: Surgical results

	Polyglactin 910 group (n=50), n (%)	Barbed suture group (n=50), n (%)	P
Suturing time (min), mean (SD)	6.91 (1.27)	5.39 (0.76)	<0.0001
Degree of surgical difficulty (VAS)	8.16 (0.77)	3.18 (0.85)	<0.0001
Postoperative complications (up to 12 weeks)			
Vaginal bleeding	6 (12)	5 (10)	0.8
Leucorrhoea	6 (12)	2 (4)	0.1
Cuff inflammation	5 (10)	1 (2)	0.09
Vault dehiscence	0	0	NA
Bowel obstruction	0	0	NA

SD: Standard deviation, VAS: Visual Analog Scale

where no patient presented with granulation tissue in the postoperative period.^[10] Inversely, Lin *et al.* reported a lower rate of vaginal cuff granuloma after TLH while using V-Loc barbed suture for vaginal cuff closure compared to CL-914 (Polysorb braided absorbable suture).^[9]

Vaginal cuff dehiscence, although rare, is a serious complication following hysterectomy, for which surgeons should anticipate. The risk of cuff dehiscence is increased in endoscopic procedures such as laparoscopic or robotic hysterectomies where tissues heal slowly due to the usage of thermal energy for hemostasis.^[15] Suture type is also implicated as a determining factor for cuff dehiscence since the surgical knot and the areas adjacent to the knot are most vulnerable to knot slippage.^[16] As stated by Greenberg in a review, barbed sutures being knotless and self-anchored, improve the tensile strength of the suture and lead to a more secured closure.^[11] In our study, no cases of vaginal cuff dehiscence were observed in both the group of patients. This result was in accordance with that reported by Blikkendaal *et al.*^[17] who found no statistical advantage in vaginal cuff dehiscence in cuff closures by barbed suture compared to continuous vicryl in laparoscopic hysterectomy. Conversely, studies have proven that the adoption of barbed sutures in minimally invasive surgeries have not only overcome technical difficulty but have significantly reduced the incidence of cuff dehiscence. Siedhoff *et al.* reported no cases of vaginal cuff dehiscence among patient sutured with barbed suture compared to 4.2% dehiscence rate in the control group sutured with other techniques.^[14] Similar results were observed by Rettenmaier *et al.*^[18] where no cases of vaginal cuff dehiscence were reported following the use of barbed suture as compared to a dehiscence rate of 0.99% for vicryl suture.

One of the rare but potentially serious complications with the use of barbed suture is bowel obstruction. If the cut end of the barbed suture is left long, the overlying mesentery or bowel may become attached leading to kinking and act as a transition point to obstruction. Rombaut *et al.* reported a case of terminal ileal strangulation due to bidirectional suture following myomectomy.^[19] We did not come across bowel complications in both groups of patients.

Using barbed suture not only reduces the excessive use of thermal energy for hemostasis thereby decreasing cuff related complications but also reduce the suturing time of vaginal cuff and technical difficulty.

CONCLUSION

We documented no severe complications such as bowel obstruction or vaginal cuff dehiscence in both groups. In addition, minor complications such as bleeding, leucorrhoea

though present were treated conservatively and appeared similar between the groups. Proven that the incidence of complications is similar to conventional suture materials, the barbed suture is a promising alternative as it simplifies the suturing technique and reduces the suturing time for vault closure during laparoscopic hysterectomy.

Limitation

Only 100 subjects were studied here and the period of follow-up was only up to 12 weeks. Therefore, larger population-based studies and extended period of follow-up would facilitate in proving the accuracy and safety of barbed sutures in gynecological surgeries.

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Conflicts of interest

There are no conflicts of interest.

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