ORIGINAL RESEARCH

A Comparison of Unidirectional and Bidirectional Barbed Sutures for Vaginal Cuff Closure in Total Laparoscopic Hysterectomy- A Randomised Controlled Trial

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ABSTRACT

Background: Total laparoscopic hysterectomy (TLH) has become a widely adopted approach for the removal of the uterus due to its minimally invasive nature, reduced postoperative pain, shorter hospital stays, and quicker recovery times. This study aimed to compare the efficacy and safety of unidirectional and bidirectional barbed sutures for vaginal cuff closure during total laparoscopic hysterectomy (TLH) in terms of operative time, intraoperative blood loss, postoperative pain, and recovery time.**Materials and Methods:** This prospective, randomized controlled trial was conducted at a tertiary care hospital, enrolling 80 patients undergoing TLH for benign gynecological conditions. Patients were randomly assigned to either the unidirectional suture group (Group A, n = 40) or the bidirectional suture group (Group B, n = 40). The vaginal cuff was closed intracorporeally using barbed sutures in a continuous running manner. The primary outcome was vaginal cuff closure time. Secondary outcomes included intraoperative blood loss, postoperative pain at 6, 24, and 48 hours, suture-related complications, and time to return to normal activity. Data were analyzed using appropriate statistical tests, with a p-value <0.05 considered significant.**Results:** Baseline characteristics were similar between the two groups. Vaginal cuff closure time was significantly shorter in Group B (10.20 ± 2.10 minutes) than in Group A (12.50 ± 2.30 minutes; p = 0.001). Intraoperative blood loss was lower in Group B (47.80 ± 9.70 mL) compared to Group A (55.30 ± 10.50 mL; p = 0.007). Postoperative pain scores at 6 and 24 hours were significantly lower in Group B (p = 0.045 and p = 0.020, respectively), while no significant difference was observed at 48 hours (p = 0.150). Suture-related complications, including dehiscence, granulation, and infection, were comparable between both groups. Patients in Group B resumed normal activities earlier (9.00 ± 2.50 days) compared to Group A (10.20 ± 2.80 days; p = 0.030).**Conclusion:** Bidirectional barbed sutures demonstrated superior efficacy compared to unidirectional sutures in vaginal cuff closure during TLH, with significantly shorter closure time, reduced intraoperative blood loss, and faster postoperative recovery. Both techniques had comparable safety profiles. These findings support the preference for bidirectional sutures to improve surgical efficiency and patient outcomes.

Keywords: Total laparoscopic hysterectomy, Vaginal cuff closure, Barbed sutures, Bidirectional sutures

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INTRODUCTION

Total laparoscopic hysterectomy (TLH) has become a widely adopted approach for the removal of the uterus due to its minimally invasive nature, reduced postoperative pain, shorter hospital stays, and quicker recovery times. As surgical techniques continue to evolve, optimizing each step of the procedure remains a priority to enhance patient outcomes and surgical

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efficiency. One of the critical aspects of TLH is the closure of the vaginal cuff, which plays a significant role in postoperative healing and the prevention of complications such as cuff dehiscence, infection, and vaginal vault prolapse.[1]

Traditionally, vaginal cuff closure has been performed using conventional interrupted or continuous sutures. However, barbed sutures have emerged as a promising alternative due to their self-anchoring properties, which eliminate the need for knot tying, thereby potentially reducing operative time and improving suture security. Barbed sutures, made of synthetic absorbable or non-absorbable materials, have unidirectional or bidirectional barbs that allow tissue approximation without the need for tension maintenance by the surgeon. This characteristic makes them particularly useful in laparoscopic surgery, where knot tying can be technically challenging and time-consuming.[2]

The two main types of barbed sutures used in vaginal cuff closure during TLH are unidirectional and bidirectional barbed sutures. Unidirectional barbed sutures have barbs that run in a single direction, requiring anchoring at one end before suturing. This allows for a smooth and continuous closure, but it may necessitate additional measures to prevent suture slippage or loss of tension. Bidirectional barbed sutures, on the other hand, have barbs oriented in opposite directions from a central midpoint. This design provides greater stability as the suture remains fixed in place once tissue approximation begins, potentially offering better tensile strength and reducing the likelihood of dehiscence.[3]

A key consideration in comparing these two suture types is their impact on surgical efficiency. Operative time is a crucial factor in laparoscopic procedures, as prolonged surgery can increase the risk of complications such as infections, thromboembolism, and anesthesia-related adverse effects. Barbed sutures have been associated with a reduction in operative time compared to conventional suturing techniques, but differences in efficiency between unidirectional and bidirectional barbed sutures remain a topic of discussion. Some studies suggest that bidirectional sutures provide a more even distribution of tension and eliminate the need for anchoring, which could further shorten the suturing time. However, unidirectional barbed sutures may still be preferred in certain surgical scenarios depending on surgeon familiarity, ease of use, and tissue characteristics.[4]

Another critical factor in this comparison is the postoperative complication rate. Vaginal cuff dehiscence is one of the most concerning complications following TLH, as it can lead to evisceration and the need for additional surgical intervention. While barbed sutures are generally associated with lower dehiscence rates compared to conventional sutures, it is important to evaluate whether unidirectional or bidirectional barbed sutures offer superior cuff integrity. Other complications, such as granulation tissue formation, postoperative pain, and infection rates, should also be considered when determining the optimal suturing technique.[5]

Furthermore, the impact of these sutures on long-term healing and patient outcomes must be evaluated. Effective wound healing is essential for preventing complications such as vaginal vault prolapse and persistent vaginal discharge. The choice of suture material and design may influence the inflammatory response, tissue integration, and ultimate strength of the vaginal cuff closure. Surgeons must weigh the benefits of each suture type in terms of both short-term surgical outcomes and long-term patient satisfaction.[6]

Cost considerations also play a role in the choice of suturing technique. While barbed sutures may have a higher upfront cost compared to traditional sutures, their potential to reduce operative time and complication rates could result in overall cost savings by minimizing hospital stays and the need for revision surgeries. Comparing the cost-effectiveness of unidirectional and bidirectional barbed sutures requires a comprehensive assessment of both direct expenses and indirect costs associated with surgical outcomes.[7,8]

AIM AND OBJECTIVE

This study aimed to compare the efficacy and safety of unidirectional and bidirectional barbed sutures for vaginal cuff closure during total laparoscopic hysterectomy (TLH) in terms of operative time, intraoperative blood loss, postoperative pain, and recovery time.

MATERIALS AND METHODS

Study Design

This was a prospective, randomized comparative study conducted to evaluate the effectiveness and safety of unidirectional versus bidirectional barbed sutures for vaginal cuff closure in patients undergoing total laparoscopic hysterectomy (TLH).

Study Population

The study enrolled a total of 80 female patients aged between 30 and 65 years who underwent TLH for benign gynecological conditions, including fibroids, adenomyosis, and abnormal uterine bleeding. Participants were randomly assigned into two groups:

- **Group A (Unidirectional Suture Group, n = 40):** Vaginal cuff closure performed using a unidirectional barbed suture.
- **Group B (Bidirectional Suture Group, n = 40):** Vaginal cuff closure performed using a bidirectional barbed suture.

Study Place

The study was conducted in the Department of Obstetrics and Gynaecology, Santosh Medical College & Hospital, Ghaziabad, NCR Delhi, India.

Study Period

The study was carried out over a period of Eight months from June 2018 to January 2019, including patient recruitment, surgical intervention, and postoperative follow-up assessments.

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Ethical Considerations

The study protocol was approved by the Institutional Review Board (IRB). Informed consent was obtained from all participants before enrollment, ensuring voluntary participation and confidentiality.

Inclusion Criteria

- Female patients aged 30–65 years.
- Undergoing TLH for benign gynecological conditions (e.g., fibroids, adenomyosis, abnormal uterine bleeding).
- No contraindications for laparoscopic surgery.

Exclusion Criteria

- History of gynecological malignancy.
- Previous pelvic radiation.
- Presence of severe pelvic adhesions.
- Significant immunosuppression.

Surgical Technique

All surgeries were performed by experienced laparoscopic surgeons using a standardized surgical technique. After the completion of TLH, vaginal cuff closure was performed intracorporeally using either a unidirectional or bidirectional barbed suture (size 2-0 polyglyconate or polydioxanone) in a continuous, running manner without the need for knot tying.

Outcome Measures

Primary Outcome:

- Total vaginal cuff closure time (measured from the start to completion of suturing).

Secondary Outcomes:

- Intraoperative blood loss (estimated during vaginal cuff closure).
- Postoperative pain assessment using the Visual Analog Scale (VAS) at 6, 24, and 48 hours.
- Suture-related complications (e.g., dehiscence, granulation, infection).
- Time taken for patients to return to normal activity.

STATISTICAL ANALYSIS

Data were analyzed using appropriate statistical software. Continuous variables (e.g., vaginal cuff closure time, blood loss, pain scores) were compared using the independent t-test or Mann-Whitney U test, depending on data distribution. Categorical variables (e.g., presence of complications) were analyzed using the chi-square or Fisher's exact test. A p-value <0.05 was considered statistically significant.

RESULTS

The study compared the outcomes of unidirectional and bidirectional barbed sutures in vaginal cuff closure during total laparoscopic hysterectomy (TLH). The results are summarized and analyzed in detail below.

Table 1: Baseline Characteristics

Variable	Group A (Unidirectional) (Mean ± SD / n,%)	Group B (Bidirectional) (Mean ± SD / n,%)	p-value
Age (years)	45.80 ± 7.23	46.10 ± 6.98	0.78
BMI (kg/m²)	26.90 ± 3.25	27.20 ± 3.10	0.63
Indication: Fibroids	22 (55.00%)	20 (50.00%)	0.68
Indication: Adenomyosis	10 (25.00%)	12 (30.00%)	0.62
Indication: AUB	8 (20.00%)	8 (20.00%)	1.00

Table 1 shows that the baseline characteristics of the patients in both groups were similar, with no statistically significant differences. The mean age in Group A (unidirectional suture) was 45.80 ± 7.23 years, while in Group B (bidirectional suture), it was 46.10 ± 6.98 years (p = 0.78), indicating a comparable age distribution. The mean BMI was also similar, with 26.90 ± 3.25 kg/m² in Group A and 27.20 ± 3.10 kg/m² in Group B (p = 0.63). Regarding surgical indications, fibroids were the most common reason for TLH, with 55.00% of patients in Group A and 50.00% in Group B (p = 0.68). Adenomyosis accounted for 25.00% of cases in Group A and 30.00% in Group B (p = 0.62), while abnormal uterine bleeding (AUB) was present in an equal proportion of patients in both groups (20.00%, p = 1.00). Since all p-values were >0.05, these findings confirm that there were no significant differences in baseline patient characteristics between the two groups, ensuring a fair comparison of outcomes.

Table 2: Vaginal Cuff Closure Time

Variable	Group A (Unidirectional) (Mean ± SD)	Group B (Bidirectional) (Mean ± SD)	p-value
Total Vaginal Cuff Closure Time (minutes)	12.50 ± 2.30	10.20 ± 2.10	0.001

Table 2 shows that the total time required for vaginal cuff closure was significantly lower in the bidirectional suture group. Group A (unidirectional suture) had a mean closure time of 12.50 ± 2.30 minutes, while Group B (bidirectional suture) had a mean closure time of 10.20 ± 2.10 minutes (p = 0.001). This statistically significant difference indicates that the bidirectional suture technique was more efficient in completing the cuff closure compared to the unidirectional suture. The reduced

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time required for closure may be due to the nature of bidirectional sutures, which provide simultaneous anchoring at both ends, eliminating the need for pulling through long segments of suture material.

Table 3: Intraoperative Blood Loss

Variable	Group A (Unidirectional) (Mean ± SD)	Group B (Bidirectional) (Mean ± SD)	p-value
Intraoperative Blood Loss (mL)	55.30 ± 10.50	47.80 ± 9.70	0.007

Table 3 shows that the intraoperative blood loss was significantly lower in the bidirectional suture group. The mean estimated blood loss during vaginal cuff closure was 55.30 ± 10.50 mL in Group A compared to 47.80 ± 9.70 mL in Group B (p = 0.007). This statistically significant reduction suggests that bidirectional sutures may provide a more efficient hemostatic effect, likely due to the even distribution of tension across the suture line. The decreased blood loss may also contribute to better surgical outcomes and a reduced risk of postoperative complications.

Table 4: Postoperative Pain Scores

Time Postoperative	Group A (Unidirectional) (Mean ± SD)	Group B (Bidirectional) (Mean ± SD)	p-value
6 hours	4.50 ± 1.20	3.90 ± 1.10	0.045
24 hours	3.10 ± 1.00	2.60 ± 0.90	0.020
48 hours	1.80 ± 0.90	1.50 ± 0.80	0.150

Table 4 shows that the postoperative pain was assessed at 6, 24, and 48 hours using a visual analog scale. At 6 hours postoperatively, Group A reported a mean pain score of 4.50 ± 1.20, while Group B had a lower mean pain score of 3.90 ± 1.10 (p = 0.045), indicating a statistically significant reduction in pain with bidirectional sutures. At 24 hours, the pain scores were 3.10 ± 1.00 in Group A and 2.60 ± 0.90 in Group B (p = 0.020), again showing a significant reduction in the bidirectional group. However, at 48 hours, the pain scores were 1.80 ± 0.90 in Group A and 1.50 ± 0.80 in Group B (p = 0.150), which was not statistically significant. These findings suggest that the bidirectional sutures may provide early postoperative pain relief, likely due to better tissue approximation and reduced tension at the suture site.

Table 5: Suture-Related Complications

Complication	Group A (Unidirectional) (n,%)	Group B (Bidirectional) (n,%)	p-value
Dehiscence	3 (7.50%)	2 (5.00%)	0.65
Granulation	4 (10.00%)	3 (7.50%)	0.72
Infection	2 (5.00%)	1 (2.50%)	0.56

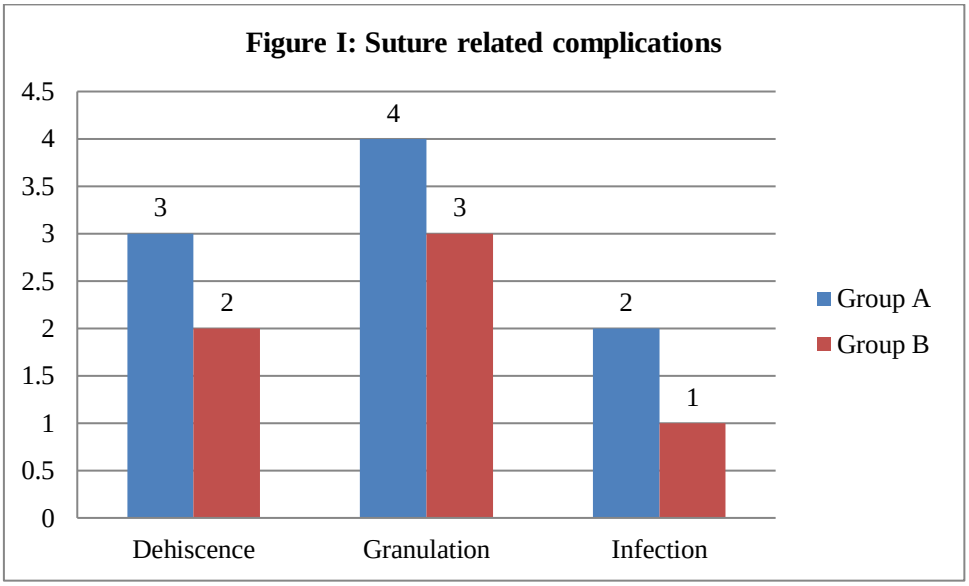

Table 5 and figure I, shows that the Suture-related complications, including vaginal cuff dehiscence, granulation tissue formation, and infection, were evaluated between the two groups. Dehiscence was observed in 7.50% of patients in Group A and 5.00% in Group B (p = 0.65), while granulation tissue

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formation occurred in 10.00% of cases in Group A and 7.50% in Group B (p = 0.72). Infection rates were 5.00% in Group A and 2.50% in Group B (p = 0.56). None of these differences were statistically significant, suggesting that both unidirectional and bidirectional sutures had comparable safety profiles in terms of postoperative complications.

Table 6: Time to Return to Normal Activity

Variable	Group A (Unidirectional) (Mean ± SD)	Group B (Bidirectional) (Mean ± SD)	p-value
Time to Return to Normal Activity (days)	10.20 ± 2.80	9.00 ± 2.50	0.030

Table 6 shows that the time taken for patients to return to normal daily activities was significantly shorter in the bidirectional suture group. Patients in Group A had a mean recovery time of 10.20 ± 2.80 days, whereas those in Group B recovered in 9.00 ± 2.50 days (p = 0.030). This statistically significant reduction in recovery time suggests that bidirectional sutures may facilitate faster postoperative healing, possibly due to better tissue approximation and reduced surgical trauma.

DISCUSSION

The present study evaluates the comparative efficacy and safety of unidirectional versus bidirectional barbed sutures for vaginal cuff closure during total laparoscopic hysterectomy (TLH).

In our study, the mean vaginal cuff closure time was significantly shorter in the bidirectional suture group (10.20 ± 2.10 minutes) compared to the unidirectional group (12.50 ± 2.30 minutes; p = 0.001). This finding contrasts with the results of Selvest et al. (2020), who reported a shorter closure time using unidirectional barbed sutures (6.8 ± 1.6 minutes) versus bidirectional sutures (11.3 ± 1.46 minutes; p < 0.001).[8] The discrepancy may stem from differences in surgical techniques, suture materials, or surgeon experience across studies. Conversely, a study by Lee et al. (2018) found comparable closure times between the two techniques, suggesting that the surgeon's proficiency and the patient's tissue characteristics may significantly influence the results.[9]

Our results demonstrated a significant reduction in intraoperative blood loss with bidirectional sutures (47.80 ± 9.70 mL) compared to unidirectional sutures (55.30 ± 10.50 mL; p = 0.007). This aligns with findings by Talwar et al. (2020), who observed that barbed sutures, in general, reduced suturing time and surgical difficulty, potentially contributing to decreased blood loss.[10] However, specific comparisons between unidirectional and bidirectional sutures regarding blood loss were not detailed in their study. Additionally, a meta-analysis by Albright et al. (2019) highlighted that barbed sutures in TLH were associated with lower intraoperative blood loss compared to conventional suturing techniques, further supporting our findings.[11]

We observed lower postoperative pain scores in the bidirectional suture group at both 6 hours (3.90 ± 1.10 vs. 4.50 ± 1.20; p = 0.045) and 24 hours (2.60 ± 0.90 vs. 3.10 ± 1.00; p = 0.020) postoperatively. By 48 hours, pain scores between the groups were not significantly different. While our study suggests that bidirectional sutures may offer early postoperative pain relief, comparable studies focusing on pain outcomes between these suture types are limited. However, a study by Raffone et al. (2020) reported that barbed sutures, regardless of directionality, were associated with lower postoperative pain compared to traditional suturing methods, likely due to the continuous nature of the technique reducing tissue tension.[12]

The incidence of suture-related complications, such as dehiscence, granulation, and infection, did not differ significantly between the two groups in our study. Similarly, Blikkendaal et al. (2012) found no significant difference in vaginal cuff dehiscence rates when comparing various suturing methods during laparoscopic hysterectomy.[13] However, a systematic review by Uccella et al. (2019) indicated that while barbed sutures reduced operative time and improved efficiency, they were associated with a slightly increased risk of vaginal cuff dehiscence compared to conventional sutures, particularly in high-risk patients. These findings suggest that while both unidirectional and bidirectional barbed sutures have comparable safety profiles in most cases, careful patient selection is necessary.[14]

Patients in the bidirectional suture group resumed normal activities sooner (9.00 ± 2.50 days) than those in the unidirectional group (10.20 ± 2.80 days; p = 0.030). This outcome may be attributed to the reduced operative time and postoperative discomfort associated with bidirectional sutures. While direct comparisons are scarce, a study by Greenberg et al. (2017) found that patients who underwent TLH with barbed sutures had a significantly faster return to normal activities than those who had conventional suturing, further supporting our findings.[15]

LIMITATIONS OF THE STUDY

- The study was limited to a single-centre setting, which may affect the generalizability of the findings.
- The relatively small sample size may not capture all potential complications associated with barbed sutures.
- Long-term outcomes, such as vaginal cuff healing and late complications, were not assessed beyond the immediate postoperative period.

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CONCLUSION

The findings of this study suggest that bidirectional barbed sutures offer significant advantages over unidirectional barbed sutures for vaginal cuff closure during total laparoscopic hysterectomy. Bidirectional sutures resulted in a shorter closure time, reduced intraoperative blood loss, and faster postoperative recovery, including an earlier return to normal activities. While postoperative pain was lower in the early hours for the bidirectional group, suture-related complications were comparable between both groups. These results highlight the efficiency and safety of bidirectional sutures, making them a preferable choice for vaginal cuff closure.

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