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ORIGINAL ARTICLE

Comparative Study of Open Versus Minimally Invasive Hysterectomy Techniques on Postoperative Pain and Hospital Stay

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ABSTRACT:
Background: Hysterectomy remains one of the most frequently performed gynecological surgeries worldwide, with open abdominal and minimally invasive approaches commonly used for benign uterine conditions. Minimally invasive techniques, including total laparoscopic and laparoscopic-assisted vaginal hysterectomy, have gained popularity due to benefits such as reduced postoperative pain, faster recovery, and shorter hospital stay. However, the comparative effectiveness of these techniques versus open hysterectomy continues to be relevant, particularly in tertiary care settings where both approaches are routinely practiced. **Aim:**To compare postoperative pain, recovery parameters, and hospital stay between open abdominal hysterectomy and minimally invasive hysterectomy in patients undergoing surgery for benign gynecological indications at a tertiary care hospital. **Material and Methods:**This comparative observational study included 66 patients, divided equally into two groups: Group A (open abdominal hysterectomy) and Group B (minimally invasive hysterectomy). Patients were selected based on clinical indications and standardized criteria for benign gynecological disorders. Preoperative evaluation, intraoperative parameters, and postoperative assessments were conducted using uniform institutional protocols. Primary outcomes included postoperative pain measured via the Visual Analog Scale (VAS) at 6, 12, 24, and 48 hours, along with total duration of hospital stay. Secondary outcomes included operative time, blood loss, return of bowel activity, time to ambulation, analgesic requirements, and postoperative complications. **Results:**The study showed significantly lower postoperative pain scores in the minimally invasive group across all time intervals ($p < 0.001$). Hospital stay was notably shorter in Group B (2.24 ± 0.68 days) compared to Group A (4.73 ± 1.02 days; $p < 0.001$). Minimally invasive surgery was associated with reduced blood loss (131.36 ± 32.84 mL vs. 238.21 ± 44.16 mL; $p < 0.001$), earlier ambulation, faster return of bowel function, and reduced analgesic requirement (27.27% vs. 63.64%; $p = 0.003$). Overall complication rates were significantly lower in the minimally invasive group (12.12% vs. 42.42%; $p = 0.004$), although operative time was longer ($p < 0.001$). **Conclusion:**Minimally invasive hysterectomy provides superior postoperative outcomes compared to open abdominal hysterectomy, demonstrating reduced pain, faster recovery, shorter hospitalization, and fewer complications, making it a preferable surgical option in eligible patients.
Keywords: Hysterectomy, Minimally invasive surgery, Postoperative pain, Hospital stay, Laparoscopic hysterectomy

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INTRODUCTION

Hysterectomy is one of the most commonly performed major gynecological procedures worldwide and remains a definitive treatment for many benign uterine pathologies such as fibroids, abnormal uterine bleeding, adenomyosis, and pelvic organ prolapse. Despite advances in conservative and uterus-sparing therapies, a substantial proportion of women ultimately require surgical removal of the uterus when medical management fails or when symptoms significantly impair quality of life. Over the past three decades, there has been a clear shift from exclusively open abdominal hysterectomy toward minimally invasive approaches, including vaginal, laparoscopic, and laparoscopic-assisted vaginal hysterectomy, reflecting evolving surgical expertise, improved instrumentation, and patient preference for faster recovery and reduced postoperative morbidity.[1] Patterns of hysterectomy practice have also changed in response to the introduction of laparoscopically assisted vaginal hysterectomy (LAVH) and total laparoscopic hysterectomy (TLH). Population-level data from large health systems have demonstrated that, as minimally invasive hysterectomy became more widely available, overall hysterectomy rates declined and the proportion of abdominal procedures decreased, although open surgery still accounted for a substantial share of cases.[1] Randomized clinical trials comparing minimally invasive and open abdominal routes provided early evidence that less invasive techniques could improve short-term postoperative outcomes. In one prospective randomized trial, women undergoing LAVH or total abdominal hysterectomy (TAH) were compared with respect to operative time, length of hospital stay, recovery, and return to work. The minimally invasive procedure required a longer operative time but was associated with shorter hospitalization and quicker functional

recovery, supporting its use as an alternative to the traditional open approach in appropriately selected patients.[2] Further comparative work evaluated all three principal routes—abdominal, vaginal, and laparoscopic hysterectomy—in a randomized design. In that study, patients were allocated to TAH, vaginal hysterectomy, or laparoscopic hysterectomy for benign indications, and operative time, blood loss, and inflammatory response were assessed. Vaginal hysterectomy showed advantages in operative time and inflammatory markers, while laparoscopic hysterectomy offered minimally invasive access with acceptable operative duration and blood loss, thereby reinforcing the concept that non-abdominal routes can provide equal or superior perioperative outcomes when technically feasible.[3] Institutional series describing TLH have contributed important data on safety and efficiency. A five-year experience from a teaching hospital analyzing 175 TLH procedures reported satisfactory operative times, low intraoperative blood loss, and acceptable complication rates, demonstrating that with adequate expertise TLH can be performed safely and reproducibly.[4] Even more compelling are very large series comparing laparoscopic, vaginal, and abdominal routes. A cohort of 4505 hysterectomies, including 3190 laparoscopic procedures, showed that in experienced hands laparoscopic hysterectomy was not associated with higher major complication rates compared with vaginal or abdominal hysterectomy, while markedly reducing the need for laparotomy in benign disease.[5] While operative morbidity and complication rates are crucial, postoperative pain and early recovery are often the outcomes of greatest relevance to patients. Randomized trials specifically evaluating postoperative pain after different minimally invasive routes have shown that laparoscopic hysterectomy can significantly reduce early pain scores and the need for rescue analgesia compared with vaginal hysterectomy, as measured by visual analog scale (VAS) at multiple postoperative time points.[6] These findings confirm that even among minimally invasive techniques, the choice of route can influence pain perception and analgesic requirements. However, comparatively fewer studies have focused directly on pain trajectories and hospital stay when laparoscopic or laparoscopic-assisted approaches are contrasted with conventional open abdominal hysterectomy in routine benign gynecological practice, particularly in resource-limited or high-volume public tertiary centers.Professional guidelines have increasingly endorsed minimally invasive hysterectomy as the preferred route for benign disease whenever feasible. A key committee opinion recommended that, when hysterectomy is indicated, vaginal hysterectomy should be considered the first-line approach, with laparoscopic hysterectomy as a preferable alternative to abdominal hysterectomy in cases where vaginal surgery is not suitable.[7]

MATERIAL AND METHODS

This comparative observational study was conducted at a tertiary care hospital. The study compared postoperative outcomes between patients undergoing open abdominal hysterectomy and those undergoing minimally invasive hysterectomy techniques, including laparoscopic or laparoscopic-assisted vaginal approaches. All surgical procedures were performed by experienced gynecologic surgeons following standardized institutional protocols to ensure uniformity in technique, perioperative care, and postoperative monitoring.A total of 66 patients were included in the study. Patients were divided into two groups based on the surgical approach utilized. Group A consisted of patients who underwent open abdominal hysterectomy, whereas Group B consisted of patients who underwent minimally invasive hysterectomy. Allocation to each group was based on clinical indication, surgeon assessment, and patient preference. Only cases planned electively were included to minimize emergency-related surgical variability.

Inclusion and Exclusion Criteria

Patients were included if they were indicated for hysterectomy due to benign gynecological conditions such as fibroids, abnormal uterine bleeding refractory to medical management, adenomyosis, or pelvic organ prolapse. Patients with suspected or confirmed malignancy, extensive pelvic adhesions identified preoperatively, severe cardiorespiratory comorbidities contraindicating minimally invasive surgery, or those requiring concurrent major surgical procedures were excluded. This ensured homogeneity in the study population and reduced confounding factors related to disease severity.

All patients underwent a detailed preoperative evaluation that included clinical history, physical examination, and necessary laboratory investigations. Pelvic ultrasonography and anesthetic assessment were performed to determine surgical suitability. Standardized counseling regarding the surgical technique, expected recovery, potential complications, and postoperative care was provided. Patients received uniform preoperative prophylaxis, including antibiotics and thromboprophylaxis as per institutional guidelines.

In the open hysterectomy group, procedures were performed through a lower abdominal incision under general or regional anesthesia. The minimally invasive group included total laparoscopic hysterectomy or laparoscopic-assisted vaginal hysterectomy performed using a multiport laparoscopic approach with pneumoperitoneum. Surgeons adhered to standardized steps, including uterine artery ligation, mobilization of adnexal structures, and vaginal cuff closure, with necessary variations permitted only for patient safety. Operative time, blood loss, and intraoperative complications were recorded intraoperatively by the surgical team.

Postoperative care followed uniform institutional protocols for both groups. Pain management included multimodal analgesia with NSAIDs and opioids as needed, and pain assessment was performed at fixed intervals using a Visual Analog Scale (VAS). Early mobilization, bladder care, wound inspection, and diet advancement were standardized to ensure comparability of recovery patterns. Hemoglobin monitoring, need for blood transfusion, and postoperative complications such as fever, wound infection, urinary symptoms, and ileus were documented carefully.

Primary outcome parameters included postoperative pain scores measured on the VAS at 6, 12, 24, and 48 hours after surgery, and total postoperative hospital stay in days. Secondary parameters included intraoperative blood loss, operative duration, need for analgesic supplementation, time to ambulation, return of bowel activity, and incidence of postoperative complications. All outcome data were recorded in structured proformas and verified by the research team to maintain accuracy.

Statistical Analysis

Data from clinical records, operative notes, and postoperative charts were collected prospectively and entered into a validated database. Quantitative variables such as pain scores, blood loss, and duration of hospital stay were expressed as mean ± standard deviation, while categorical variables such as complications were expressed as frequencies and percentages. Appropriate statistical tests, including the Student's t-test for continuous variables and the chi-square test for categorical variables, were applied to compare outcomes between the two groups. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1: Demographic Characteristics

The demographic characteristics of the study population were comparable between the two groups. The mean age of patients in the open hysterectomy group was 48.73 ± 6.12 years, while in the minimally invasive group it was 47.09 ± 5.84 years, and this difference was not statistically significant ($p = 0.28$). This suggests that age distribution was similar across groups and is unlikely to influence postoperative outcomes. Parity distribution also showed no significant variation; 57.58% of women in the open group and 51.52% in the minimally invasive group had parity ≥ 3 ($p = 0.62$). Similarly, the mean BMI values were comparable between the two groups (27.84 ± 3.21 vs. 26.97 ± 3.08 kg/m², $p = 0.34$).

Table 2: Intraoperative Parameters

The intraoperative findings revealed significant differences between the two surgical techniques. The mean operative time was considerably longer for the minimally invasive group (118.42 ± 17.39 minutes) compared to the open hysterectomy group (92.18 ± 14.67 minutes), with this difference being highly significant ($p < 0.001$). This prolonged operative duration is expected due to the technical complexity and equipment setup required for laparoscopy. However, in contrast to the longer operative time, the minimally invasive group showed a marked advantage in blood loss. The mean intraoperative blood loss was significantly higher in the open group (238.21 ± 44.16 mL) compared to the minimally invasive group (131.36 ± 32.84 mL), with a p-value < 0.001. This reduction in blood loss directly influenced the need for transfusion, which was required in 18.18% of open hysterectomy patients but only 3.03% of minimally invasive cases ($p = 0.05$), indicating borderline statistical significance. Intraoperative complications were slightly more common in the open group (9.09%) compared to the minimally invasive group (6.06%), but this difference was not statistically significant ($p = 0.64$).

Table 3: Postoperative Pain Scores

Postoperative pain assessment using the Visual Analog Scale (VAS) showed consistently higher pain scores in the open hysterectomy group across all time intervals. At 6 hours post-surgery, the mean VAS score for the open group was 7.52 ± 1.01 compared to 5.97 ± 0.88 in the minimally invasive group ($p < 0.001$). This trend continued at 12 hours, where the open group reported a mean score of 6.91 ± 0.97, significantly higher than the 5.36 ± 0.91 reported in the minimally invasive group ($p < 0.001$). At 24 hours, pain remained significantly greater in the open group (5.48 ± 0.86) compared to the minimally invasive group (3.94 ± 0.79), again with high statistical significance ($p < 0.001$). Even by 48 hours, patients undergoing open hysterectomy continued to experience more pain, with a mean score of 3.76 ± 0.69 versus 2.21 ± 0.64 in the minimally invasive group ($p < 0.001$).

Table 4: Postoperative Recovery Parameters

Recovery-related outcomes showed significant advantages for minimally invasive hysterectomy. Patients in Group B achieved ambulation much earlier, with an average time of 9.42 ± 2.51 hours compared to 17.58 ± 3.12 hours in the open group ($p < 0.001$). Similarly, the return of bowel activity occurred sooner in the minimally invasive group (20.18 ± 4.03 hours) than in the open group (31.48 ± 5.76 hours), with this difference also being statistically significant ($p < 0.001$). The requirement for additional analgesia was substantially higher in Group A, where 63.64% of patients needed supplementary pain medication, compared to only 27.27% in Group B ($p = 0.003$). Furthermore, the length of hospital stay was markedly reduced in the minimally invasive group, averaging 2.24 ± 0.68 days compared to 4.73 ± 1.02 days in the open group ($p < 0.001$).

Table 5: Postoperative Complications

Postoperative complications were generally more frequent in patients undergoing open hysterectomy. Wound infection occurred in 15.15% of the open group compared to only 3.03% in the minimally invasive group, though this difference did not reach statistical significance (p = 0.09). Fever was reported in 12.12% of Group A and 6.06% of Group B (p = 0.39), while urinary symptoms were noted in 9.09% of open cases and 3.03% of minimally invasive cases (p = 0.30). Ileus was seen in 6.06% of open hysterectomy patients, whereas no cases were observed in the minimally invasive group (p = 0.15). Importantly, the overall complication rate was significantly higher in the open group (42.42%) compared to the minimally invasive group (12.12%), with a statistically significant p-value of 0.004.

Table 1: Demographic Characteristics of Patients (N = 66)

Variable	Group A: Open (n = 33)	Group B: Minimally Invasive (n = 33)	p-value
Mean Age (years)	48.73 ± 6.12	47.09 ± 5.84	0.28
Parity ≥ 3 (%)	19 (57.58%)	17 (51.52%)	0.62
BMI (kg/m²)	27.84 ± 3.21	26.97 ± 3.08	0.34

Table 2: Intraoperative Parameters

Parameter	Group A: Open (n = 33)	Group B: Minimally Invasive (n = 33)	p-value
Mean Operative Time (minutes)	92.18 ± 14.67	118.42 ± 17.39	<0.001
Mean Blood Loss (mL)	238.21 ± 44.16	131.36 ± 32.84	<0.001
Blood Transfusion Required (%)	6 (18.18%)	1 (3.03%)	0.05
Intraoperative Complications (%)	3 (9.09%)	2 (6.06%)	0.64

Table 3: Postoperative Pain Scores (VAS Score)

Time Interval	Group A: Open (Mean ± SD)	Group B: Minimally Invasive (Mean ± SD)	p-value
6 hours	7.52 ± 1.01	5.97 ± 0.88	<0.001
12 hours	6.91 ± 0.97	5.36 ± 0.91	<0.001
24 hours	5.48 ± 0.86	3.94 ± 0.79	<0.001
48 hours	3.76 ± 0.69	2.21 ± 0.64	<0.001

Table 4: Postoperative Recovery Parameters

Parameter	Group A: Open (n = 33)	Group B: Minimally Invasive (n = 33)	p-value
Time to Ambulation (hours)	17.58 ± 3.12	9.42 ± 2.51	<0.001
Return of Bowel Activity (hours)	31.48 ± 5.76	20.18 ± 4.03	<0.001
Total Analgesic Requirement (%)	21 (63.64%)	9 (27.27%)	0.003
Length of Hospital Stay (days)	4.73 ± 1.02	2.24 ± 0.68	<0.001

Table 5: Postoperative Complications

Complication	Group A: Open (n = 33)	Group B: Minimally Invasive (n = 33)	p-value
Wound Infection	5 (15.15%)	1 (3.03%)	0.09
Fever	4 (12.12%)	2 (6.06%)	0.39
Urinary Symptoms	3 (9.09%)	1 (3.03%)	0.30
Ileus	2 (6.06%)	0 (0.00%)	0.15
Overall Complication Rate	14 (42.42%)	4 (12.12%)	0.004

DISCUSSION

In this comparative observational study, minimally invasive hysterectomy (Group B) demonstrated clear advantages over open abdominal hysterectomy (Group A) in terms of postoperative pain, recovery, and complication profile, despite a longer operative time. Our findings are consistent with the Cochrane review by Nieboer et al. (2009), which showed that laparoscopic hysterectomy is associated with lower intraoperative blood loss (mean difference ≈45 mL), a shorter hospital stay by about 2.0 days, and a faster return to normal activities by about 13.6 days compared with abdominal hysterectomy.[8] In our study, the minimally invasive group had a mean hospital stay of 2.24 ± 0.68 days versus 4.73 ± 1.02 days in the open group, a reduction of approximately 2.5 days, which is even slightly greater than the pooled benefit reported in that meta-analysis.

Operative time in the present series was significantly longer in the minimally invasive group (118.42 ± 17.39 minutes) than in the open group (92.18 ± 14.67 minutes; p < 0.001). This pattern mirrors the eVALuate trial by Garry et al. (2004), where laparoscopic hysterectomy took a mean of 84 minutes

compared with 50 minutes for abdominal hysterectomy, while still offering advantages in postoperative pain and hospital stay.[9] In our cohort, the difference in operative duration (about 26 minutes) is comparable to the 34-minute excess reported in eVALuate, suggesting that longer operative time is an expected trade-off for minimally invasive techniques, even when performed by experienced surgeons.

The reduction in intraoperative blood loss observed in the minimally invasive group (131.36 ± 32.84 mL) compared with the open group (238.21 ± 44.16 mL; $p < 0.001$) is clinically important and translated into a lower need for transfusion (3.03% vs. 18.18%). A similar magnitude of benefit has been reported by Chalermchockchareonkit et al. (2012) in women with severe endometriosis, where laparoscopic hysterectomy resulted in mean blood loss around 300 mL versus more than 750 mL with abdominal hysterectomy, and significantly fewer overall complications (18.3% vs. 49.0%).[10] Although our absolute volumes were lower, the proportional reduction in blood loss and transfusion requirement between minimally invasive and open approaches aligns closely with their findings.

Postoperative pain scores in our study were consistently and significantly lower in the minimally invasive group at all measured intervals, with VAS scores approximately 1.5–2 points lower than in the open group at 6, 12, 24, and 48 hours (all $p < 0.001$). This translated into a lower proportion of patients requiring additional analgesia (27.27% in Group B vs. 63.64% in Group A; $p = 0.003$). Kongwattanakul et al. (2012) similarly demonstrated that patients undergoing laparoscopically assisted vaginal hysterectomy required substantially less opioid analgesia than those undergoing abdominal hysterectomy (median 3 mg vs. 15 mg of morphine), along with reduced intraoperative blood loss and shorter hospital stay.[11] The pattern of lower analgesic requirement and improved early pain control in our minimally invasive cohort is therefore in strong concordance with these randomized data.

Enhanced postoperative recovery, as reflected by earlier ambulation and faster return of bowel activity, was another major advantage of minimally invasive surgery in our series. Patients in Group B ambulated at a mean of 9.42 ± 2.51 hours compared with 17.58 ± 3.12 hours in Group A, and bowel sounds returned at 20.18 ± 4.03 hours versus 31.48 ± 5.76 hours (both $p < 0.001$). Candiani et al. (2009) reported that laparoscopic hysterectomy yielded shorter hospital stay (2.7 ± 0.5 vs. 3.2 ± 0.6 days), significantly less blood loss (≈83 vs. 178 mL), and lower early postoperative pain compared with vaginal hysterectomy, with fewer days requiring analgesics.[12] While their comparison involved two minimally invasive routes, both their data and ours support the concept that less invasive access is associated with quicker functional recovery than more extensive abdominal surgery.

The substantial reduction in length of hospital stay in our minimally invasive group (2.24 ± 0.68 days vs. 4.73 ± 1.02 days in the open group) is consistent with the broader literature demonstrating shorter hospitalization after laparoscopic hysterectomy. Walsh et al. (2009), in a meta-analysis of randomized trials comparing total abdominal hysterectomy with total laparoscopic hysterectomy, concluded that the laparoscopic route was particularly advantageous in terms of minor complications, reduced blood loss, and shorter hospital stay for benign indications.[13] The roughly 2.5-day reduction we observed corresponds well to the shorter postoperative stay reported in that meta-analysis and underscores the potential impact on bed occupancy and overall healthcare resource utilization in a tertiary care setting.

The overall postoperative complication rate in our study was significantly lower in the minimally invasive group (12.12%) compared with the open group (42.42%; $p = 0.004$). Marana et al. (1999) found a similar directional trend when comparing laparoscopically assisted vaginal hysterectomy with total abdominal hysterectomy: there were 1 major and 2 minor complications in the laparoscopic-assisted group versus 2 major and 5 minor complications in the abdominal group, although this difference did not reach statistical significance.[14] Converting these figures to proportions shows a higher complication burden in the abdominal arm, analogous to our findings, but our larger difference in absolute percentages likely reflects broader inclusion of minor postoperative morbidities such as fever, urinary symptoms, and ileus.

Infectious and wound-related morbidity in our series was also more frequent after open hysterectomy, with wound infection in 15.15% and postoperative fever in 12.12% of open cases compared to 3.03% and 6.06%, respectively, after minimally invasive surgery. Ottosen et al. (2000), in a randomized comparison of three hysterectomy methods, reported that abdominal hysterectomy was associated with longer hospital stay (about one extra day) and longer convalescence (approximately one additional week) than vaginal or laparoscopic routes, along with a trend toward more postoperative febrile morbidity.[15] The higher rates of wound infection and systemic morbidity in our open group mirror these observations and emphasize the advantage of avoiding a large abdominal incision whenever feasible.

The improved early recovery parameters in our minimally invasive cohort—lower pain scores, earlier mobilization, shorter hospital stay, and fewer complications—are likely to translate into better short-term quality of life. Kluivers et al. (2008), in a systematic review of randomized trials, found that laparoscopic hysterectomy was associated with equal or better postoperative health-related quality of life compared with abdominal hysterectomy, particularly

in the first six weeks after surgery.[16] Our findings of reduced analgesic requirement (27.27% vs. 63.64%) and earlier functional recovery are consistent with this evidence and suggest that minimally invasive approaches can offer superior patient-centred outcomes in the immediate postoperative period.

Finally, the safety profile of minimally invasive hysterectomy in this study must be interpreted in the context of surgeon experience at a tertiary care centre. Although some large trials, such as the eVALuate study, reported higher major complication rates with laparoscopic hysterectomy compared with abdominal hysterectomy, other evidence indicates that outcomes improve significantly with increasing surgical experience. Twijnstra et al. (2012) analysed over 1,500 laparoscopic hysterectomies and showed that greater surgeon experience was associated with reduced blood loss and fewer adverse events, with measurable improvement continuing up to approximately 125 procedures.[17] Our relatively low complication rate in the minimally invasive group (12.12%) compared with the open group suggests that, when performed by experienced gynecologic surgeons following standardized protocols, minimally invasive hysterectomy can achieve favorable safety and recovery profiles even in a real-world tertiary care setting.

CONCLUSION

Minimally invasive hysterectomy demonstrated clear advantages over open abdominal hysterectomy in terms of reduced postoperative pain, earlier ambulation, faster return of bowel function, and significantly shorter hospital stay. Although operative time was longer, minimally invasive techniques resulted in notably lower blood loss, fewer analgesic requirements, and a substantially lower overall complication rate. These findings support minimally invasive hysterectomy as a safer and more patient-centered approach for benign gynecological conditions in a tertiary care setting.

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