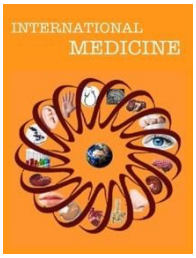

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**Original Research Article**

# Total Laparoscopic versus Abdominal Hysterectomy for Benign Uterine Conditions: A Prospective Comparative Evaluation of Surgical Outcomes, Recovery, and Safety in a Tertiary Teaching Institute Running Head – Laproscopic vs Abdominal Hysterectomy Ouctomes

**Dr. Sonal Jamwal, MS[1]*, Dr. Rama Thakur, MS[2], Dr. Sandeep Singh Rathore, MS[3], Dr Ananya Thakur, MBBS[4]**

[1]Junior Resident, Department of Obstetrics & Gynaecology, Kamla Nehru State Hospital for Mother and Child, IGMC Shimla, India
[2]Professor, Department of Obstetrics & Gynaecology, KNSHM&C, IGMC Shimla, India
[3]Assistant Professor, Department of Obstetrics & Gynaecology, KNSHM&C, IGMC Shimla, India
[4]Foundation 2nd Year Doctor at University Hospitals of North Midlands NHS Foundation Trust

Corresponding Author: **Dr. Sonal Jamwal, MS**

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**Abstract**

**Introduction**

Hysterectomy is one of the most commonly performed gynecological procedures. With advances in minimally invasive surgery, Total Laparoscopic Hysterectomy (TLH) offers a potential alternative to the traditional Total Abdominal Hysterectomy (TAH) for benign uterine conditions.

Materials and Methods

This prospective cohort study was conducted over one year at Kamla Nehru State Hospital, IGMC Shimla. A total of 76 women with benign uterine conditions and uterine size ≤12 weeks were randomized into two groups: TLH (n=38) and TAH (n=38). Intraoperative parameters such as operative time, blood loss, and complications were assessed, along with postoperative outcomes including hemoglobin drop, pain relief, hospital stay, catheterization duration, and recovery. Statistical significance was set at $p<0.05$.

**Results:**

Both groups were demographically comparable. TLH had a longer operative time (94.47 vs. 83.42 minutes, $p<0.001$) but showed significant advantages in reduced blood loss and hemoglobin drop ($p<0.001$), fewer wound infections (2.6% vs. 13.1%, $p=0.002$), shorter hospital stay (<3 days in 76.3% TLH vs. 28.9% TAH, $p<0.001$), quicker pain relief ($p=0.002$), and shorter catheterization duration ($p=0.050$). Conversion to TAH was required in 7.9% of TLH cases. No significant differences were found in remote complications or ICU admissions.

**Conclusion:**

TLH demonstrates better perioperative outcomes than TAH for benign uterine conditions. Despite a longer operative time, TLH is associated with reduced morbidity and faster recovery, making it a favorable option when laparoscopic expertise is available

**Keywords**: Total Laparoscopic Hysterectomy, Total Abdominal Hysterectomy, Benign Gynecological Conditions, Intraoperative Complications, Postoperative Recovery..

## Introduction

Hysterectomy, the surgical removal of the uterus, remains one of the most frequently performed gynecological procedures worldwide, with hundreds of thousands of cases conducted annually in countries like the United States and the United Kingdom. Historically, the origins of the term "hysterectomy" trace back to ancient Greek medicine, where “hystera” referred to the uterus, and surgical removal was associated with treating so-called "hysteria" in women. Over the centuries, evolving surgical techniques have redefined the approach to hysterectomy, moving from the more invasive abdominal procedures to minimally invasive strategies such as vaginal and laparoscopic hysterectomy.[1-4]

Among the surgical options available today, Total Abdominal Hysterectomy (TAH) and Total Laparoscopic Hysterectomy (TLH) are commonly employed for the management of benign uterine conditions such as fibroids, adenomyosis, and abnormal uterine bleeding. While TAH offers excellent visibility and control during surgery—particularly beneficial in cases involving large uteri or complex pelvic pathology—it is associated with increased postoperative morbidity, including longer hospital stays, higher blood loss, and prolonged recovery times.[5-8]

In contrast, TLH represents a significant advancement in minimally invasive gynecological surgery. Introduced in 1989, laparoscopic hysterectomy techniques have been increasingly adopted due to their association with reduced surgical trauma,

quicker patient recovery, and fewer complications. TLH allows for enhanced visualization of pelvic structures, greater surgical precision, and shorter convalescence. However, widespread adoption of TLH, especially in cases involving large uteri, remains limited due to its steep learning curve, longer operative times, and technical challenges such as morcellation and intraoperative navigation in restricted anatomical spaces.[9-13]

Despite the clear advantages and limitations of each technique, there remains a lack of consensus regarding the optimal surgical approach, particularly in patients with uteri up to 12 weeks in size. The choice of procedure often depends on a combination of patient characteristics, surgical expertise, and institutional resources. In this context, understanding the comparative safety, efficacy, and postoperative outcomes of TLH versus TAH is essential to guide evidence-based surgical decision-making.

This study aims to address this gap by prospectively evaluating and comparing the intraoperative and postoperative outcomes of TLH and TAH in women with benign uterine conditions. Through a detailed analysis of operative time, blood loss, complication rates, hospital stay, recovery, and patient morbidity, this research seeks to provide valuable insights to support clinical decision-making and inform surgical best practices.

## Materials and Methods

### Study Design and Setting

This prospective cohort study was conducted over a period of one year in the Department of Obstetrics and Gynaecology at Kamla Nehru State Hospital for Mother and Child, Indira Gandhi Medical College (IGMC), Shimla. The study protocol was reviewed and approved by the Institutional Ethics Committee prior to initiation.

### Study Population

A total of 76 women planned for hysterectomy due to benign uterine conditions were recruited. Eligible participants were identified based on specific inclusion and exclusion criteria and were enrolled after obtaining informed written consent. They were then randomized into two equal groups using computer-generated random number tables. Group A comprised 38 women who underwent Total Laparoscopic Hysterectomy (TLH), while Group B included 38 women who underwent Total Abdominal Hysterectomy (TAH). Although the randomization process allocated participants, the final surgical route was chosen by the patient following detailed counseling on the benefits and risks of both procedures.

### Eligibility Criteria

Women were included if they had benign uterine conditions such as leiomyoma, adenomyosis, simple or complex endometrial hyperplasia without atypia, or benign endometrial polyps, and were symptomatic with issues such as abnormal uterine bleeding, pelvic pain, or bulk-related complaints. Only women with uterine size up to 12 weeks on clinical or ultrasound evaluation were considered. Exclusion criteria included suspected or confirmed pelvic malignancy, chronic pelvic inflammatory disease, endometriosis, adnexal masses, uterovaginal prolapse, asymptomatic fibroids, inability to provide consent, and significant uncontrolled systemic illnesses such as hypertension, diabetes, renal disease, cardiovascular disease, or connective tissue disorders.

### Sample Size Calculation

The sample size was calculated using OpenEpi software, based on a 95% confidence level, 80% power, and a clinically meaningful difference of two days in mean postoperative hospital stay between the TLH and TAH groups. Assuming standard deviations of 1.28 days for TLH and 4 days for TAH, the final required sample size was determined to be 76 participants, with 38 in each group.

### Surgical Team and Observer Protocol

All surgeries were performed by a consistent team of experienced consultants and faculty who routinely conducted both abdominal and laparoscopic hysterectomies. Independent observers, who were not involved in decision-making regarding the route of surgery or intraoperative care, were responsible for measuring and recording outcomes, ensuring objectivity and reducing observer bias.

### Preoperative Assessment

Each participant underwent a comprehensive preoperative evaluation, including a detailed medical history and physical examination. Diagnostic work-up included transabdominal and/or transvaginal ultrasound to assess uterine size, myometrial lesions, endometrial thickness, and the status of bilateral adnexa. Endometrial biopsy and Pap smear were performed in all participants to rule out malignancy. Routine laboratory investigations included complete hemogram with ESR, fasting blood glucose, renal and liver function tests, coagulation profile, thyroid function tests, viral serology (HIV, HBsAg, HCV, VDRL), ABORh typing, chest X-ray, and ECG. All patients were admitted two days before surgery and received standard preoperative preparation with antibiotics, antiemetics, and anxiolytics as per institutional protocol.

### Intraoperative Assessment

During surgery, data were collected on the type of hysterectomy performed, type of anesthesia used, operative duration (from initial incision to wound closure), and estimated blood loss. Blood loss was quantified using suction canisters and mop counts. Intraoperative complications were recorded, including injuries to the bladder, ureters, bowel, and vascular structures. Any need for intraoperative blood transfusion was also documented.

### Postoperative Evaluation

Postoperative outcomes were closely monitored. Hemoglobin levels were checked, and any postoperative blood transfusion requirement was noted. Duration of urinary catheterization and incidence of urinary retention were evaluated. Systemic complications, hospital stay from the first postoperative day to discharge, and any readmissions or reoperations were also recorded. Postoperative complications included pyrexia (>38°C), wound infections, urinary tract infections, vault hematomas, significant bleeding, and any iatrogenic injuries requiring further surgical intervention. Late complications such as urinary leakage or ureterovaginal fistula were assessed at the follow-up visit 4–6 weeks after surgery. Vault healing and vaginal discharge were also evaluated through per-speculum examination.

**Statistical Analysis**

Data was compiled and analyzed using standard statistical software. Continuous variables such as operative time, blood loss, hemoglobin drop, and hospital stay were expressed as means with standard deviations and compared between groups using the Student's t-test. Categorical variables such as complication rates and transfusion requirements were compared using the Chi-square test. A p-value of less than 0.05 was considered statistically significant for all comparisons.

## Results

**A prospective cohort study was conducted on 76 women undergoing hysterectomy for benign uterine conditions, comparing intraoperative and postoperative outcomes between Total Laparoscopic Hysterectomy (TLH, Group A) and Total Abdominal Hysterectomy (TAH, Group B). Each group comprised 38 participants.**

**Table 1. Demographic and Baseline Characteristics of Study Participants (N = 76)**

| Parameter | Group A (TLH) (n = 38) | Group B (TAH) (n = 38) | Total (N = 76) | p-value |
|---|---|---|---|---|
| **Age (years), Mean ± SD** | 48.42 ± 3.10 | 49.01 ± 3.56 | — | 0.685 |
| Age Group 40–45 years | 2 (5.3%) | 2 (5.3%) | 4 (5.3%) | |
| Age Group 45–50 years | 30 (78.9%) | 27 (71.1%) | 57 (75.0%) | |
| Age Group > 50 years | 6 (15.8%) | 9 (23.7%) | 15 (19.7%) | |
| **Place of Residence** | | | | 0.435 |
| - Rural | 26 (68.4%) | 30 (78.9%) | 56 (73.7%) | |
| - Urban | 12 (31.6%) | 8 (21.1%) | 20 (26.3%) | |
| **Educational Status** | | | | 0.0021 |
| - Illiterate | 2 (5.2%) | 6 (15.8%) | 8 (10.5%) | |
| - Primary | 4 (10.5%) | 16 (42.1%) | 20 (26.3%) | |
| - Secondary | 9 (23.6%) | 8 (21.1%) | 17 (22.3%) | |
| - Higher Secondary | 8 (21.1%) | 5 (13.1%) | 13 (17.1%) | |
| - Graduate and above | 15 (39.4%) | 3 (7.8%) | 18 (23.6%) | |
| **Menopausal Status** | | | | 0.701 |
| - Premenopausal | 7 (18.4%) | 6 (15.8%) | 13 (17.1%) | |
| - Perimenopausal | 24 (63.2%) | 22 (57.8%) | 46 (60.5%) | |
| - Menopausal | 7 (18.4%) | 10 (26.4%) | 17 (22.4%) | |
| **Parity** | | | | 0.165 |
| - Para 2 | 20 (52.6%) | 13 (34.2%) | 33 (43.4%) | |
| - Para ≥ 3 | 18 (47.4%) | 25 (65.8%) | 43 (56.6%) | |
| **Uterine Size on Bimanual Exam** | | | | 0.25 |
| - Normal size | 10 (26.3%) | 11 (28.9%) | 21 (27.6%) | |
| - 6–8 weeks | 6 (15.7%) | 4 (10.5%) | 10 (13.5%) | |
| - 8–10 weeks | 6 (15.7%) | 5 (13.1%) | 11 (14.4%) | |
| - 10–12 weeks | 16 (42.1%) | 18 (47.3%) | 34 (44.7%) | |
| **Medical Co-morbidities** | 23 (60.5%) | 32 (84.2%) | 55 (72.4%) | 0.039 |
| - Controlled Diabetes Mellitus | 6 (26.0%) | 8 (25.0%) | 14 (25.4%) | |
| - Controlled Hypertension | 9 (39.1%) | 7 (21.8%) | 16 (29.0%) | |
| - Chronic Obstructive Pulmonary Disease (COPD) | 0 (0%) | 4 (12.5%) | 4 (7.2%) | |
| - Hypothyroidism | 7 (30.4%) | 11 (34.3%) | 18 (32.7%) | |
| - History of Myocardial Infarction | 1 (4.3%) | 2 (6.2%) | 3 (5.4%) | |

Table 1 outlines the demographic profile and baseline clinical parameters of the 76 participants equally divided into TLH (Group A) and TAH (Group B). The mean age of participants was comparable between the groups (48.42 ± 3.10 vs. 49.01 ± 3.56 years, $p = 0.685$), with most women in the perimenopausal age range. There was no statistically significant difference in place of residence or menopausal status between the groups, though rural representation was higher overall, reflecting the state's demographics. Educational attainment differed significantly ($p = 0.0021$), with a higher proportion of graduates in the TLH group. Parity and uterine size distribution were similar across both groups. However, medical co-morbidities were significantly more common in the TAH group (84.2% vs. 60.5%, $p = 0.039$), including conditions like COPD, hypertension, hypothyroidism, and previous myocardial infarction—likely influencing surgical route selection.

**Table-2: Clinical Indications for Hysterectomy Among Study Participants (N = 76)**

| Indication | Group A (TLH) (n = 38) | Group B (TAH) (n = 38) | Total (N = 76) | p-value |
|---|---|---|---|---|
| **Abnormal Uterine Bleeding (AUB)** | | | | |
| - AUB-P (Polyp) | 3 (7.9%) | 2 (5.2%) | 5 (6.6%) | |
| - AUB-A (Adenomyosis) | 4 (10.5%) | 12 (31.6%) | 16 (21.1%) | |
| - AUB-L (Leiomyoma) | 16 (42.1%) | 7 (18.4%) | 23 (30.3%) | |
| - AUB-M (Malignancy Ruled Out/Myometrial Disorders) | 5 (13.2%) | 3 (7.9%) | 8 (10.5%) | |
| **Leiomyoma (Non-AUB Symptoms)** | 3 (7.9%) | 10 (26.3%) | 13 (17.1%) | |
| **Postmenopausal Bleeding (PMB)** | | | | |
| - Atrophic Endometrium | 7 (18.4%) | 2 (5.2%) | 9 (11.8%) | |

| | | | | |
|---|---|---|---|---|
| - Endometritis | 0 (0%) | 2 (5.2%) | 2 (2.6%) | |
| **Total** | 38 (100%) | 38 (100%) | 76 (100%) | **0.025** |

As shown in Table 2 categorizes the clinical indications prompting hysterectomy. Abnormal uterine bleeding (AUB) accounted for the majority of cases, with AUB-L (fibroid-related bleeding) more prevalent in TLH (42.1%), while AUB-A (adenomyosis) and non-bleeding fibroid symptoms were significantly more common in TAH (31.6% and 26.3%, respectively). Postmenopausal bleeding (PMB), predominantly due to atrophic endometrium, contributed to 11.8% of total cases. Endometritis was noted only in the TAH group. The difference in the indication profile was statistically significant ($p = 0.025$), suggesting that larger or more complex pathology often led to preference for the abdominal route.

Table-3 Preoperative Clinical and Investigative Parameters of Study Participants (N = 76)

| **Parameter** | **Group A (TLH) (n = 38)** | **Group B (TAH) (n = 38)** | **Total (N = 76)** | **p-value** |
|---|---|---|---|---|
| **Preoperative Hemoglobin (g/dL)** | | | | 0.724 |
| - 8–9.9 g/Dl | 5 (13.1%) | 7 (18.4%) | 12 (15.7%) | |
| - 10–10.9 g/Dl | 5 (13.1%) | 3 (7.8%) | 8 (10.5%) | |
| - 11–11.9 g/dL | 6 (15.7%) | 4 (10.5%) | 10 (13.1%) | |
| - ≥12 g/Dl | 22 (57.8%) | 24 (63.1%) | 46 (60.5%) | |
| **Cervical Cytology Report** | | | | 0.277 |
| - NILM (Negative for Intraepithelial Lesion) | 25 (65.8%) | 16 (42.1%) | 41 (53.9%) | |
| - Non-Neoplastic Cellular Changes | 8 (21.1%) | 10 (26.3%) | 18 (23.6%) | |
| - Inflammatory Changes | 2 (5.3%) | 4 (7.9%) | 6 (6.6%) | |
| - Benign Endometrial Cells | 3 (7.9%) | 5 (13.2%) | 8 (10.5%) | |
| - LSIL / HSIL | 0 / 0 | 2 (5.3%) / 1 (2.6%) | 2.6% / 1.3% | |
| **Ultrasound Findings (Uterus)** | | | | 0.050 |
| - Normal | 9 (23.6%) | 2 (5.3%) | 11 (14.4%) | |
| - Abnormal Uterine Findings | 29 (76.3%) | 36 (94.7%) | 65 (85.5%) | |
| • Polyp | 3 (10.3%) | 2 (5.5%) | 5 (7.6%) | |
| • Adenomyosis | 4 (13.7%) | 12 (33.3%) | 16 (24.6%) | |
| • Leiomyoma | 17 (58.6%) | 19 (52.7%) | 36 (55.3%) | |
| • Thickened Endometrium | 5 (17.2%) | 3 (8.3%) | 8 (12.3%) | |
| **Endometrial Histopathology** | | | | 0.111 |
| - Hyperplasia with Atypia | 0 (0%) | 2 (5.2%) | 2 (2.6%) | |
| - Hyperplasia without Atypia | 2 (5.2%) | 8 (21.0%) | 10 (13.2%) | |
| - Benign Endometrial Polyp | 4 (10.5%) | 2 (5.2%) | 6 (7.8%) | |
| - Disordered Proliferative Phase | 12 (31.5%) | 8 (21.0%) | 20 (26.3%) | |
| - Secretory Phase | 12 (31.5%) | 14 (36.8%) | 26 (34.2%) | |
| - Atrophic Endometrium | 7 (18.4%) | 2 (5.2%) | 9 (11.8%) | |
| - Endometritis | 1 (2.6%) | 2 (5.2%) | 3 (3.9%) | |
| **Preoperative Pharmacotherapy Received** | 38 (100%) | 34 (89.5%) | 72 (94.7%) | 0.115 |
| • NSAIDs | 10 (26.3%) | 12 (35.2%) | 22 (30.5%) | |
| • Tranexamic Acid | 14 (36.8%) | 8 (23.5%) | 22 (30.5%) | |
| • Hormonal Agents | 12 (31.5%) | 13 (38.2%) | 25 (34.7%) | |
| • LNG-IUS | 2 (5.2%) | 1 (2.9%) | 3 (4.1%) | |
| **Preoperative Blood Transfusion** | 5 (13.2%) | 7 (18.4%) | 12 (15.8%) | 0.754 |

Table 3 presents preoperative laboratory and imaging findings. Preoperative hemoglobin levels and need for blood transfusion were similar in both groups. Cervical cytology predominantly showed NILM (65.8% in TLH vs. 42.1% in TAH), with low incidences of LSIL and HSIL noted only in the TAH group. Ultrasound revealed abnormal uterine pathology in a majority of cases, more so in TAH (94.7%) than TLH (76.3%), primarily fibroids and adenomyosis. Histopathology confirmed benign changes, though hyperplasia without atypia was more common in the TAH group (21.0% vs. 5.2%). All TLH patients and most TAH patients received prior pharmacotherapy. Despite slightly higher use of hormonal treatment in the TAH group, differences were not statistically significant. These findings indicate overall comparable clinical profiles, with slightly more complex pathology in the abdominal group.

Table-4: Intraoperative Outcomes of Study Participants (N = 76)

| **Parameter** | **Group A (TLH) (n = 38)** | **Group B (TAH) (n = 38)** | **Total (N = 76)** | **p-value** |
|---|---|---|---|---|
| **Operative Time (minutes), Mean ± SD** | 94.47 ± 16.6 | 83.42 ± 15.9 | — | <0.001 |
| Operative Time: 60–90 min | 15 (39.4%) | 29 (76.3%) | 44 (57.9%) | |
| Operative Time: 90–120 min | 21 (55.2%) | 7 (18.4%) | 28 (36.8%) | |

| | | | | |
|---|---|---|---|---|
| Operative Time: >120 min | 2 (5.3%) | 2 (5.3%) | 4 (5.3%) | |
| **Type of Anaesthesia** | | | | <0.001 |
| - General | 38 (100%) | 2 (5.3%) | 40 (52.6%) | |
| - Spinal | 0 (0%) | 32 (84.2%) | 32 (42.1%) | |
| - Epidural + Spinal | 0 (0%) | 4 (10.5%) | 4 (5.3%) | |
| **Estimated Blood Loss (EBL)** | | | | <0.001 |
| - <200 mL | 25 (65.7%) | 4 (10.5%) | 29 (38.2%) | |
| - 200–500 mL | 9 (23.6%) | 24 (63.1%) | 33 (43.4%) | |
| - >500 mL | 4 (10.5%) | 10 (26.3%) | 14 (18.4%) | |
| **Intraoperative Blood Transfusion Required** | 2 (5.2%) | 6 (15.7%) | 8 (10.5%) | 0.262 |
| **Intraoperative Injuries** | | | | 0.499 |
| - Bladder Injury | 2 (5.2%) | 1 (2.6%) | 3 (3.9%) | |
| - Ureteric Injury | 1 (2.6%) | 0 (0%) | 1 (1.3%) | |
| - Total Intraoperative Injuries | 3 (7.9%) | 1 (2.6%) | 4 (5.2%) | |
| **Conversion from TLH to TAH** | 3 (7.9%) | — | 3 (3.9% of total) | — |

Table 4 summarizes intraoperative parameters, highlighting significant differences. TLH was associated with longer operative times (mean 94.47 ± 16.6 min vs. 83.42 ± 15.9 min, $p < 0.001$), likely reflecting the early phase of laparoscopic adoption and learning curve. However, TLH demonstrated significantly lower blood loss, with 65.7% losing <200 mL versus only 10.5% in TAH ($p < 0.001$). All TLH procedures required general anesthesia, while spinal or combined anesthesia was common in TAH. Intraoperative injuries occurred more frequently in TLH (7.9%), including bladder and ureteric injuries, resulting in a 7.9% conversion rate to open surgery. Although transfusion rates and injuries were slightly higher in TAH, the differences were not statistically significant.

Table-5: Immediate Postoperative Outcomes of Study Participants (N = 76)

| Parameter | Group A (TLH) (n = 38) | Group B (TAH) (n = 38) | Total (N = 76) | p-value |
|---|---|---|---|---|
| **Postoperative Fall in Hemoglobin (g/dL)** | | | | <0.001 |
| - 1–2 g/dL | 35 (92.1%) | 16 (42.1%) | 51 (67.1%) | |
| - >2–3 g/dL | 3 (7.9%) | 21 (55.3%) | 24 (31.6%) | |
| - >3 g/dL | 0 (0%) | 1 (2.6%) | 1 (1.3%) | |
| Mean Hb Drop (g/dL), Mean ± SD | 1.58 ± 0.27 | 2.11 ± 0.55 | — | |
| **Postoperative Blood Transfusion Required** | 2 (5.2%) | 4 (10.5%) | 6 (7.8%) | 0.261 |
| **Need for Oxygen Support Postoperatively** | | | | 0.020 |
| - <6 hours | 27 (71.1%) | 16 (42.1%) | 43 (56.6%) | |
| - 6–12 hours | 11 (28.9%) | 22 (57.9%) | 33 (43.4%) | |
| **ICU Admission Required** | 0 (0%) | 0 (0%) | 0 (0%) | — |
| **Postoperative Pyrexia (>38°C)** | 1 (2.6%) | 3 (7.8%) | 4 (5.2%) | 0.207 |
| **Wound Infection** | 1 (2.6%) | 5 (13.1%) | 6 (7.8%) | 0.002 |
| **Urinary Tract Infection (UTI)** | 1 (2.6%) | 3 (7.8%) | 4 (5.2%) | 0.607 |
| **Urinary Retention** | 1 (2.6%) | 2 (5.2%) | 3 (3.9%) | 1.000 |

Immediate postoperative outcomes, detailed in Table 5, demonstrate better recovery profiles for TLH. Hemoglobin drop was significantly lower in the TLH group (mean 1.58 g/dL vs. 2.11 g/dL, $p < 0.001$), with only 7.9% experiencing >2 g/dL decline, compared to 57.9% in TAH. Need for postoperative oxygen support was also lower in TLH (28.9% vs. 57.9% required support beyond 6 hours, $p = 0.020$), possibly reflecting lower perioperative stress. Postoperative pyrexia and UTI were infrequent and not significantly different. However, wound infections were significantly more frequent in the TAH group (13.1% vs. 2.6%, $p = 0.002$), reinforcing the benefits of minimally invasive surgery in terms of reduced surgical site complications.

Table-6: Functional Recovery and Hospital Course (N = 76)

| Parameter | Group A (TLH) (n = 38) | Group B (TAH) (n = 38) | Total (N = 76) | p-value |
|---|---|---|---|---|
| **Postoperative Hospital Stay** | | | | <0.001 |
| - <3 days | 29 (76.3%) | 11 (28.9%) | 40 (52.6%) | |
| - 3–5 days | 8 (21.1%) | 20 (52.6%) | 28 (36.8%) | |
| - >5 days | 1 (2.6%) | 7 (18.4%) | 8 (10.5%) | |
| **Duration of Catheterization** | | | | 0.050 |
| - ≤ 24 hours | 35 (92.1%) | 24 (63.2%) | 59 (77.6%) | |
| - > 24 to <48 hours | 3 (7.9%) | 12 (31.6%) | 15 (19.7%) | |

| | | | | |
|---|---|---|---|---|
| - > 48 hours | 0 (0%) | 2 (5.3%) | 2 (2.6%) | |
| **Time to Pain Relief After Analgesia** | | | | 0.002 |
| - 3–5 days | 33 (86.8%) | 20 (52.6%) | 53 (69.7%) | |
| - >5 days | 5 (13.2%) | 18 (47.4%) | 23 (30.3%) | |

Table 6 evaluates functional recovery, revealing significant differences favoring TLH. A greater proportion of TLH patients had shorter hospital stays (<3 days in 76.3% vs. 28.9% in TAH; $p < 0.001$) and shorter catheterization duration (≤24 hours in 92.1% vs. 63.2%; $p = 0.050$). Postoperative pain relief was also quicker, with 86.8% in TLH experiencing adequate relief within 3–5 days compared to 52.6% in TAH ($p = 0.002$). These findings highlight the enhanced recovery profiles associated with laparoscopic hysterectomy and emphasize its benefits in terms of early ambulation, lower bladder handling, and reduced postoperative discomfort.

Table-7: Remote Postoperative Complications and Vault Status at Follow-Up (N = 76)

| **Parameter** | **Group A (TLH) (n = 38)** | **Group B (TAH) (n = 38)** | **Total (N = 76)** | **p-value** |
|---|---|---|---|---|
| **Ureteric Injury (Delayed Presentation)** | 1 (2.6%) | 0 (0%) | 1 (1.3%) | 1.000 |
| **Re-exploration Required** | 1 (2.6%) | 0 (0%) | 1 (1.3%) | 1.000 |
| **Vault Status on Speculum Examination** | | | | 1.000 |
| - Healthy Vault | 38 (100%) | 37 (97.4%) | 75 (98.7%) | |
| - Unhealthy Vault | 0 (0%) | 1 (2.6%) | 1 (1.3%) | |
| **Discharge Per Vaginum (at 4–6 weeks)** | | | | 1.000 |
| - Present | 12 (31.6%) | 12 (31.6%) | 24 (31.6%) | |
| - Absent | 26 (68.4%) | 26 (68.4%) | 52 (68.4%) | |

Table 7 addresses remote complications observed during follow-up. A single case of delayed ureteric injury leading to ureterovaginal fistula occurred in the TLH group, necessitating surgical re-exploration. Vault status was satisfactory in nearly all patients, with one unhealthy vault noted in the TAH group. Discharge per vaginum was equally observed in both groups (31.6%), and no cases of vault hematoma, dehiscence, or persistent infection were reported. There were no statistically significant differences in any remote outcomes, suggesting comparable long-term safety of both surgical approaches when performed appropriately.

## Discussion

This prospective cohort study was designed to provide a comprehensive comparison of intraoperative and postoperative outcomes between Total Laparoscopic Hysterectomy (TLH) and Total Abdominal Hysterectomy (TAH) in women undergoing surgery for benign uterine conditions. With equal distribution of participants (n = 38 in each group), our study ensures balanced comparisons and eliminates sample size bias, thereby strengthening the validity of the results. This methodological approach mirrors the study designs of Perino et al. (1999)[14], Marana et al. (1999)[15], and Gupta et al. (2020)[16], who similarly allocated participants evenly between TLH and TAH groups to facilitate accurate outcome analysis.

The mean age of participants was comparable across both groups (48.42 ± 3.10 years for TLH vs. 49.01 ± 3.56 years for TAH), showing no significant difference (p = 0.685). These results are consistent with previous studies by Balaci et al. (2014)[17] , Goyal et al. (2021)[18], and Gupta et al. (2020)[16], where the age distributions between TLH and TAH cohorts were similarly matched, indicating age is not a determining factor in route selection.

Educational status, however, significantly differed between groups (p = 0.0021). A higher proportion of women undergoing TLH had completed higher secondary education or above, suggesting that health literacy may influence the choice of minimally invasive surgery. This observation aligns with the findings of Morton et al. (2008)[19], who reported that educational disparities can impact healthcare access, understanding of treatment options, and ultimately surgical choice.

There was no statistically significant difference in menopausal status between the two groups (p = 0.701), with most participants being perimenopausal. This pattern is in agreement with Seracchiolo et al. (2001)[20], who found similar distributions in menstrual status among women undergoing hysterectomy. Likewise, parity showed no significant influence on the choice of surgical route (p = 0.165), consistent with Marana et al. (1999)[15], supporting the notion that both TLH and TAH are viable options irrespective of parity.

A significantly higher proportion of TAH patients (84.2%) had pre-existing medical comorbidities compared to the TLH group (60.5%) (p = 0.039). This finding is consistent with studies by O'Hanlan et al. (2005)[21] and Khan et al. (2019)[22], who reported that patients with more complex systemic conditions are often directed toward open abdominal procedures due to perceived intraoperative challenges and risks associated with laparoscopy. This underscores the importance of patient selection and preoperative optimization in determining the surgical approach.

The most common indication for surgery in our study was AUB-L (abnormal uterine bleeding with leiomyoma), particularly in the TLH group (42.1%). This mirrors findings from Maccio et al. (2016)[23] and Goyal et al. (2021)[18], who also reported leiomyoma as the predominant indication. Pap smear findings were normal (NILM) in 65.8% of TLH patients versus 42.1% in TAH patients, similar to the trend observed by Rajamanoharan et al. (2012)[24]. This suggests that better cervical health, as confirmed by cytology, may influence the selection of a laparoscopic approach.

The mean operative time was significantly longer in the TLH group (94.4 ± 16.6 minutes) compared to the TAH group (83.4 ± 15.9 minutes) (p < 0.001), a trend also reported by Perino et al. (1999)[14], Balaci et al. (2014)[17], and Goyal et al. (2021)[18]. The

learning curve associated with TLH—especially in training institutions—likely contributes to increased operative durations. Our study reported a 7.9% conversion rate from TLH to TAH, slightly higher than rates observed by Kanmani et al. (2014)[25] and Gupta et al. (2020)[16], likely due to the newer adoption of laparoscopy in our center.

Although intraoperative injury rates (bladder and ureteric) were low and not significantly different between groups, slightly more complications occurred in the TLH group (7.9%) compared to TAH (2.6%). This is consistent with Kanmani et al. (2014)[25] and Wakhloo et al. (2015)[26] . Notably, TLH was associated with significantly less estimated blood loss and a smaller drop in hemoglobin (1.58 ± 0.27 g/dL vs. 2.11 ± 0.55 g/dL; $p < 0.001$), aligning with findings from Seracchiolo et al. (2001)[20], Balaci et al. (2014)[17] , and Perino et al. (1999)[14]. These outcomes reaffirm the hemostatic advantage of laparoscopic techniques due to better visualization and precise dissection.

TLH patients had a significantly shorter hospital stay (mean: 2.5 ± 0.4 days) than TAH patients (4.4 ± 1.5 days; $p < 0.001$), consistent with Perino et al. (1999)[14] and Balaci et al. (2014)[17]. ICU admissions were not required in either group, confirming the safety of both procedures when performed on carefully selected patients, as supported by Maccio et al. (2016)[23].

TLH patients also experienced faster pain relief, with 86.8% achieving symptom resolution within 3–5 days versus only 52.6% in the TAH group ($p = 0.002$), corroborating results from Gupta et al. (2020)[16] and Rajamanoharan et al. (2012)[24]. These findings reflect reduced tissue trauma and inflammation associated with minimally invasive procedures.

Wound infection rates were significantly higher in the TAH group (13.1% vs. 2.6%, $p = 0.002$), a finding consistent with Goyal et al. (2021)[18] and Wakhloo et al. (2015)[26]. TLH patients also required significantly shorter durations of catheterization (92.1% < 24 hrs vs. 63.2%, $p = 0.009$), highlighting the benefits of earlier ambulation and reduced pelvic floor disruption, in line with results by Goyal et al. (2021)[18].

Collectively, these findings strongly advocate for the use of TLH in appropriately selected patients due to its favorable perioperative outcomes. TLH offers the advantages of reduced blood loss, lower complication rates, faster postoperative recovery, shorter hospital stays, and greater patient satisfaction—benefits well supported by the existing body of literature.[14,17,18,20,23] Nonetheless, careful consideration must be given to individual patient characteristics, including comorbidities, uterine size, surgical indication, and anatomical complexity, which may necessitate conversion or the selection of an open approach.

## Conclusion

This study provides compelling evidence that Total Laparoscopic Hysterectomy (TLH) offers significant advantages over Total Abdominal Hysterectomy (TAH) in the management of benign gynecological conditions. Despite a longer operative time, TLH was associated with markedly lower intraoperative blood loss, reduced postoperative pain, fewer surgical site infections, shorter hospital stays, quicker functional recovery, and a higher rate of early pain relief—outcomes that collectively translate into improved patient satisfaction and reduced healthcare burden. These findings are consistent with the existing literature and underscore the value of minimally invasive surgical approaches in modern gynecological practice. As surgical expertise and access to laparoscopic training continue to improve, TLH should be increasingly considered the preferred approach for eligible patients. Future studies should focus on further minimizing the learning curve, integrating advanced laparoscopic technologies, and expanding access to minimally invasive techniques, particularly in resource-limited settings. By prioritizing training, patient selection, and institutional support, the broader adoption of TLH can lead to safer surgeries, faster recoveries, and better quality of life for women worldwide.

## Ethics Statement

The study was approved by the Institutional Ethics Committee of Indira Gandhi Medical College (IGMC), Shimla. Approval was granted on 15 January 2023 under registration number IEC/IGMC/OBG/2023/027. Written informed consent was obtained from all participants.

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