

# Surgical Site Infection in Laparoscopic Hysterectomy versus Abdominal Hysterectomy in Gynecological Disease(s): An Overview

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## Abstract

**Objective:** Surgical site infection (SSI) is an unsettled complication seen in any surgery. The aim of this study is to assess the rate of postoperative SSIs between total laparoscopic hysterectomy (TLH) and total abdominal hysterectomy (TAH). Can the rate of SSI be reduced with the use of a laparoscopic mode of hysterectomy over abdominal?

**Materials and Methods:** It was a retrospective comparative study. The study was conducted in the obstetrics and gynecology department at a tertiary care center from June 2016 to March 2020. A total of 300 patients who underwent hysterectomy either via laparoscopic or abdominal route were included in the study. They were subdivided into two groups: a total of 167 underwent TLH (Group 1) and 133 had TAH (Group 2). The results were compared. It included the age and body mass index of the patient, indication of surgery, size of the uterus, intraoperative blood loss, postoperative SSIs, duration of hospital stay, and readmission rates.

**Results:** It was found a high rate of SSI in TAH (82.4% vs. 17.6%,  $P < 0.001$ , Cramer's V-0.18), the operative time taken ( $75 \pm 25$  min vs.  $128 \pm 52$  min,  $P < 0.001$ ), and the mean blood loss during TLH ( $110 \pm 30$  ml vs.  $160 \pm 116$  ml,  $P < 0.001$ ) was found significant for patients. The hospital stay after TLH was found to be significantly shorter ( $4 \pm 2.47$  days vs.  $7 \pm 2.43$ ,  $P < 0.001$ ).

**Conclusion:** TLH has improved the psychological, physical, and financial burden on the health care department. Thus, it has proved a preferred route over TAH.

**Keywords:** Financial burden, surgical site infection, total laparoscopic hysterectomy

## INTRODUCTION

Hysterectomy is the most common gynecological surgery next to cesarean section. With time, the laparoscopic route has gained edge to the laparoscopic route of hysterectomy over the abdominal and vaginal route. The indications for hysterectomy have, however, remained the same over the past two decades, mainly, abnormal uterine bleeding, endometrial hyperplasia, adenomyosis, and endometriosis among which abnormal uterine bleeding alone may account for more than 25% of all hysterectomies.<sup>[1-4]</sup> With improvements in surgical

skills and experiences, a surgeon should choose the procedure which best achieves the goal of surgery and at the same time maximizes patient safety.<sup>[5]</sup>

## Objective

It was a comparative study to assess the rate of postoperative surgical site infections (SSIs) seen between laparoscopic routes with conventional abdominal hysterectomy.

SSI is defined as a postoperative infection occurring within 30 days of surgical procedure (or within 1 year for permanent

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implant) and infection is thought to be secondary to surgery. The Centers for Disease Control and Prevention further classified it into incisional SSI (superficial/deep) and organ/space SSI. This as a postoperative complication has an erratic negative impact on patients in multiple aspects. It not only increases morbidity by prolonging hospital stay, resuturing/operation, and delayed wound healing but also has a psychological and financial impact on them. Prolonged absence from work and home adds to the anxiety of the patient and family.<sup>[6]</sup> SSI is the most common hospital-acquired infection in low- and middle-income countries.<sup>[7]</sup> Incidence has been reported as 36%, demonstrating infection as a persistent complication of surgery.

SSIs are a common but potentially unavoidable complication after any surgical procedure in which the skin is breached. Complications can range in severity, from wound discharge to a more life-threatening infection that can affect the deeper tissues. It depends on the level of contamination. The most common source for SSI is bacterial colonization from the patient’s skin, from opened internal organs and genital tract. The most common organisms isolated are *staphylococcus aureus*, *E.coli* (Gram Negative), and *Actinobacter baumannii* and *pseudomonas* (Gram Positive).

To assist avoid SSI, new suggestions based on the NICE Guideline 2019<sup>[8]</sup> have been added to prior lists. Before procedures in which *Staphylococcus aureus* is a possible source of a surgical site infection, nasal mupirocin in combination with a chlorhexidine body wash may be considered. Use evaporation to dry antiseptic skin preparations and avoid pooling of alcohol-based preparations. Apply an antiseptic or antibiotic just to the open wound before closing it. Furthermore, aseptic measures during pre-surgical, operating, and post-operative time, a well-prepared patient prior to surgery, and post-operative care with hygiene can help prevent the majority of instances of SSI.

## MATERIALS AND METHODS

It was a retrospective comparative study. It was conducted in the department of obstetrics and gynecology at a tertiary care center. Patients who underwent hysterectomy either via laparoscopic route and abdominal route from June 2016 to March 2020, operated in a single unit, were taken into consideration. A total of 300 patients were enrolled. All patients who underwent gynecological procedures such as vaginal hysterectomy and hysterectomy due to complications of childbirth like uterine rupture and intractable hemorrhage were excluded from the study. The patients who had total laparoscopic hysterectomy (TLH) were under Group 1 and those who had total abdominal hysterectomy (TAH) were under Group 2. The medical records with preoperative, operative, postoperative, and readmission, if any, were retrieved.

It considered the patient’s age and BMI, the reason for the surgery, the size of the uterus, intraoperative blood loss, postoperative problems like surgical site infections, the length of hospital stay, and readmission rates. The baseline characteristics of the two groups were comparable. All data analyses were done by SPSS version 22 (IBM Corp., Armonk, NY). All the continuous variables were presented as mean and standard deviation and categorical data as frequency and percentage. Continuous data were analyzed using the *t*-test and categorical data were analyzed using the Chi-square test. *P* < 0.05 was considered statistically significant. The study adheres to the Declaration of Helsinki’s ethical norms and standards, including the local ethics committee approval statement, registration number, and informed consent statement, as well as the local Institutional Ethics Committee, All India Institute of Medical Science, India (ref no. AIIMS/Pat/IEC/2021/724).

## RESULTS

In this study, a total of 300 patients were taken into account, out of which 167 underwent TLH (Group 1) and 133 had TAH (Group 2). The baseline characteristics of patients were similar for both the groups. The operative indicators have been consistent throughout time. 92% of the cases were elective. TAH had a higher rate of surgical site infection (82.4% vs 17.6%, *p*0.001, Cramer’s V-0.18) [Table 1].

Various factors affecting the SSI were studied and their association was reviewed. The mean age with an increased rate of SSI was found to be 47.8 years. The mean BMI was found to be 26.4kg/m<sup>2</sup>, which was another contributing factor to an increased rate of SSI. The mean duration of surgery and intraoperative blood loss were other statistically significant associated factors [Table 2]. The operational time [75±25minutes v/s 128±52minutes. *P*< 0.001] and mean blood loss during TLH [110±30ml v/s 160±116ml. *p*0.001] were statistically significant for patients with TAH. The hospital stay following TLH was significantly reduced (4±2.47days v/s

**Table 1: Rate of surgical site infections**

SSI	Procedure		
	TAH	TLH	Total
0			
Observed	119	164	283
Percentage within row	42.0	58.0	100.0
1			
Observed	14	3	17
Percentage within row	82.4	17.6	100.0
Total			
Observed	133	167	300
Percentage within row	44.3	55.7	100.0

Chi-square tests:  $\chi^2$  value: 10.6, Degree of freedom: 1, *P*: 0.001. Fisher’s exact test: *P*: 0.002. *n*: 300. TLH: Total laparoscopic hysterectomy, TAH: Total abdominal hysterectomy, SSI: Surgical site infection

$\pm 2.43$  days,  $P < 0.001$ ) [Table 2]. The culture sensitivity pie chart [Figure 1] displays frequent organisms causing surgical site infection, primarily *E. Coli* (colistin sensitive), *S. aureus*, with *Actinobacter* and *Klebsiella* contributing.

## DISCUSSION

Hysterectomy is likely the most common gynecological procedure performed in day-to-day life for abnormal uterine bleeding (AUB), endometriosis, endometrial hyperplasia, and failed medical management of PID/AUB.<sup>[4]</sup> Any kind of operative and postoperative complication has an erratic negative impact on the patient. SSI, whether superficial, deep, or organ space, is a surgical complication that can be avoided.

In the present study, the maximum number of patients was beyond 45 years of age, and the mean age was 47.8 years. In a study conducted by Azoury *et al.*,<sup>[9]</sup> the 2015 age group between 55 and 65 years was predicted as having a higher risk of SSI, whereas age beyond 65 years was predicted as having a decreased risk of SSI.

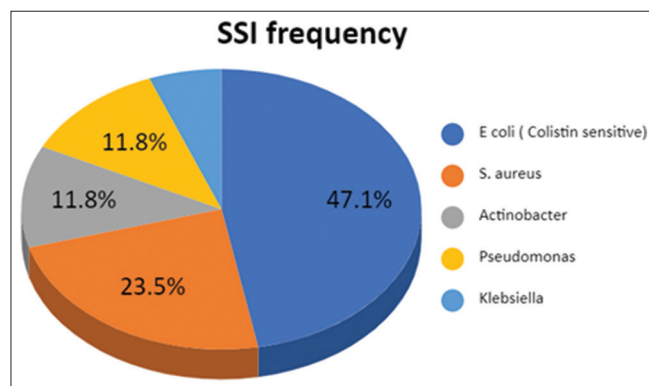
In our study, the mean BMI for patients with SSI was 26.4 kg/m<sup>2</sup>. A normal range BMI shows a lesser rate of SSI than obese/overweight patients. A study done by Azoury *et al.*,<sup>[9]</sup> 2015, showed that a BMI of  $>30$  is associated with an increased likelihood of developing an SSI, and this relationship strengthens with increasing BMI. Increased abdominal fat interferes with wound healing.

SSI, in the present study, showed a significant increased rate in TAH (14 out of 17 cases) as compared to TLH (3 out of 17) (82.4% vs. 17.6%,  $P < 0.001$ ). In a study done by Alkaaki *et al.*,<sup>[10]</sup> 2019, SSI developed in 61% of cases with malignancy as compared to 11% in benign diseases, in which about 54% underwent emergency. It was seen that it is 6.5 times (95% confidence interval [CI]: 2.16–19.6) more likely to develop SSI in open cases as compared to laparoscopy and 4.8 times (95% CI: 1.58–14.4) likely an emergency hysterectomy. According to a 2019 prospective study, all

surgical procedures have an overall risk of SSI of 1%-3%, with open operations accounting for approximately 35% and laparoscopic procedures accounting for approximately 4%.<sup>[10]</sup> The use of steroids has been associated to an increased risk of SSI, yet it is crucial to remember that the underlying reason for the patient's steroid treatment may raise the risk of SSI.<sup>[11]</sup> Drapeau *et al.*<sup>[12]</sup> reported a twofold higher rate of SSI in HIV-infected patients when compared to the general population. Furthermore, patients with lower preoperative CD4 counts are more likely to develop SSIs.<sup>[13,14]</sup> Prolonged surgeries are yet another risk for SSI. Operative time of more than 2 h exposes the patient to an increased risk of SSI.

In the present study, the mean postoperative hospital stay was  $4 \pm 2.47$  days for TLH as compared to  $7 \pm 2.43$  days for TAH in patients with non-SSI; however, the median was 11 days for patients with SSI ( $P < 0.001$ ). In a study comparing TLH to open surgical techniques, Osman *et al.*<sup>[15]</sup> discovered that laparoscopic surgery creates less tissue stress and inflammatory response, resulting in a faster healing period. Another study demonstrated that the mean operating time for uteri smaller than 12 weeks was significantly shorter in the TLH group ( $75 \pm 25$  min) than in the TAH group ( $117 \pm 28$  min,  $p < 0.001$ ).<sup>[16]</sup> However, as uterine size increased, the mean operational time was comparable in both groups. Technical challenges in assisting with increased uterine size/intra-operative complexities were identified as a risk factor for the rising occurrence of SSI.<sup>[16]</sup> As a result, surgical morbidity can be decreased through efficient and skilled practice, as well as attentive post-operative care.<sup>[16]</sup> The length of hospital stay increases with the complexity of cases, and the development of SSI operated via laparotomy as compared to laparoscopy. Furthermore, the primary source of SSI is the skin or vaginal tract, which can be decreased using prophylactic antimicrobials and cleaning patients before surgery. The hazard to the external environment is greater in open situations.<sup>[8,13,17]</sup>

In the current study, we discovered that the readmission rate after TAH is 4%, significant when compared to TLH



**Figure 1:** Culture sensitivity of organisms isolated in surgical site infections

**Table 2: Demographic characteristics and factors affecting rate of surgical site infection**

	Mean $\pm$ SD		P
	TLH (n=167)	TAH (n=133)	
Age (years)	47.8 $\pm$ 3.94	48 $\pm$ 4.91	0.080
BMI (kg/m <sup>2</sup> )	26.4 $\pm$ 2.61	25 $\pm$ 2.15	0.785
Mean operative time (min)	75 $\pm$ 25	128 $\pm$ 52	<0.001
Mean blood loss intra-operatively (ml)	110 $\pm$ 30	160 $\pm$ 116	<0.001
Hospital stay (days)	4 $\pm$ 2.47	7 $\pm$ 2.43	0.002

$P < 0.05$ : Significant. TLH: Total laparoscopic hysterectomy, TAH: Total abdominal hysterectomy, n: Total number of cases, SD: Standard deviation, BMI: Body mass index, MI: Mean Blood Loss Intra-operatively

( $P < 0.001$ ). The result could be due to low socioeconomic status and poor nutritional status of patients, unable to maintain hygiene following hysterectomy.

Some surgeons are hesitant to perform laparoscopic staging because they have reservations about staging adequacy, tumor contamination, and the risk of port-site cancer metastases.<sup>[18]</sup> Previous research and literature evaluations have bolstered the case for laparoscopy. Laparoscopy is a good addition to computed tomography (CT), and the combination of CT and laparoscopy may be a better preoperative assessment for patients with epithelial ovarian cancer before planning primary cytoreduction and estimating resectability and hence prognosis.<sup>[19-21]</sup>

All the above factors cause an economic burden on the patient contributing to the economic burden of the country and worldwide. There have been various studies in the past to assess the impact of SSI on the quality of life and financial burden of patients. The additional cost of SSI ranged from \$174 to \$29,610 (India). The highest relative magnitude of cost difference was seen in India, where Tiwari *et al* reported that SSI raised economic burden costs by 4.8 times when compared to non-SSI costs.<sup>[17]</sup> Nationally, 91613 readmissions due to SSIs were reported in 2005, overall associated hospital costs exceeded \$900 million.<sup>[9]</sup> Preventing SSIs will decrease the financial burden on both the patient and the health system. Hospital bed overcrowding is problematic in low- and middle-income countries and any reduction in SSIs would help increase capacity in bed days.<sup>[22,23]</sup>

## CONCLUSION

This study suggests that with time, laparoscopic approach of hysterectomy has proved various advantages over the abdominal route with a decreased rate of operative and postoperative complications and hospital stay, thus preventing psychological, physical, and financial burdens to patients and health-care centers.

## Take home message

1. Laparoscopic route is the preferred route with decreased rate of SSI, thus reducing financial burden to health-care infrastructure. Hence, a step to provide better health care to patients with efficient and effective health care delivery.

## Limitation

Because the patients in the trial were largely from outlying areas, their hospital stays and discharges would take longer than usual.

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## Conflicts of interest

There are no conflicts of interest.

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