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Comparison of LigaSure and conventional suture techniques in total abdominal hysterectomy: Impacts on postoperative pain and duration of surgery

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ABSTRACT

Introduction: Pain management after hysterectomy is a critical concern, and limited studies have investigated the effect of LigaSure on postoperative pain. This study aimed to compare pain levels after Total Abdominal Hysterectomy (TAH) using traditional methods versus the LigaSure device.

Methods: This registered clinical trial included 29 patients undergoing TAH at an institutional tertiary hospital in Tehran, Iran, from 2021 to 2023. 16 patients underwent TAH with traditional methods, and 13 with LigaSure. Data on pain intensity (6 hours and 24 hours post-surgery), analgesic consumption, intraoperative blood loss, hospitalization length, hemoglobin drop, and cancer surgery duration were collected through patient interviews and medical records. SPSS 26 and the Mann-Whitney U test were used for analysis (Registry ID: IRCT20221109056457N1).

Results: Pain intensity at 6 hours and 24 hours post-surgery was significantly lower in the LigaSure group compared to the traditional method group ($p<0.05$). Surgery duration was also significantly shorter with LigaSure ($p<0.05$). No significant differences were found between the two groups in terms of analgesic consumption, intraoperative blood loss, hospitalization length, or hemoglobin drop ($p>0.05$).

Conclusion: TAH with LigaSure significantly reduces postoperative pain and cancer surgery duration compared to traditional methods. This method is recommended for women undergoing hysterectomy. However, cancer multicenter clinical trials with larger sample sizes are needed to further evaluate its benefits and potential complications.

Keywords: Total Abdominal Hysterectomy (TAH), LigaSure, pain intensity, clinical trial, suture

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INTRODUCTION

Hysterectomy is the second most common major surgical procedure among women and the third most common of all surgical procedures. More than 600,000 cases are reported each year in North America [1]. In low-income countries, the incidence of hysterectomy has been estimated to be 0.32 per 1,000 woman-years [2]. Hysterectomy has traditionally been performed using either an abdominal or vaginal approach. Approximately 75% of all hysterectomies are performed abdominally and the remaining 25% are performed vaginally [3]. In 1988, Reich introduced laparoscopic hysterectomy, and this novel method has since been improved, however, its acceptance in surgical practice is slow, due in part to little interest among surgeons in this technique, economic factors, and the lack of inclusion of this procedure in residency programs in developing countries [4].

Three types of hysterectomies are currently practiced by surgeons including vaginal hysterectomy cancer, abdominal hysterectomy cancer, and minimally invasive hysterectomy cancer [5, 6]. The decision on which technique to use depends on many factors, including the surgeon's experience, the presence or absence of adnexal or pelvic disease, the size of the uterus, previous lower abdominal operations and parity, among others [7].

Total Abdominal Hysterectomy (TAH) is employed to excise both benign and malignant uterine growths and facilitates adnexal surgery. It is particularly beneficial for managing associated pelvic diseases such as endometriosis or adhesions [8]. However, this procedure is invasive, involves significant blood loss, and results in considerable postoperative pain and an extended recovery period, which delays the patient's return to normal activities and work [9]. One particular reason for the relatively frequent postoperative complications of TAH is the method used for maintaining hemostasis or management of perioperative hemorrhage, an important component of which is ligature of the vasculature involved in surgery [8, 10].

The Electrothermal Bipolar Vessel Sealing (EBVS) system, known more commonly as LigaSure, effectively controls hemorrhage in arteries of various sizes, as shown in animal studies [11, 12]. LigaSure uses a controlled high-power, low-voltage current to melt collagen and elastin in tissue, permanently fusing the vascular layers and sealing the vessel. It can fuse vessels between 2 mm and 7 mm in diameter [13]. Initially, LigaSure was used as an alternative to traditional sutures for perioperative management

of hemorrhage in surgeries such as hemorrhoidectomies, prostatectomies, and hepatectomies [14-16]. Later, it was adopted in gynecologic surgeries, including hysterectomies and robotic radical parametrectomies. Studies comparing abdominal and vaginal hysterectomies using LigaSure versus conventional methods have shown mixed results regarding operative time, blood loss, postoperative pain, complications, and hospital stay length [13].

This study aimed to compare the outcomes of using LigaSure versus traditional suturing during abdominal hysterectomy in patients with various benign gynecologic conditions. We specifically looked at how LigaSure affected operative time, blood loss, hospital stay length, complications, and postoperative pain compared to conventional methods.

MATERIALS AND METHODS

The present investigation was clinical trial conducted on 29 female patients who were candidates for Total Abdominal Hysterectomy (TAH) at an institutional tertiary hospital in Tehran between the years 2021 and 2023. Among these, 16 patients underwent Total Abdominal Hysterectomy (TAH) using the traditional method, and 13 patients underwent TAH using the LigaSure device consisting of a main device (LS10, Medtronic, Minnesota, US) equipped with a handpiece (LF4418, Medtronic, Minnesota, US). The study population comprised all women candidates for abdominal hysterectomy referred to the hospital during this period.

Inclusion and exclusion criteria

We adopted a set of inclusion and exclusion criteria for recruitment of eligible patients. Our inclusion criteria were candidates for abdominal hysterectomy for benign conditions such as abnormal uterine bleeding, adnexal masses, and leiomyoma. Eligible patients who had the following conditions were excluded from the study:

- unwillingness to participate in the study
- hysterectomy due to malignant conditions
- presence of endometriosis
- underlying neuropathic diseases
- diabetes
- peripartum hysterectomy (obstetric)
- concurrent suspension surgery

Data collection

Data were collected using a comprehensive checklist, which included the following variables:

- Pain intensity (measured 6 hours and 24 hours after surgery) based on the Visual Analogue Scale (VAS) Score
- Number of doses of analgesics consumed post-surgery
- Amount of bleeding during cancer surgery
- Length of hospitalization
- Hemoglobin drop
- Duration of surgery
- Out of Bed (OOB) mobility time
- Incidence of rehospitalization due to postoperative complications

The data were gathered through patient interviews and extraction from their medical records.

Procedures

Traditional TAH method:

The traditional method of TAH involves making an incision in the abdomen to access and remove the uterus. This method relies on standard surgical instruments and techniques to control bleeding and ensure proper closure of the surgical site [4].

TAH with LigaSure device:

The LigaSure device is an advanced tool that uses a combination of pressure and energy to seal blood vessels and tissue bundles. This method provides more efficient hemostasis and can reduce operative time and blood loss compared to traditional techniques [9]. In this study, we used an LS10 LigaSure device (Medtronic), which was equipped with an LF4418 handpiece (Medtronic, Minnesota, US) for operative purposes.

Data analysis

After collecting the relevant data, it was entered into IBM SPSS 26 software for analysis. To compare the average variables (pain intensity, analgesic doses, bleeding volume, length of hospitalization, hemoglobin drop, and duration of cancer surgery) between the two groups, the Mann-Whitney U test was used. This test was preferred due to the non-normality of the data distribution, as confirmed by the Kolmogorov-Smirnov test. A significance level (p-value) of less than 0.05 was considered for all comparisons.

Ethical considerations and trial registry

The protocol of the present cancer study was approved by the Cancer Research Ethics Committees of Shahid Beheshti University of Medical Sciences (Approval ID: IR.SBMU.MSP.REC.1401.354). Additionally, this clinical trial was also registered with Iranian Registry of Clinical Trials (IRCT: IRCT20221109056457N1). All procedures were conducted after obtaining informed signed consent from all participants.

RESULTS

Table 1 lists the primary findings among the two groups of patients undergoing conventional TAH or TAH with LigaSure device. As can be seen, the mean pain intensity 6 hours after surgery in patients undergoing conventional TAH was 9.25 ± 1.61. In contrast, patients undergoing TAH with the LigaSure device had a mean pain intensity of 5.53 ± 2.96. This difference was statistically significant (p-value<0.01). Similarly, the mean pain intensity 24 hours after surgery was significantly higher in conventional TAH group compared to the group undergoing TAH + LigaSure (4.81 ± 1.93 *vs.* 2.53 ± 1.19, p-value 0.01). In terms of analgesic intake, the mean number of analgesics consumed by patients after surgery in the TAH group was 2.31 ± 0.79, which was only marginally different from that of the TAH + LigaSure group (2.38 ± 0.76), rendering the difference statistically insignificant (p>0.05).

Tab. 1. Postoperative outcomes of TAH combined with LigaSure in comparison to conventional TAH

Variable		Group		p-value
		TAH (n = 16)	TAH + LigaSure (n = 13)	
Postoperative pain intensity	6-hours	9.25 ± 1.61	5.53 ± 2.96	0.003
	24-hours	4.81 ± 1.93	2.53 ± 1.19	0.003
Analgesic intake frequency		2.31 ± 0.79	2.38 ± 0.76	0.997
Perioperative hemorrhage (ml)		250 ± 70.71	230 ± 94.73	0.746
Hemoglobin drop (g/dL)		1.27 ± 0.72	1.30 ± 0.56	0.846
Hospitalization length (day)		2.25 ± 0.44	2.0 ± 0.0	0.268
Surgery duration (min)		173.43 ± 32.38	124.61 ± 32.04	0.001

We did not observe a statistically significant difference between the two surgical interventions in terms of perioperative hemorrhage, since the volume of bleeding was slightly higher in the TAH group compared to the TAH + LigaSure group (250 ± 70.71 *vs.* 230 ± 94.73, p>0.05). This was prospectively reflected in the mean values of hemoglobin after surgery, which were found to have decreased moderately when compared to preoperative hemoglobin values. Accordingly, the difference in the mean postoperative hemoglobin drop between the two groups was found to be negligible (1.27 ± 0.72 *vs.* 1.30 ± 0.56, p>0.05). When comparing the mean length of hospital stay between the two groups, we did not notice a significant difference between the two groups, as patients in the TAH group had a marginally longer hospital stay (2.25 ± 0.44) days compared to patients in TAH + LigaSure group (2 days), making the difference statistically insignificant (p>0.05). Conversely, we noticed a sharp difference between the two groups in terms of surgery duration. According to the findings presented in table 1, the mean duration of surgery in TAH + LigaSure group was 124.61 ± 32.04 min, a substantially shorter duration compared to that of the TAH group (173.43 ± 32.38), suggesting that the LigaSure method significantly decreased the overall time required for TAH, improving patient welfare.

DISCUSSION

The present study aimed to compare the outcomes of using the LigaSure Vessel Sealing System (LVSS) versus conventional suturing methods during Total Abdominal Hysterectomy (TAH) for various benign gynecologic conditions. To this end, we enrolled a total of 29 patients who were assigned to two groups based on the surgical procedure, namely, TAH and TAH + LigaSure. The primary findings indicated that the use of LigaSure significantly reduced postoperative pain at 6 hours and 24 hours after surgery and decreased the overall duration of surgery, while showing no significant differences in perioperative blood loss, analgesic intake, or length of hospital stay compared to conventional methods.

Our findings are consistent with several studies that have demonstrated the advantages of LigaSure in reducing operative time. In a clinical trial study conducted by Ahmed et al. in 2023 in Egypt with the aim of comparing the combined effects of LigaSure and the conventional suturing method on perioperative and postoperative complications on 40 candidates for vaginal hysterectomy cancer, women undergoing LigaSure experienced a shorter surgical time and less blood loss during surgery compared to the reference group. Additionally, the intensity of pain 24 and 48 hours after surgery was significantly lower and the prerequisite to prescribe analgesics after surgery was also less frequent in this group. This study concluded that the use of the LigaSure device can reduce the operation time [17]. Compared to conventional suturing, LigaSure provides faster, safer, and more efficient hemostasis while reducing blood loss, pain, and hospitalization. Likewise, in another cancer clinical trial conducted by Dubey et al. in 2023 in India with the aim of comparing hemostatic efficiency of EBVS to conventional suturing in abdominal hysterectomy, 60 cancer patients were randomly assigned to two groups, namely LigaSure (n=30) and conventional suture method (n=30). The results showed that the average operation time in the LigaSure group (26.97 ± 8.92 minutes) was significantly lower than the conventional suture method (33.67 ± 8.62 minutes). Also, intraoperative blood loss in the LigaSure group (111 ml ± 53.31 ml *vs.* 320 ml ± 193.90 ml) was significantly lower than the conventional suture method. In addition, the average pain intensity in the first 3 days after surgery and the duration of hospitalization in the LigaSure group were significantly lower than the conventional suture method [18].

In 2021, Shady et al. observed a significant decrease in operating time with the use of LVSS compared to conventional techniques in overweight and obese women undergoing abdominal hysterectomy cancer [19]. Similarly, Ulubay et al. (2022) reported shorter operation times with LigaSure compared to conventional suture ligation in their retrospective analysis [13]. In another retrospective study conducted by Bakacak et al. in 2021, the efficacy of LigaSure in cesarean hysterectomy for placenta percreta in Turkey was investigated. Patients with placenta percreta undergoing elective cesarean section by the same team of surgeons were divided into two groups, one undergoing standard conventional hysterectomy, and the other receiving the same intervention combined with LigaSure [13]. The results showed that the duration of the operation, the units of red blood carcinoma cells injected during the operation, the need to close the internal iliac artery (internal iliac artery ligation) and the length of hospital stay were less in LigaSure group than in the conventional hysterectomy group. This suggests that the use of LigaSure in abdominal hysterectomy for cancer patients with placenta percreta may reduce operation time and the amount of bleeding [20]. These findings highlight the efficiency of LigaSure in surgical procedures, which can potentially enhance patient throughput and reduce operative fatigue.

Pain management is a crucial aspect of postoperative care, and our study showed significantly lower pain scores at both 6 hours and 24 hours postoperatively in the LigaSure group. This is in line with the results from Yildiz et al., who, in 2013, found that patients in the LigaSure group reported lower pain scores at 0 hour and 24 hours post-surgery compared to those in the conventional suture group [21]. The reduced pain levels with LigaSure can be attributed to its precise vessel sealing capability, which minimizes tissue cancer trauma and inflammation.

Although there was no statistically significant difference in in-

traoperative blood loss between the two groups in our study, the trend of lower blood loss in the LigaSure group aligns with the findings of Shady et al. and Wang et al., both of which reported significant reductions in blood loss with LigaSure [19-21]. The slight reduction in blood loss with LigaSure, while not statistically significant in our study, still suggests a potential benefit in terms of surgical field visibility and reduced need for transfusions.

Regarding the length of hospital stay, our study did not find a significant difference between the LigaSure and conventional suture groups, a result that mirrors findings by Türkçüoğlu et al. and Yildiz et al., who also reported no significant differences in hospitalization duration between the two methods [21-23]. Similar observations were made by Macario et al. (2008), Lakeman et al., and Darwade et al., as well [24-26]. This suggests that while LigaSure offers intraoperative advantages, the postoperative recovery trajectory remains similar to conventional techniques in the context of hospital discharge.

The reduction in surgery duration observed in our study (mean duration of 124.61 ± 32.04 min with LigaSure *vs.* 173.43 ± 32.38 min with conventional sutures) is a substantial improvement and underscores the potential of LigaSure to streamline surgical workflows. Similar reductions in operative time have been documented by Aydin et al. and Allam et al. [27, 28]. This efficiency not only benefits cancer surgeons but also reduces the duration of anesthesia for cancer patients, potentially decreasing anesthesia-related risks.

CONCLUSION

In conclusion, the LigaSure vessel sealing system offers significant advantages in terms of reducing operative time and postoperative pain in total abdominal hysterectomy cancer. While it does not significantly impact intraoperative blood loss, analgesic consumption, or hospital stay duration, its benefits in operative efficiency and patient comfort make it a valuable tool in cancer gynecologic surgery. Future studies should focus on long-term outcomes and cost-effectiveness analyses to further validate the widespread adoption of LigaSure in surgical practice.

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