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A Comparison of Peri-Operative Outcomes for Total Laparoscopic Hysterectomy Using Conventional Bipolar Electrosurgery and High-Pressure Pulsed Ligasure

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Abstract

Background: Hysterectomy is the second most prevalent operation for women globally. Electrosurgery has advanced rapidly to provide safer, faster, and more precise surgeries.
Purpose: To compare the intraoperative and postoperative outcomes of LigaSure and conventional bipolar energy sources during total laparoscopic hysterectomy.
Methods: This study was randomized controlled study. The study population (n=140) underwent total laparoscopic hysterectomy under general anesthesia and was divided into two equal groups, the conventional bipolar group (n=70) and the LigaSure group (n=70)
Results: The mean age of patients in the conventional bipolar group was (43.08 ± 17.25) and (39.53 ± 16.84) years in the LigaSure group with none statistically significant difference between both groups (p=0.671). There was none statistically significant difference between both groups regarding BMI (p=0.156), uterine size (p=0.371) and previous laparotomy (p=0.2). There were statistically significant differences in the mean primary operating time, the mean total operating time (p=0.001) and the mean time to dissect adenxal ligaments (p=0.022).
Conclusions: LigaSure is an adequate and successful instrument for laparoscopic hysterectomy, capable of significantly reducing the duration of surgery.

Key words: Electrosurgery, Hysterctomy, Laparoscopic, LigaSure.

Introduction

One of the most prevalent surgeries in gynecology is the hysterectomy, which could be performed in three ways: open, vaginal, or laparoscopic (Orhan et al., 2019). Reich et al. pioneered the laparoscopic route to minimally invasive hysterectomy in January 1988, and it is currently a highly popular method (Reich et al., 1989).
Electrocautery is a well-known method for haemostasis. "Electrocautery" refers to both the procedure and the equipment utilized to carry it out (Kalari et al., 2022).
Conventional electrosurgery uses two sorts of diathermy: unipolar and bipolar. Monopolar electrosurgery employs excessive voltage for trimming, dissection, and fulguration. In bipolar electrosurgery, minimal voltage is employed for the coagulation (Wang et al., 2005). Electrosurgical bipolar vessel sealing systems can seal large tissue bundles and blood vessels up to seven millimetres in diameter. Employing this approach, only one clamp can be introduced via the vagina to secure the vessels and cut the tissue, rather than one clamp and one

scissors. This could reduce the length of the surgery due to a limitation in surgical stages, however it can additionally decrease pain after the procedure since less traction is required to pull the uterus downward, theoretically reducing pain after the procedure (Lakeman et al., 2012).Novel vascular sealing equipment using ultrasonic and bipolar energy were established. These developed bipolar vessel-sealing devices significantly reduce lateral thermal spread, making them safer and more successful than conventional electrosurgical devices. These advantageous characteristics show up more clearly in complicated processes (Yalcin and Yalcin, 2019)

The LigaSure (LS) vessel sealing tools utilize a high-current, low-voltage constant bipolar radiofrequency energy in conjunction with a feedback-controlled response system that automatically delivers and interferes with the power in accordance to the structure and capacitance of the tissue within the instruments' jaws. It fuses collagen and elastin within the vessel walls, forming a long-term seal capable of sustaining three times normal systolic pressure and sealing vessels up to seven mm. The highest temperature throughout stimulation is less than 100 °C, which decreases thermal extend to 1 mm with LS Particular and to 1.5 mm with LS V (Jaiswal and Huang, 2017).

The present study aimed to compare the intraoperative and postoperative outcomes of LigaSure and conventional bipolar energy sources during total laparoscopic hysterectomy.

Patients and methods:

This study was conducted at (Al shefaa) Hospital from October 2018 to October 2022. All participants in the study provided written informed consent. The participants (n=140) underwent total laparoscopic hysterectomy under general anesthesia. The study population (n=140) was divided into two equal groups, the conventional bipolar group (n=70) and the LigaSure group (n=70)

The inclusion criteria were: female patients aged from 35 to 65 years. The uterine size was restricted that corresponds to approximately 20 weeks. Patients were excluded if they had assumed cancers, past three or more surgeries, converting to laparotomy, or concurrent surgeries.

After admission and allocation, detailed history taking, and clinical examination was done.

All laparoscopic hysterectomies were carried out by a single expert in minimally invasive gynecology in a well-equipped operating room. LigaSure was employed for cutting up and haemostasis in one group, but a standard bipolar instrument had been employed in the other group of participants. The outcomes significance involved dissecting adnexal ligaments, surgical time, bleeding average, adverse effects, and postoperative stay. Primary operating time was defined as the time between the first incision and complete uterine detachment. The total operating time has been estimated from the first skin incision to the final skin closure.

For the assessment of intraoperative blood loss, amount of irrigation fluid left in the bottle after surgery was subtracted from the initial volume, and the volume of fluid used for irrigation was calculated. This number was subtracted from the volume of fluid collected in the suction bottle. Any unintentional harm to the bowel, bladder, or ureter caused by the device used was documented. On the day of exit, the occurrence of fever, drain production, length of comeback of bowel activity, and bladder activity status were all recorded. The duration of postoperative hospital stay was measured from the day of surgery to the day of being released.

Statistical analyses

Recorded data were analyzed using the statistical package for social sciences, version 23.0 (SPSS Inc., Chicago, Illinois, USA). The quantitative data were presented as mean± standard deviation and ranges when their distribution was parametric (normal) while non-normally distributed variables (non-parametric data) were presented as median with inter-quartile range (IQR). Also, qualitative variables were presented as number and percentages. Data were explored for normality using Kolmogorov-Smirnov and Shapiro-Wilk Test.

Results:

The results of the current study are displayed in the following tables and figures:

Table (1) shows that the mean age of patients in the conventional bipolar group was (43.08 ± 17.25) and (39.53 ± 16.84) years in the LigaSure group with none statistically significant difference between both groups (p=0.671). The mean BMI of patients in the conventional bipolar group was (27.20 ± 7.85) and (31.25 ± 16.07) kg/m2 in the LigaSure group (p=0.156). Fibroid was the most common indication in the conventional bipolar group in 39(55.71%) of patients while adenomyosis was the most common indication in the LigaSure group in 37(52.86%) of patients. There was none statistically significant difference between both groups regarding uterine size (p=0.371) and previous laparotomy (p=0.2).

Table (1): Comparison of the baseline characters between the two study groups

	Conventional bipolar (n=70)	**LigaSure (n=70)**	**p- value**
Age (years)	43.08 ± 17.25	39.53 ± 16.84	0.671
BMI (kg/m^2)	27.20 ± 7.85	31.25 ± 16.07	0.156
Common indications			
Fibroid	39(55.71%)	33(47.14%)	
Adenomyosis	31(44.29%)	37(52.86%)	
Uterine size (weeks)	11.33 ± 3.61	13.25 ± 3.96	0.371
Previous laparotomy	22(31.43%)	36(51.43%)	0.2

Table (2) shows that the mean time to dissect adenxal ligaments was (10.89 ± 1.04) in the conventional bipolar group and (10.02 ± 0.91) minutes in the LigaSure group with statistically significant difference between both groups (p=0.022). The mean primary operating time was (95.25 ± 8.57) in the conventional bipolar group and (84.50 ± 7.28) minutes in the LigaSure group with statistically significant difference between both groups (p=0.001). The mean total operating time was (141.00 ± 25.18) in the conventional bipolar group and (109.14 ± 18.63) minutes in the LigaSure group with statistically significant difference between both groups (p=0.001). The mean blood loss was (182.31 ± 77.46) in the conventional bipolar group and (172.33 ± 85.14) ml in the LigaSure group with none statistically significant difference between both groups (p=0.709). There were none statistically significant difference between both groups regarding hemoglobin mean difference (p=0.410) and postoperative stay (p=0.161).

Table (2): The main outcome measures in the two study groups

	Conventional bipolar (n=70)	**LigaSure (n=70)**	**p- value**
Mean time to dissect adenxal ligaments (minutes)	10.89 ± 1.04	10.02 ± 0.91	0.022
Primary operating time(minutes)	95.25 ± 8.57	84.50 ± 7.28	0.001
Total operating time(minutes)	141.00 ± 25.18	109.14 ± 18.63	0.001
Mean blood loss (ml)	182.31 ± 77.46	172.33 ± 85.14	0.709
Hemoglobin mean difference	1.13 ± 0.23	1.05 ± 0.16	0.410
Postoperative stay (days)	4.08 ± 0.33	3.82 ± 0.38	0.161

Discussion:

LigaSure was employed properly in gynecology, laparoscopic operations, urology, and abdominal surgery (Yalcin and Yalcin, 2019).
This study compared the perioperative outcomes of LigaSure and conventional bipolar devices during total laparoscopic hysterectomy for benign gynecological indications.
Results of the present study showed that the mean age of patients in the conventional bipolar group was (43.08 ± 17.25) and (39.53 ± 16.84) years in the LigaSure group (p=0.671). This result was supported with that of Batra et al., (2022) who reported that the mean age of patients in the conventional bipolar group was (49.33±6.144) and (48.80±6.449) years in the LigaSure group (p=0.993). Yalcin and Yalcin, (2019) results showed that the patients in the LigaSure and conventional bipolar groups had mean ages of (48.1 ± 7) and (47.6 ± 6.5) years, respectively (p > 0.05).
Results of the current study showed that the mean time to dissect adenxal ligaments was (10.89 ± 1.04) in the conventional bipolar group and (10.02 ± 0.91) minutes in the LigaSure group with statistically significant difference between both groups (p=0.022). This finding agrees with that of Batra et al., (2022) who found that the average time to dissect adnexal ligaments was (9.4486±2.155) minutes in the bipolar group and (7.05±1.466) minutes in the LigaSure group. The difference was found to be highly significant (P = 0.000).
In our study, the mean primary operating time was (95.25 ± 8.57) in the conventional bipolar group and (84.50 ± 7.28) minutes in the LigaSure group with statistically significant difference between both groups (p=0.001). This finding disagrees with that of Janssen et al., (2011) who found no statistically significant difference in primary operating time (P = 0.39) in their study.

Results of the current study showed that the mean total operating time was (141.00 ± 25.18) in the conventional bipolar group and (109.14 ± 18.63) minutes in the LigaSure group with statistically significant difference between both groups (p=0.001). This finding agrees with that of Batra et al., (2022) who found that the mean total operating time was (142.50) minutes in the bipolar group and (136.37±14.35) minutes in the LigaSure group. The difference was found to be highly significant (P = 0.002). Lee et al., (2007) also observed a substantial decrease in total operating time with a pulsed bipolar system in comparison with conventional bipolar (p < 0.001). This finding disagrees with that of Janssen et al., (2011) who found no statistically significant difference regarding total operating time (P = 0.46) between the conventional bipolar group and the LigaSure group. Additionally, Lee et al., (2019) findings revealed that LigaSure reduces operative time in comparison to traditional bipolar vessel sealing devices with no boosting the risk of problems following surgery and negative outcomes.
Past research found that advanced bipolar groups had lower intraoperative blood loss compared to conventional groups (Seehofer et al., 2012). In our study, the mean blood loss was (182.31 ± 77.46) in the conventional bipolar group and (172.33 ± 85.14) ml in the LigaSure group with none statistically significant difference between both groups (p=0.709). This result agrees with that of Batra et al., (2022) who reported none statistically significant difference regarding blood loss (p = 0.846) between the conventional bipolar group and the LigaSure group. Yalcin and Yalcin, (2019) results revealed that the mean blood loss was (70.0 ± 22.0) in the conventional bipolar group and (65.0 ± 21.0) ml in the LigaSure group (p=0.22).
Our study had limitations due to its small sample size. Although the LigaSure group may have influenced the results, the study was conducted by a single surgeon who had prior experience with both of the procedures. Future research should include larger, prospective, and randomized studies.

In conclusion,

LigaSure is an adequate and successful instrument for laparoscopic hysterectomy, capable of significantly reducing the duration of surgery. Conventional bipolar energy devices can be reused, making them less costly. Low-income hospitals without having accessibility to advanced bipolar energy devices, like LigaSure, can securely and successfully employ these methods.

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