



# Comparison of Electrocautery and Scalpel Methods in Surgical Incisions of Hysterectomy Surgery



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## ABSTRACT

**Aims** Surgical incisions have been performed by a scalpel for many years, and today, the use of an alternative method, catheter incision, is increasing daily. This study aimed to evaluate the complications of using electrocautery and scalpel in surgical abdominal wall incisions in hysterectomy surgery.

**Materials & Methods** The present single-blind study was performed on 92 eligible women undergoing hysterectomy surgery with a transverse incision in Imam Sajjad Hospital, Yasuj, Iran. Patients were randomly divided into hysterectomy with a scalpel (46 samples) and electrocautery (46 samples). Then, post-surgery infection after the surgery, the extent of wound separation after a month, pain intensity in the first, second, and eighth days after the surgery, blood loss (weighting consumed blood gauzes before and after surgery), in both groups of scalpel and electrocautery were measured and compared. The collected data were analyzed using descriptive statistics in SPSS 19 software.

**Findings** The two groups were similar in age, cause of hysterectomy, and type of delivery. There were no significant differences between the two groups in postoperative infection rate, incision time, and wound separation rate. However, a significant difference was indicated in the distribution of pain intensity in the electrocautery group on the first ( $p < 0.001$ ), second ( $p < 0.001$ ), and eighth day after surgery ( $p = 0.03$ ), and blood loss ( $p = 0.017$ ), which were reported significantly lower than in the scalpel group.

**Conclusion** The electrocautery method causes less pain intensity and blood loss than the scalpel method.

**Keywords** Hysterectomy; Scalpel; Pain; Electrocautery

## CITATION LINKS

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## Introduction

Hysterectomy is the removal of the uterus, and it is the most common surgical procedure in women. Hysterectomy is used in benign cases such as fibroids, menorrhagia, prolapse, and endometriosis of the uterus, and malignant cases including endometrial, ovarian, and cervical cancer [1]. In abdominal surgery, it is necessary to cut several layers to reach the desired tissue. To do this, the surgeon must use electrocautery or a scalpel [2]. The scalpel has been recognized as the gold standard tool for surgical incision for an extended period. This method enables the surgeon to perform the surgical incision without worrying about electric burn and tissue damage around the incision [3]. Also, surgical incisions such as hysterectomy were performed with a scalpel for many years, leading to many complications. Among these complications was heavy bleeding during the operation. By controlling the bleeding during the process, the duration of the surgery increased. There was also a delay in wound healing in this surgical procedure [4]. Moreover, injuries to the operating room personnel were often reported [3]. Therefore, replacing the scalpel with cauterization is increasing daily [4] and has started since the 20<sup>th</sup> [5]. Previous research on cauterization suggests that this method has been successfully used in gynecological surgeries, especially in ovarian surgeries, and it is less invasive than surgeries that did not use this method [6, 7]. The use of cauterization in uterine myomas surgery with a uterus is more extensive than 10cm is known to be useful [8]. It is thought that compared to the scalpel, electrocautery causes less bleeding, faster tissue separation, and less risk at the surgical site [2]. However, using the cauterization method has its complications, for example, the possibility of tissue burns, ischemia, tissue necrosis, and scarring. In addition, the tissue under operation can show inflammation and infection, poor wound healing, and adhesion formation [8, 9].

Despite the benefits of the cauterization method, the studies showed contrasting results. For example, the survey by Shinohara *et al.* indicated that cauterization of the fallopian tubes was a helpful measure to prevent the spread of cancer cells to the peritoneal cavity during hysterectomy surgery [10]. Moreover, in a study by Choi *et al.*, uterine cauterization during the fallopian tube removal procedure ruins the remaining epithelial tissue of the fallopian tubes after surgery [11]. However, in a study conducted in Spain in 2018, although minimal cauterization was used in a cesarean section surgery, the researchers stated that cauterization prevents proper myometrial repair in such surgeries [12]. Besides, a case study indicated that cauterization use in vaginal surgeries, with laparoscopy and laser, could not eliminate the patient's symptoms, and vaginal secretion was present after surgery [13].

The goal of choosing the type of surgery is to create

an incision with less risk of bleeding and infection [5]. In the review meta-analysis by Charoenkwan *et al.*, there were no significant differences in wound infection, incision time, blood loss, and wound infection between electrocautery and scalpel methods in abdominal incisions [2]. However, in the study of Parkash *et al.*, no significant difference was observed between the two groups incision time, postoperative pain, and infection. Still, a significant decrease in blood loss was observed in the electrocautery method compared to the scalpel [14]. Therefore, the results of using electrocautery in gynecological surgeries indicate a vague contradiction. This requires further research to confirm or disapprove the use of electrocautery in gynecological abdominal surgeries. Due to the conflicting results of the studies on the complications of the two methods of electrocautery and scalpel surgery, the researcher decided to conduct a study to compare the difficulties of electrocautery and scalpel in abdominal wall incision surgery in hysterectomy surgery.

## Materials and Methods

### Design and participants

This randomized clinical trial was conducted on the women referred to Imam Sajjad Hospital who underwent hysterectomy surgery for nine months, from the beginning of July to the end of March 2019. The study participants were women admitted to Imam Sajjad Hospital in Yasuj, Iran, to undergo hysterectomy surgery with a transverse incision. According to previous studies, the mean and standard deviation of bleeding volume in the scalpel group was  $0.3399 \pm 1.8262$  ml/cm wound [15], so assuming that electrocautery is associated with a bleeding difference of 0.2ml/cm, with 95% confidence interval ( $z=1.96$ ) and 90% test power ( $z=1.26$ ), the required number of samples is equal to 46 patients in each group, and the total sample size was 92 females.

Accordingly, 92 qualified women were selected by convenience sampling; then, they were assigned into two groups of scalpel and electrocautery using block randomization. For this purpose, seven blocks of 6 and 5 blocks of 10 were selected, and the samples were randomly assigned to the scalpel and electrocautery groups (46 people in each group). Therefore, sampling continued until having 46 patients in each group.

All women living in Yasuj, Iran, who underwent hysterectomy surgery with transverse incision using electrocautery and scalpel methods at Imam Sajjad Hospital, and the women under 65 years were included in this study. Exclusion criteria were females unwilling to participate in the study, the occurrence of severe adhesions during operation, hysterectomy due to malignancy, underlying diseases such as diabetes, women taking immunosuppressive

drugs, overweight women with a body mass index greater than or equal to 30, and with no coagulation disorders [16].

### Intervention

The interventions were electrocautery (as a routine method) and scalpel methods in surgical incisions in the abdominal wall in a hysterectomy surgery, and outcomes were the complications of the incision of the surgery, including infection, blood loss, pain, incision time, and separation of the wound.

The patients underwent hysterectomy, in which the incision was made using either a scalpel or an electrocautery. The surgery on each group was performed in the same surgical unit by one surgeon, a fellowship in gynecology oncology. All patients received the same general anesthesia. No. 20 knife was used in the skin incision of all operations, and the length of the transverse incision was from 10 to 15cm, depending on the uterus size. In the electrocautery group, monopolar cautery was used. The subcutaneous tissue repair was performed using plane 2.0, and skin closure was achieved using nylon 2.0 stitches in each group. Closing the vessels in the scalpel group was performed by a suture with a chromic 2.0. Intravenous apotel was given within 24h, postoperatively, followed by mefenamic acid every 8 hours for another 24h. The patients in both groups underwent prophylactic antibiotics in the form of intravenous Ceftriaxone (Dose of 1-2gr) at 0.5-1h pre-operation. This dose was repeated every 12 hours for two days.

### Instrument

A form for demographic and clinical characteristics of the patients and the complications of surgery incision in hysterectomy (temperature for measuring fever, the duration of the abdominal incision in minutes, the blood loss during the surgery, weighting gauzes before and after surgery, pain intensity on the first, second and eighth days after the operation, and the extent of wound separation - Fascia, skin, and subcutaneous tissue in centimeters - during a month was used to gather data.

Infection was assessed by measuring body temperature and fever (Body temperature equal to or greater than 38°C) using a digital thermometer for one month. The researcher estimated and recorded the temperature after the operation during hospitalization. In addition, at the time of discharge, the patient and his/her family were taught to use a thermometer and signs and symptoms of wound separation, and they were asked to visit the surgeon if the temperature was 38°C or higher or each of the signs and symptoms of an opening wound appear. To check the separation of the wound, for the patients who came with the complaint of separation of the skin suture or bloody discharge and serosa, as well as infectious shot at the site of the skin suture, at first, the skin and all tissue layers were examined. Then, the integrity of the fascia was checked with a cotton swab. The operation site measured the extent of

wound separation, and the size of wound separation (Fascia, skin, and subcutaneous tissue) was determined by sonography. Incision time during surgery was recorded by chronometer.

For measuring blood loss, the weight of the consumed gauze was measured by a digital electronic weighing scale with an accuracy of 1 gram before and after the operation (Blood volume in cc=weight of gauze used after the operation minus the weight of gauze before the process). The visual analog scale was used for measuring the pain. The visual analog scale was designed straight from zero to 2 centimeters. A score of zero on the left side indicates no pain, and a ten on the right side of the line indicates the most intense imaginable pain. On this scale, 1-3 means mild pain, 4-7 moderate pain, and 8-10 shows severe pain. According to this scale, the patient is asked to illustrate the severity of their discomfort with one of the numbers on the scale. The complications were recorded in the first, second, and eighth days after the surgery.

One of the researchers collected the data during operation hospitalization through face-to-face interviews on their beds. Other information required by the researcher was collected after discharge by phone calls.

### Data Analysis

Data were analyzed using SPSS 19 software. To compare the mean and standard deviation of quantitative data in two groups, the T-test was used for normal distribution, and the Mann-Whitney U test was used for non-normal distribution. Quantitative data were analyzed with a Chi-square test and contingency table.

### Findings

Each group had 46 patients, and based on the Kolmogorov-Smirnov test results, the participants' age data followed a normal distribution ( $p > 0.05$ ). There was no significant difference between the two groups in terms of body mass index (In two categories less than 25 and 25-30kg/m<sup>2</sup>;  $p = 0.245$ ), type of delivery ( $p = 0.58$ ), and causes of hysterectomy ( $p = 0.78$ ; Table 1).

There was no significant difference in the age of the participants between groups. The difference in blood loss during surgery between the two groups in the phase before intervention was insignificant ( $p = 0.446$ ); however, during the intervention, blood loss increased significantly in the scalpel group compared to the electrocautery group ( $p = 0.018$ ). Also, there was no significant difference between groups in incision time ( $p = 0.329$ ; Table 2).

Pain intensity in the electrocautery group on the first day ( $p < 0.001$ ), the second day ( $p < 0.001$ ), and the eighth day ( $p = 0.003$ ) was significantly lower than in the scalpel group. There was no statistically significant difference between the two groups regarding postoperative infection ( $p = 0.617$ ) and wound separation ( $p = 0.434$ ; Table 3).

**Table 1.** Comparing characteristics of the participants between electrocautery and scalpel groups in baseline (Chi-square test)

Parameter	Electrocautery	Scalpel	p Value
<b>Body mass index</b>			
Less than 25	22 (42.3)	30 (57.7)	0.092
25-30	4 (60)	16 (40)	
<b>Type of delivery</b>			
Natural	26 (48.1)	28 (51.9)	0.580
Natural and C-section	20 (54.1)	17 (45.9)	
<b>Causes of hysterectomy</b>			
Abnormal Uterine Bleeding	22 (44)	28 (56)	0.78
Myoma	8 (57.1)	6 (42.9)	
Pelvic Inflammatory disease	3 (60)	2 (40)	
Adenomyosis	5 (45.5)	6 (54.5)	
Chronic pelvic pain and myxomatosis of the uterus	3 (60)	2 (40)	
Benign solid mass of adnexa and postmenopausal	4 (66.7)	2 (33)	
Uterine prolapse and a large uterus are not amenable to TVH	1 (100)	0 (0)	

**Table 2.** Comparing age (independent sample T-test), blood loss, and incision time (U Mann-Whitney test) between electrocautery and scalpel groups

Parameter	Electrocautery	Scalpel	p Value
Age (year)	46.02±7.15	46.67±6.36	0.245
Blood loss	45.80±7.83	47.20±8.09	0.017
Incision Time	13.4±2.2	13.6±1.9	0.329

**Table 3.** Comparing pain (U Mann-Whitney test), infection, and separation of the wound (Fischer's exact test) between electrocautery and scalpel groups

Parameter	Electrocautery	Scalpel	p Value
<b>Pain</b>			
First day	7.78 (0.81)	8.84 (0.75)	0.001
Second day	4.58 (1.57)	6.41 (1.7)	0.001
Eighth day	2.1 (1.25)	3.2 (1.74)	0.003
<b>Infection after surgery</b>			
Yes	3 (75)	1 (25)	0.617
No	43 (48.9)	45 (51.1)	
<b>Wound separation</b>			
Yes	5 (71.4)	2 (28.6)	0.434
No	41 (48.2)	44 (51.8)	

## Discussion

This study aimed to compare the complications of using electrocautery and scalpel methods in abdominal wall incisions on 92 women undergoing hysterectomy surgery. Considering the contradictory results in the results of the present study in other studies, the results of the study help to confirm the results of similar studies. In the present study, the most common cause of hysterectomy was severe uterine bleeding and then myoma. Similar to the present study, in the study of Malik *et al.*, uterine bleeding was the most common cause of hysterectomy, followed by uterine fibroid, pelvic pain, and endometriosis<sup>[17]</sup>. However, in the study of Acharya *et al.*, fibroid was the most common cause of hysterectomy, followed by bleeding and adenomyosis<sup>[18]</sup>.

The results of the present study did not show any significant difference in the complications of abdominal incision in patients with hysterectomy, including infection, incision time, and wound separation between electrocautery and scalpel

methods. However, Pain intensity in the electrocautery group on the first, second, and eighth days was significantly lower than in the scalpel group. Moreover, blood loss in the electrocautery group is less than in the scalpel group.

Similar to the results of the present study, in the studies by Parkash *et al.*<sup>[14]</sup>, Yada *et al.*<sup>[19]</sup>, and Patil *et al.*<sup>[20]</sup>, the mean score of blood loss during the laparotomy surgery in the cauterization group was significantly lower than scalpel group. Also, in the study of Hasabe *et al.* in patients with laparoscopic hysterectomy, LigaSure and the bipolar Shearer had lower blood loss and operative time than harmonic scalpel<sup>[21]</sup>. Moreover, in a systematic review and meta-analysis of 41 articles, Ismail *et al.* found that compared to scalpel incision, electrocautery showed a significant decrease in blood loss<sup>[22]</sup>. Contrary to the present findings, in the Chrysos *et al.* study, there was no difference in blood loss between the scalpel and diathermy methods<sup>[23]</sup>. Moreover, unlike the results of the present study, in the study by Lin *et al.* on 313 patients with knee arthroplasty, no significant difference was observed in blood loss between scalpel and electrocautery groups<sup>[24]</sup>. Also, unlike the results of the present study, in the meta-analysis study by Charoenkwan *et al.*, there was no significant difference in blood loss between electrosurgery and scalpel methods<sup>[2]</sup>. In the present study, blood loss during the operation in the scalpel method is more than in electrocautery. Maybe the reason for this difference was the different incision sites and methods of measuring blood loss in the above study. The amount of consumed gauze was calculated, but in the present study, the weight of consumed gauze was compared to before the intervention.

The present study showed no significant differences between scalpel and cautery methods in infection. Consistent with the current findings, in Charoenkwan *et al.*<sup>[2]</sup> and Yadav *et al.*<sup>[19]</sup> studies, infectious complications were not shown in any of the two methods of electrocautery and scalpel methods. Although the National Institute of Clinical Excellence guidelines even prohibit electrocautery due to the risk of infection, the MEMON *et al.* study showed that seroma formation in the electrocautery group was significantly higher than that of the scalpel. Still, infection and hematoma formation were considerably higher in the scalpel group<sup>[9]</sup>. However, although the use of cautery for hemostasis and tissue dissection is increasing, some surgeons only use cautery to cut the skin. They believe using cautery during tissue dissection can increase the risk of infection tissue scarring and wound healing time due to heat and damaging effects. Still, some studies have not confirmed this<sup>[25]</sup>. Parassas & Schumacher found in their research that laparoscopy with cauterization reduces the incidence of postoperative hernia recurrence and seroma formation in patients undergoing hernia surgery<sup>[26]</sup>. However, in the present study, although infection occurred in two

groups, there was no significant difference between the scalpel and electrocautery groups. In another study by Novotny *et al.*, laparoscopy of inguinal hernia under cauterization is safe and beneficial for young girls [27]. Also, in a survey conducted by Saremi and Pouladi, the benefits of laparoscopic treatment with cauterization for patients with endometriosis were indicated [28].

In the present study, the pain was less in the electrocautery group than in the scalpel group. Like the present study, Chiappa *et al.* [4] and Pati *et al.* [20] indicated that the amount of pain in the incisions done with cautery was far less. Besides, in most studies, the consumption of analgesics in electrocautery was lower than in the scalpel method. Like the present study, a study by Lin *et al.* on patients with knee arthroplasty, in the scalpel group, the pain, joint scores, and knee range of motion were higher compared to the electrocautery method [24]. Also, in the study of Ismail *et al.*, electrocautery showed a significant decrease in pain scores compared to the scalpel method [22]. In the Chrysos *et al.* study, Patients in the diathermy group needed less injection analgesics than the scalpel group [23].

Low consumption of analgesics and reduction of pain in the electrocautery method compared to the scalpel method in most of the mentioned studies, like the present study, indicates that the incision pain after the operation in the electrocautery method is less than the scalpel method. However, In the study by Parkash *et al.* [14] and Yadav *et al.* [19], pain was not significantly different between the two groups. The possible reason for this difference could be the difference in the hysterectomy disease compared to other laparotomy and the incision site.

The present study showed no differences between electrocautery and scalpel methods in incision time and wound separation. Similar to the present study, In the study by Parkash *et al.* [14] and Charoenkwan *et al.* [2], the incision time was not significantly different between the two groups of electrocautery and scalpel methods. Moreover, in Lin *et al.*'s study, no significant difference was indicated in the operation time between scalpel and electrocautery groups in patients with knee arthroplasty [24]. As in the present study, these variables remained without significant changes. However, Ismail *et al.* [22] and Yadav *et al.* [19] found that electrocautery showed a significant decrease in incision and operation time compared to scalpel incision. It was expected that the surgery and incision time would be less than the scalpel method by controlling the bleeding in the electrocautery method. Still, no difference was observed in the incision and operation time between the two processes. Pandey *et al.* stated that Cautery is an efficient method that reduces rapid wound separation [29], while, in the present study, wound separation in the electrocautery group was more than in the scalpel group. However, there was no

significant difference between groups. Perhaps more samples are needed for more research.

However, the meta-analysis study by Li *et al.* indicated that in the harmonic scalpel group, operation time, blood loss, hospitalization time, saliva fistula, and facial nerve palsy were significantly less compared to the electrocautery group [30]. This difference can be due to the type of scalpel and the different incision sites of the participants in this study compared to the present study.

Therefore, due to the less pain and blood loss in the electrocautery method compared to the method scalpel and due to the ease of the electrocautery method, this method can be replaced by the scalpel in surgical incisions in the abdominal wall in a hysterectomy surgery.

Some limitations could not blind the intervention for the doctor as a researcher. The consumption of analgesics and narcotics after the operation in the participants was not controlled and could be a confounding variable. For further research, studies with a bigger sample size should be conducted. In addition, it is suggested in future studies the use of analgesics after surgery was recorded and compared. Moreover, three-blind research was considered so that someone outside the researchers does the data collection; the statistical analyst is unaware of the type of groups, and the participants are unaware of the kind of intervention.

## Conclusion

The electrocautery method causes less pain intensity and blood loss than the scalpel method.

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**Ethical Permissions:** All ethical considerations were paid attention to in this study. The registration number on the Iranian Clinical Trial Website is IRCT20200919048762N1. The Ethics Committee of Yasuj Medical Sciences University (IR.YUMS.REC1399.049) approved the study. The advantages and disadvantages of both methods were explained to the participants. The participants completed and signed the informed consent form before the examination. Researchers considered anonymity and confidentiality of information throughout the study. Participants were also assured that all their information would remain confidential. The relevant guidelines and regulations performed all methods in accordance with the Declaration of Helsinki.

**Conflicts of Interests:** The authors declare that they have no competing interests.

**Authors' Contribution:** Aramesh Sh (First Author), Main Researcher/Methodologist/Introduction Writer/ Discussion Writer (30%); Ghaffari P (Second Author), Assistant Researcher/Introduction Writer/Methodologist/ Discussion Writer (20%); Mardani S (Third Author), Methodologist/Assistant Researcher/Introduction Writer (30%); Malekzade J. (Fourth Author), Assistant Researcher/ Introduction Writer/Statistical Analyst/ Discussion Writer (20%)

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