International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Researcher Article *DOI: 10.61336/im/26-07-24*

EVALUATION OF ELECTROCAUTERY VERSUS SCALPEL FOR SKIN INCISIONS IN ELECTIVE ABDOMINAL SURGERIES.

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Received: 22-05-2026
Revised: 13-06-2026
Accepted: 25-06-2026
Published: 03-07-2026

Abstract

Background: Skin incision is a fundamental step in every surgical procedure and plays an important role in determining operative efficiency, blood loss, postoperative pain, wound healing, and cosmetic outcome. Traditionally, scalpels have been used for skin incisions because of their precision and minimal tissue damage. Electrocautery has emerged as an alternative technique due to its hemostatic advantages and reduced operative bleeding. Comparing both methods is essential to identify a safe and effective approach for elective abdominal surgeries. ***Aims:*** To compare scalpel and electrocautery skin incisions in elective abdominal surgeries. ***Materials and Methods:*** This prospective comparative study was conducted in the Department of General Surgery over a duration of 10 months. A total of 90 patients undergoing elective abdominal surgeries were included and divided equally into two groups of 45 patients each. Group S underwent skin incision using a scalpel, while Group E underwent skin incision using electrocautery. Detailed demographic data, operative duration, incision time, intraoperative blood loss, postoperative pain score, wound complications, duration of hospital stay, and wound healing outcomes were recorded. Postoperative pain was assessed using the Visual Analog Scale (VAS). Patients were followed during postoperative recovery. Statistical analysis was performed using SPSS software version 25, and p-value less than 0.05 was considered statistically significant. ***Results:*** Mean incision time was significantly shorter in the electrocautery group compared to the scalpel group (4.1 ± 0.8 minutes vs 6.3 ± 1.1 minutes, p <0.001). Mean intraoperative blood loss was significantly lower in the electrocautery group (58.4 ± 12.6 mL) compared to the scalpel group (96.7 ± 18.4 mL, p <0.001). Postoperative pain scores on day one were lower in the electrocautery group. Wound infection occurred in 3 (6.7%) patients in the electrocautery group and 4 (8.9%) patients in the scalpel group. Mean duration of hospital stay was slightly shorter in the electrocautery group. ***Conclusion:*** Electrocautery skin incision demonstrated advantages over scalpel incision with reduced incision time, lower intraoperative blood loss, and decreased postoperative pain without increasing wound complications or delayed healing. Electrocautery can therefore be considered a safe, effective, and efficient alternative to scalpel skin incision in elective abdominal surgeries.

Keywords: Elective abdominal surgery, Electrocautery, Intraoperative blood loss, Postoperative pain, Scalpel incision, Surgical wound healing.

INTRODUCTION

Surgical skin incision is one of the most important initial steps in any operative procedure and significantly influences operative efficiency, tissue handling, wound healing, postoperative pain, and cosmetic outcome.1 Traditionally, the scalpel has been regarded as the standard instrument for making skin incisions because of its precision, minimal tissue trauma, and clean wound edges. Scalpel incisions produce sharp dissection with less collateral tissue damage and have been widely accepted in all surgical specialties for several decades.2, 3

With advancements in surgical technology, electrocautery has emerged as an alternative method for skin incision and tissue dissection. Electrocautery utilizes high-frequency electrical current to cut tissues and achieve simultaneous coagulation, thereby reducing bleeding during surgery.4 It has become increasingly popular in modern surgical practice because of its hemostatic advantages, improved operative visibility, and reduction in operative time. Electrocautery can be used in cutting mode for skin incision and coagulation mode for hemostasis during surgery.5

Despite its widespread use, the application of electrocautery for skin incisions remains controversial. Traditionally, surgeons preferred scalpels for skin incision due to concerns that thermal injury caused by electrocautery might delay wound healing, increase postoperative pain, predispose to surgical site infection, and result in poor scar formation.6 However, several recent studies have suggested that electrocautery skin incisions may provide comparable wound healing outcomes while offering additional benefits such as reduced blood loss, decreased incision time, and lower postoperative discomfort.7

Elective abdominal surgeries frequently require long skin incisions and extensive tissue dissection, making effective hemostasis an important factor during surgery. Excessive intraoperative bleeding may obscure the operative field, prolong operative duration, and increase postoperative morbidity.8 Electrocautery has the potential to minimize these issues by achieving simultaneous cutting and coagulation. Reduced tissue handling and better visualization during surgery may also contribute to improved postoperative recovery.9

Postoperative pain remains an important determinant of patient satisfaction and recovery after abdominal surgery. Tissue trauma, nerve irritation, and inflammatory response associated with surgical incision contribute significantly to postoperative discomfort. Electrocautery incisions may reduce pain because of sealing of small nerve endings during tissue dissection. Similarly, shorter operative duration and reduced blood loss may decrease surgical stress and facilitate early recovery.10, 11
Although both scalpel a
nd electrocautery are routinely used in surgical practice, differences regarding wound complications, infection rates, healing characteristics, and postoperative recovery continue to be debated. Comparative evaluation of these techniques is therefore essential to determine their safety, effectiveness, and clinical utility in elective abdominal surgeries.

AIMS AND OBJECTIVES

- To compare scalpel and electrocautery skin incisions in elective abdominal surgeries.

MATERIALS AND METHODS

This prospective comparative study was conducted in the Department of General Surgery at Sree Mookambika Institute of Medical Sciences over a period of 10 months from January 2025 to October 2025. Written informed consent was obtained from all patients before inclusion in the study.

Inclusion Criteria

- Patients aged more than 18 years.
- Patients undergoing elective abdominal surgeries.
- Patients willing to participate in the study and provide informed consent.
- Patients fit for elective surgical procedures under anesthesia.

Exclusion Criteria

- Patients undergoing emergency abdominal surgeries.
- Patients with uncontrolled diabetes mellitus or severe systemic illness.
- Patients with bleeding disorders or coagulation abnormalities.
- Patients receiving anticoagulant therapy.
- Patients with local skin infection at the operative site.
- Immunocompromised patients.
- Patients unwilling to participate in the study.

A total of 90 patients undergoing elective abdominal surgeries were included in the study and divided equally into two groups consisting of 45 patients each. Group S underwent skin incision using a surgical scalpel, while Group E underwent skin incision using electrocautery in cutting mode. Demographic details such as age, gender, diagnosis, type of surgery, and associated comorbidities were recorded in a structured proforma.

All patients underwent standard preoperative investigations including complete blood count, blood sugar levels, renal function tests, liver function tests, urine analysis, electrocardiogram, and chest radiograph wherever indicated. Elective abdominal procedures including hernia repair, appendectomy, cholecystectomy, laparotomy, and gastrointestinal surgeries were performed under appropriate anesthesia using standard aseptic precautions.

In Group S, skin incision was made using a sterile scalpel blade, whereas in Group E, skin incision was performed using electrocautery in pure cutting mode. Hemostasis during surgery was achieved as required in both groups. Parameters assessed during surgery included incision time and intraoperative blood loss. Incision time was measured from initiation

of skin incision to completion of skin opening. Blood loss was estimated using surgical mop count and suction collection after excluding irrigation fluids.

Postoperative assessment included evaluation of pain using the Visual Analog Scale (VAS), wound infection, seroma formation, hematoma, wound healing, scar characteristics, and duration of hospital stay. Patients were monitored throughout the postoperative period and followed regularly until suture removal and wound healing. Any postoperative complications were documented and managed accordingly.

The collected data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software version 25. Quantitative variables were expressed as mean ± standard deviation, while qualitative variables were expressed as frequency and percentage. Student's t-test and Chi-square test were used for comparison between the two groups. A p-value less than 0.05 was considered statistically significant.

RESULTS

A total of 90 patients undergoing elective abdominal surgeries were included in the study and divided equally into Group S (scalpel skin incision) and Group E (electrocautery skin incision), with 45 patients in each group. Most patients belonged to the 41–60 years age group in both study groups. Male predominance was observed among patients undergoing elective abdominal surgeries. No statistically significant difference was noted between the groups regarding age and gender distribution. (Table 1)

Table 1: Age and gender distribution of study population

Variable	Group S n (%)	Group E n (%)	p-value
21–40 years	12 (26.7%)	11 (24.4%)	0.91
41–60 years	24 (53.3%)	25 (55.6%)	
>60 years	9 (20.0%)	9 (20.0%)	
Male	28 (62.2%)	30 (66.7%)	0.65
Female	17 (37.8%)	15 (33.3%)	

Inguinal hernia repair was the most commonly performed elective abdominal surgery in both groups. Distribution of surgical procedures was comparable between the groups without statistically significant variation. (Table 2)

Table 2: Distribution of elective abdominal surgeries performed

Type of surgery	Group S n (%)	Group E n (%)	p-value
Inguinal hernia repair	14 (31.1%)	13 (28.9%)	0.94
Open appendectomy	10 (22.2%)	11 (24.4%)	
Open cholecystectomy	8 (17.8%)	7 (15.6%)	
Exploratory laparotomy	7 (15.6%)	8 (17.8%)	
Gastrointestinal surgeries	6 (13.3%)	6 (13.3%)	

Electrocautery skin incision significantly reduced incision time and intraoperative blood loss compared to scalpel incision. Overall operative duration was also shorter in the electrocautery group, indicating improved surgical efficiency and better hemostasis. (Table 3)

Table 3: Comparison of operative parameters

Parameter	Group S	Group E	p-value
Mean incision time (minutes)	6.3 ± 1.1	4.1 ± 0.8	<0.001
Mean intraoperative blood loss (mL)	96.7 ± 18.4	58.4 ± 12.6	<0.001
Mean operative duration (minutes)	78.5 ± 12.3	69.2 ± 10.4	0.001

Patients undergoing electrocautery incision experienced significantly lower postoperative pain and shorter hospital stay compared to the scalpel group. Wound healing duration was comparable between the two groups without statistically significant difference. (Table 4)

Table 4: Comparison of postoperative outcomes

Parameter	Group S	Group E	p-value
Postoperative pain score (VAS)	5.9 ± 1.0	4.4 ± 0.9	<0.001
Hospital stay (days)	6.1 ± 1.5	5.0 ± 1.2	0.002
Time for wound healing (days)	11.4 ± 2.1	11.8 ± 2.3	0.41

Postoperative wound complications were slightly lower in the electrocautery group compared to the scalpel group; however, the difference was not statistically significant. Most patients in both groups had uncomplicated postoperative recovery. (Table 5)

Table 5: Postoperative wound complications

Complication	Group S n (%)	Group E n (%)	p-value
Wound infection	4 (8.9%)	3 (6.7%)	0.69
Seroma	3 (6.7%)	2 (4.4%)	0.64
Hematoma	2 (4.4%)	1 (2.2%)	0.55
Hypertrophic scar	2 (4.4%)	2 (4.4%)	1.00
No complications	34 (75.6%)	37 (82.2%)	0.44

Severe postoperative pain was more commonly observed in the scalpel incision group, whereas mild pain predominated in the electrocautery group. The difference in pain distribution between the groups was statistically significant, favouring electrocautery incision. (Table 6)

Table 6: Distribution of postoperative pain categories

Pain score category (VAS)	Group S n (%)	Group E n (%)	p-value
Mild pain (1–3)	6 (13.3%)	18 (40.0%)	0.01
Moderate pain (4–6)	28 (62.2%)	24 (53.3%)	
Severe pain (>6)	11 (24.5%)	3 (6.7%)	

Most patients in both groups developed healthy linear scars during follow-up. Scar-related complications were slightly lower in the electrocautery group, though no statistically significant difference was observed between the groups. (Table 7).

Table 7: Scar outcome assessment at follow-up

Scar outcome	Group S n (%)	Group E n (%)	p-value
Linear healthy scar	36 (80.0%)	39 (86.7%)	0.58
Hypertrophic scar	5 (11.1%)	4 (8.9%)	
Irregular scar	4 (8.9%)	2 (4.4%)	

DISCUSSION

In the present study, majority of patients were between 41 and 60 years of age, and males constituted the predominant proportion in both groups. Similar demographic distributions were reported by Govindaraju S et al.12 Priya J et al.13 and Albeniz G et al.14 who observed comparable age and gender characteristics between patients undergoing scalpel and electrocautery incisions, thereby ensuring valid comparison of surgical outcomes.

Electrocautery incision demonstrated significant intraoperative advantages in the present study. The mean incision time was lower in the electrocautery group (4.1 ± 0.8 minutes) compared to the scalpel group (6.3 ± 1.1 minutes). Intraoperative blood loss was also markedly reduced in the electrocautery group (58.4 ± 12.6 mL versus 96.7 ± 18.4 mL). Similar findings were reported by Priya J et al.13 who observed significantly shorter incision time and reduced blood loss with diathermy incisions. Albeniz G et al.14 also demonstrated significantly faster incision creation and lower bleeding in the electrocautery group. Likewise, Begum MR et al.15 Samuel RM et al.16 and Abdulkareem MF et al.17 reported that electrocautery incisions were associated with superior hemostasis and shorter operative time. Furthermore, the systematic review by Charoenkwan K et al.18 concluded that electrosurgery significantly reduced blood loss without adversely affecting surgical outcomes.

The mean operative duration was shorter among patients undergoing electrocautery incision, suggesting improved operative efficiency. This finding may be attributed to simultaneous tissue dissection and coagulation, minimizing interruptions for hemostasis. Similar observations were noted by Abdulkareem MF et al.17 and Begum MR et al.16 who highlighted improved surgical efficiency associated with electrocautery use.

Postoperative pain assessment revealed significantly lower pain scores in the electrocautery group (4.4 ± 0.9) compared to the scalpel group (5.9 ± 1.0). Mild pain was more frequent among electrocautery patients, whereas severe pain predominated in the scalpel group. Comparable results were reported by Govindaraju S et al.11 who demonstrated significantly lower pain scores following diathermy incision. Reddy DA et al.19 similarly observed reduced postoperative pain at 6, 12, and 24 hours among patients undergoing electrocautery incisions. Priya J et al.13 also reported significantly

lower postoperative pain in the cautery group. Reduced pain may result from simultaneous sealing of sensory nerve endings and decreased tissue trauma during incision.

Hospital stay was shorter in the electrocautery group (5.0 ± 1.2 days) compared to the scalpel group (6.1 ± 1.5 days), indicating earlier postoperative recovery. Improved recovery associated with electrocautery has also been reported by Govindaraju S et al.11 and Reddy DA et al.19 who noted better postoperative comfort and faster mobilization among patients receiving electrocautery incisions.

Wound healing outcomes were comparable between the two groups. Although wound infection, seroma, hematoma, and hypertrophic scar formation were slightly less frequent in the electrocautery group, the differences were not statistically significant. Healthy linear scar formation was observed in most patients in both groups. Similar findings were reported by Charoenkwan K et al.18 whose meta-analysis demonstrated no significant difference in wound infection or wound dehiscence between electrosurgery and scalpel incision. Albeniz G et al.14 Begum MR et al.16 Samuel RM et al.16 and Abdulkareem MF et al.17 also reported comparable wound complication rates between the two techniques despite the operative advantages of electrocautery.

CONCLUSION

Electrocautery skin incision proved to be an effective alternative to conventional scalpel incision in elective abdominal surgeries. It significantly reduced incision time, intraoperative blood loss, operative duration, postoperative pain, and duration of hospital stay when compared to scalpel incision. Wound healing and scar outcomes were comparable in both groups, with no significant increase in postoperative wound complications associated with electrocautery use. The findings indicate that electrocautery provides better operative efficiency and patient comfort while maintaining acceptable wound healing characteristics. Adequate surgical expertise and proper use of electrocautery can contribute to improved surgical outcomes in elective abdominal procedures.

FINANCIAL SUPPORT AND SPONSORSHIP

Nil.

CONFLICTS OF INTEREST

There are no conflicts of interest.

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