

Original Article

# Comparison of Electrocautery and Scalpel Incision in Midline Abdominal Surgery

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## ABSTRACT

**Background:** With the advancement of surgical techniques, the comparison of electrocautery and scalpel incisions in midline abdominal surgeries has become an essential area of study. Traditional scalpel incisions have been known for their precision but carry risks of excessive blood loss and sharp injuries. Electrocautery, offering a potentially safer and more efficient alternative, has been gaining attention in surgical practices.

**Objective:** The primary objective of this study was to compare the effectiveness, safety, and outcomes of electrocautery versus scalpel incisions in midline abdominal surgeries, with a focus on incision time, blood loss, wound infection, and postoperative pain.

**Methods:** A randomized controlled trial was conducted at the Military Hospital, Rawalpindi, over 12 months from June 2021 to June 2022. A total of 150 patients, split evenly into electrocautery and scalpel groups, were evaluated. Patients aged 20-75 years, undergoing midline abdominal surgery, were included. The main parameters measured were incision time, blood loss, wound infection, and postoperative pain. Data were analyzed using SPSS version 25.0, employing independent samples t-tests and chi-square tests.

**Results:** The electrocautery group exhibited a significantly shorter incision time ( $13.73 \pm 2.45$  seconds) compared to the scalpel group ( $18.67 \pm 3.02$  seconds,  $p < 0.001$ ). Blood loss was also lower in the electrocautery group ( $11.47 \pm 2.49$  ml) than in the scalpel group ( $27.27 \pm 4.13$  ml,  $p < 0.001$ ). Wound infection rates were 6.7% for electrocautery and 13.3% for scalpel, though this was not statistically significant ( $p = 0.174$ ). Remarkably, 100% of the electrocautery group reported postoperative pain, in contrast to none in the scalpel group ( $p = 0.000$ ).

**Conclusion:** The study concluded that electrocautery is more effective than scalpel incision in terms of incision time and blood loss, making it a preferable method for midline abdominal surgeries. However, the higher incidence of postoperative pain in the electrocautery group warrants further investigation.

**Keywords:** Electrocautery, Scalpel Incision, Midline Abdominal Surgery, Randomized Controlled Trial, Surgical Outcomes.

## INTRODUCTION

In the field of surgery, the evolution of techniques and tools is a critical aspect of enhancing patient outcomes and safety. While the rise of minimally invasive surgery has marked a significant advancement, traditional methods, particularly midline and transverse incisions, continue to hold paramount importance due to their versatility in providing optimal access for various surgical procedures. It's noteworthy that a considerable proportion of patients, ranging from 15% to 30%, who undergo midline incisions encounter postoperative wound infections (2). This statistic underscores the complexities of wound healing, a process that in healthy individuals progresses methodically from inflammation to epithelialization, then to fibroplasia, and finally culminating in maturation (3). The prevalence of surgical wound infections has become a recurring challenge within medical practice, prompting an increase in research dedicated to enhancing surgical preparation and improving patient management during the recovery phase (4, 5).

Historically, the scalpel has been the instrument of choice for making skin incisions, revered for its precision and minimal risk of causing burn injuries which can lead to scarring and impede the healing process. However, the inherent risks associated with the use of sharp instruments in surgery, particularly the increased seroconversion rates among healthcare workers, have necessitated the exploration of alternative incision methods (6). In this context, electrocautery has emerged as a notable advancement. Recent studies have highlighted several benefits of electrocautery, including reduced operation time, enhanced safety, and improved wound healing, although its widespread acceptance in the medical community is still a matter of debate (1-6, 7).

In response to these developments, the focus of our study is to provide concrete evidence for the local population and to apply these findings within our local healthcare setting. The aim is to refine our surgical techniques in line with the latest advancements, thereby setting new standards of care tailored to our community's needs. By conducting a comparative analysis of electrocautery and scalpel incisions in midline abdominal surgeries, this research endeavors to ascertain the efficacy of electrocautery. Our goal is to establish electrocautery as a more effective and time-efficient method, which could potentially revolutionize surgical practices and minimize postoperative complications, making it a superior alternative to the conventional scalpel.

## MATERIAL AND METHODS

The study was designed as a randomized controlled trial to investigate the comparative efficacy of electrocautery and scalpel incisions in midline abdominal surgery. Conducted at the Department of Surgery, Military Hospital, Rawalpindi, over a duration of one year from June 2021 to June 2022, the research aimed to provide a comprehensive analysis of these surgical techniques.

The sample size was meticulously calculated to include 150 patients, divided equally into two groups of 75 each. This calculation was based on the desired 95% confidence level and 95% power of the study. The mean blood loss figures used for this calculation were  $6.46 \pm 3.94$  ml for electrocautery and  $23.40 \pm 15.28$  ml for scalpel incisions, as documented in prior studies (8). The sample selection was done using a non-probability consecutive sampling method.

The inclusion criteria for the study encompassed patients aged between 20 and 75 years, of both genders, who were scheduled for midline abdominal surgery. Exclusion criteria were comprehensive, excluding patients with previous unsuccessful surgeries, those classified as ASA III or IV, individuals with major abdominal trauma, renal dysfunction, malignancy, or metastatic diseases, and those undergoing tumor resection.

For data collection, the 150 patients who met these criteria were recruited from the Surgery Department wards. Prior to their inclusion, written informed consent was obtained from each patient. Demographic data, including patient names, ages, genders, and Body Mass Index (BMI), were collected from medical records. The patients were then randomly assigned to two groups through a random number table. Group A patients received incisions via electrocautery, whereas Group B patients underwent incisions with a scalpel, following standard surgical routines.

All surgeries were conducted under general anesthesia, adhering to the hospital's standard protocols and operating procedures. Key variables such as the time taken for the incision and blood loss during the procedure were carefully recorded. Post-surgery, patients were moved to post-surgical wards for a period of 3-5 days, followed by a two-week outpatient department follow-up. During this follow-up, patients were evaluated for wound infection and postoperative pain at the incision site, with pain levels assessed using the numerical rating scale. All data collected were systematically recorded in a proforma designed for this study.

Data analysis was carried out using SPSS version 25.0. The two groups were compared in terms of mean incision time and blood loss, using independent samples t-tests. Incidences of wound infection and postoperative pain were analyzed using chi-square tests, with a p-value of  $\leq 0.05$  set as the threshold for statistical significance.

## RESULTS

In the study comparing electrocautery and scalpel incisions for midline abdominal surgery, a total of 150 patients were evaluated, with 75 in each group. The age distribution was comparable between the two groups, with the electrocautery group averaging 54.00 years ( $\pm 18.45$ ) and the scalpel group 55.13 years ( $\pm 13.43$ ). Regarding gender distribution, the electrocautery group comprised 45 males (60.0%) and 30 females (40.0%), while the scalpel group included 40 males (53.3%) and 35 females (46.7%). The Body Mass Index (BMI) showed a slight variation, with the electrocautery group averaging 22.95 ( $\pm 3.03$ ) and the scalpel group 23.67 ( $\pm 3.26$ ). Both groups had an equal proportion of patients with hypertension, 30 (40%) in each. However, there was a notable difference in the prevalence of diabetes; the electrocautery group had 35 patients (46.7%) with diabetes, compared to 25 patients (33.3%) in the scalpel group. The distribution of surgery types was also evenly matched between the groups, with 35 patients (46.7%) undergoing emergency surgery and 40 patients (53.3%) undergoing elective surgery in each group.

Table 1 Baseline Characteristics of Patients

Characteristic	Electrocautery Group	Scalpel Group
Number of Patients (N)	75	75
Age (years)	54.00 ± 18.45	55.13 ± 13.43
Gender		
Male	45 (60.0%)	40 (53.3%)
Female	30 (40.0%)	35 (46.7%)
BMI	22.95 ± 3.03	23.67 ± 3.26
Hypertension	30 (40%)	30 (40%)
Diabetes	35 (46.7%)	25 (33.3%)
Type of Surgery		
Emergency	35 (46.7%)	35 (46.7%)
Elective	40 (53.3%)	40 (53.3%)

Table 2 Comparison of Outcomes

Outcome	Electrocautery Group	Scalpel Group	P-value
Incision Time (seconds)	13.73 ± 2.45	18.67 ± 3.02	<0.001
Blood Loss (ml)	11.47 ± 2.49	27.27 ± 4.13	<0.001
Wound Infection	5 (6.7%)	10 (13.3%)	0.174
Postoperative Pain	75 (100%)	0 (0.0%)	0.000

The outcomes showed significant differences between the two groups. The incision time was markedly less in the electrocautery group, with an average of 13.73 seconds ( $\pm 2.45$ ), compared to 18.67 seconds ( $\pm 3.02$ ) in the scalpel group, with a p-value of less than 0.001. Blood loss was also significantly lower in the electrocautery group, averaging 11.47 ml ( $\pm 2.49$ ), in contrast to the scalpel group's 27.27 ml ( $\pm 4.13$ ), also with a p-value of less than 0.001. Wound infection rates were 6.7% in the electrocautery group and 13.3% in the scalpel group, though this difference was not statistically significant (p-value = 0.174). Remarkably, all patients in the electrocautery group reported postoperative pain, compared to none in the scalpel group, a difference that was statistically significant (p-value = 0.000).

## DISCUSSION

In light of the data from the Centers for Disease Control and Prevention indicating that 27 percent of all sharp injuries in the operating room involve scalpels, second only to needle injuries, the efficacy and safety of surgical incisions have become a topic of significant interest in medical research (6, 9). Traditionally, the scalpel has been the instrument of choice for surgical incisions, valued for its precision and ability to create incisions of the required depth without causing electrical burns or tissue damage (10, 11, 12). However, concerns regarding excessive blood loss and the risk of injury to healthcare workers have been consistently documented (13, 14). In contrast, diathermy or electrocautery, which originated in the early 1900s, offers a method of creating incisions and coagulation without damaging nearby tissues and is also instrumental in managing hemostasis (15, 16).

The study conducted observed that the mean time for incision in the electrocautery group was significantly shorter, 13.73  $\pm$  2.45 seconds, compared to 18.67  $\pm$  3.02 seconds in the scalpel group. Additionally, mean blood loss was considerably lower with electrocautery, 11.47  $\pm$  2.49 ml, compared to 27.27  $\pm$  4.13 ml with the scalpel. An intriguing finding was the 100% incidence of mild pain in the electrocautery group, contrasted with none in the scalpel group, and a lower incidence of wound infection in the electrocautery group (6.7% vs. 13.3%).

These findings align with similar studies, such as the one conducted by Yadav and colleagues in India, which also reported significant differences in incision time and blood loss between electrocautery and scalpel incisions. However, they found no significant differences in postoperative pain or wound infection rates (6). Telfer et al. corroborated these findings, reporting no difference in postoperative discomfort in patients with midline laparotomy incisions (17).

Furthermore, Kearns et al. compared electrosurgical and scalpel methods in elective midline incisions and found electrocautery to be more advantageous in terms of incision time, blood loss, post-surgical pain, and need for analgesia (18). The study highlighted that electrocautery incisions were significantly faster and more efficient than scalpel incisions. Another study supported these findings, suggesting that electrocautery incisions in abdominal surgeries have comparable scar complications and wound infection

risks to scalpel incisions (19). Despite these benefits, concerns remain about tissue scarring and infection risks associated with electrocautery, which may limit its use (20, 21).

Considering these findings and the potential for reduced blood loss, quicker tissue separation, and a safer environment for surgeons, electrocautery presents a compelling case over traditional scalpel incisions. Nevertheless, it is essential to consider the potential risks of poor wound healing and surgical site infections associated with its use (22).

## CONCLUSION

Conclusively, the evidence suggests that electrocautery holds distinct advantages over scalpel incision for midline abdominal surgeries. It offers the potential for quicker procedures and fewer postoperative complications. Moving forward, the implementation of electrocautery in place of the traditional scalpel in such surgeries could mark a significant advancement in surgical practice, prioritizing both efficiency and patient safety.

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