

# Prospective Randomized Control Trial Comparing Diathermy versus Scalpel for Skin Incisions in Patients Undergoing Elective Surgeries

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**Abstract:** ***Background:** Electrocautery is widely used in surgery. However it is less frequently used for skin incisions. This is because of fear of scarring of tissues, post-operative pain, and wound infection in view of devitalisation of tissues. This study compares the efficacy of diathermy versus scalpel for skin incisions in patients undergoing elective surgeries. **Materials and Methods:** In this prospective randomized study, 200 patients undergoing elective surgeries are divided into two groups. In Group A, skin incision is taken with electrocautery, and in Group B, incision is taken with steel scalpel. Incision time, incision related blood loss and post-operative wound complication rates are compared between the two groups. The results are finally analyzed and compared for the two groups using Chi-square test and unpaired 't' test. **Results:** Compared with a scalpel incision, cutting diathermy resulted in significantly less blood loss (mean difference 0.36 ml/cm;  $P < 0.001$ ) and shorter incision times (mean difference 14 s;  $P < 0.001$ ), with no differences in the wound complication rate. **Conclusion:** Although results are similar in both the groups, we still recommend the use of electrocautery for skin incisions, as it is an alternative, attractive and easily available new method. On the basis of this study we recommend a wider use of electrocautery in all surgical procedures to make skin incisions as this technique is quite safe. We recommend further broad studies in this regard to confirm the reliability of this method of skin incision.*

**Keywords:** Electrocautery, Diathermy, Scalpel, Skin incision

## 1. Introduction

Incision is a cut or a slit to gain access to the underlying structures. Very few operations can be performed without cutting through the skin. An incision may be used to gain access to deeper structures or surgery may be performed on the skin itself, whether for repair of trauma or for excision of a skin lesion. Surgeons have been in search for ideal methods of skin incisions which would provide quick and adequate exposure with minimal blood loss.

Cauterization is a medical term describing burning of body to remove or close a part of it. Electrocautery is used increasingly for tissue dissection, although fear of excessive scarring and poor wound healing has curtailed its widespread use for skin incisions [1].

Traditionally incisions are made with stainless steel scalpel. These incisions are supposed to be more bloody and painful. To overcome this problem many advanced techniques have come viz laser, plasma scalpel, cavitron surgical aspirator but the above said methods are costly and relatively unavailable at peripheries.

However, common practice by most surgeons is still to make skin incisions with a scalpel and to divide the deeper tissues with coagulation diathermy. Electrocautery which is available in all surgical theatres is less frequently used for skin incisions for the fear of tissue damage, post-operative pain, increase in infection rate and scarring. Nevertheless, electrocautery (Diathermy) is frequently used by some surgeons for skin incisions.

Various studies [2]-[8] have been undertaken to evaluate the efficacy of electrocautery over scalpel in making skin incision and the results are varying; some showing better

results with electrocautery while some showing similar results.

Recent advances and studies have shown that electrocautery can be used for skin incisions without any post-operative complications like wound infection, scarring and post-operative pain. Cutting diathermy incises skin with little charring and necrosis compared with coagulation diathermy, which generates heat more slowly via an interrupted current output.

This study is undertaken to alleviate the fear of using electrocautery for skin incisions in surgical community.

## 2. Objective

The objective of this study was to evaluate and compare the incision time, incision related blood loss & post-operative complications in electrocautery incision and scalpel incision over skin in patients undergoing elective surgeries.

## 3. Material and Methods

In this prospective randomized study, 200 patients undergoing elective surgeries are divided into two groups.

- In Group I skin incision is taken with electrocautery.
- In Group II incision is taken with scalpel.

Incision time, Incision related blood loss and postoperative wound complications are compared between the two groups.

### 3.1 Study Design

Prospective randomized control trial.

The observer is blinded to the type of incision used and gave his observation based on the predefined criteria.

### 3.2 Source of Data

Cases undergoing elective surgeries in MGM Medical College and Hospital over 2 years.

### 3.3 Sample Size: 200 Cases

- In 100 cases incision is taken with electrocautery.
- In 100 cases incision is taken with conventional scalpel.

### 3.4 Selection Criteria

#### Inclusion criteria:

- All routine non-emergency clean and clean contaminated cases.

#### Exclusion Criteria:

- Emergency cases
- Laparoscopic surgeries
- H/O drug or alcohol abuse
- Severe hepatic, renal or CVS dysfunction
- Diabetes Mellitus
- Patients on anti-coagulant therapy
- Surgeries on infected wounds
- Immunocompromised status

### 3.5 Outcome

During post-operative period complications are noted in hospital stay and are measured by means of -  
Seroma - collection of serous discharge at suture site.  
Hematoma - collection of blood clots at suture site.  
Purulent discharge - collection of pus at suture site.  
Suture line - At 8<sup>th</sup> post-operative day.

### 3.6 Statistical Analysis

The results are finally analyzed and compared for the two groups using Chi-Square Test.

### 3.7 Method of Collection of Data

After taking the informed consent, patients are randomized and divided in two Groups- Group I and Group II.

In Group I, incision is taken with electrocautery needle using pulse sine wave current and power setting of 25 watts. Haemostasis is achieved with force of coagulation. In Group II, skin incision is taken with scalpel and bleeding is controlled by force of coagulation using pulse sine wave on power setting of 30 watts.

All the procedures are carried under standardized suitable anaesthesia. Valleylab Force FX™ electrocautery machine is used for all the cases. Premedication is given with appropriate antibiotics, one hour prior to the procedure.

Closure of the subcutaneous tissue is done with 2-0 polyglactin simple interrupted suture and skin closure is done with 3-0 nylon, either simple interrupted or mattress suture.



Figure 1a]: Incision with electrocautery



Figure 1b]: Incision with scalpel



Figure 5a]: Incision site after electrocautery

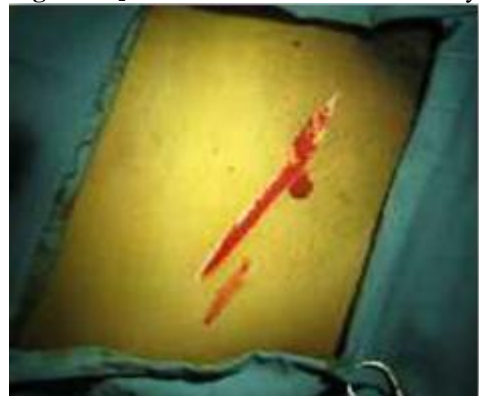


Figure 5b]: Incision site after scalpel

## 4. Results

### 4.1 Patient Demographs

200 cases were randomized prospectively to either electrocautery group or scalpel group for skin incision. There were no significant demographic differences noted between the two groups. There was no significant difference in the gender distribution in both the groups. However males outnumbered females in both the groups. The mean age of patients in Group I is  $36.33 \pm 18.15$  and Group II is  $37.83 \pm 19.08$

### 4.2 Operative Parameters

The various intra operative parameters compared between the two groups were the length of the incision, the time taken for completing the incision and the amount of blood loss related to the incision. The length of incision was recorded in both the groups intra operatively and is shown in table 1. The mean length (cm) of incision in Group I is  $8.15 \pm 3.75$  and Group II is  $9.04 \pm 4.44$

**Table 1:** Length (cm) of Incision

Length (cm)	Mean $\pm$ SD	t-value	p-value
Group I	$8.15 \pm 3.75$	1.53	P = 0.128 NS
Group II	$9.04 \pm 4.44$		

The time of incision was recorded in both the groups and analysed in table 2. The mean time (secs) of incision in

Group I is  $6.45 \pm 3.36$  and in Group II is  $8.83 \pm 5.55$ . This difference is statistically significant.

**Table 2:** Time (secs) of Incision

Time	Mean $\pm$ SD	t - value	P-value
Group I	$6.45 \pm 3.36$	3.36	P=0.000 S
Group II	$8.83 \pm 5.55$		

Table 3 shows the amount of blood loss (in cc or ml). The mean amount of blood loss (cc) in Group I is  $0.16 \pm 0.087$  and in Group II is  $0.39 \pm 0.53$ . This difference is also statistically significant.

**Table 3:** Amount of Blood Loss (cc) of Operative Incision

Blood Loss	Mean $\pm$ SD	t -value	p-value
Group I	$0.16 \pm 0.087$	4.24	P=0.000 S
Group II	$0.39 \pm 0.53$		

### 4.3 Post-Operative Wound Complications

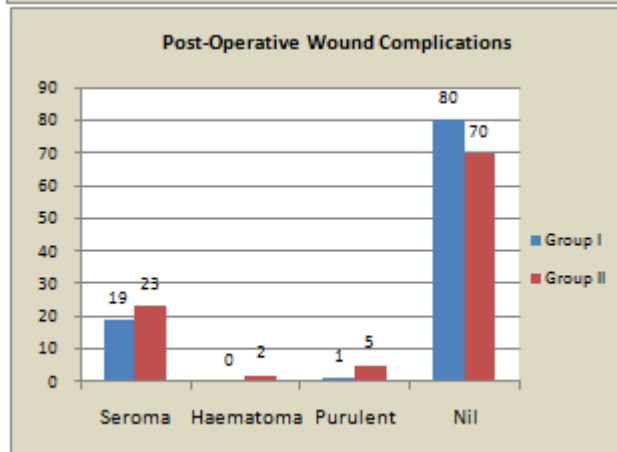
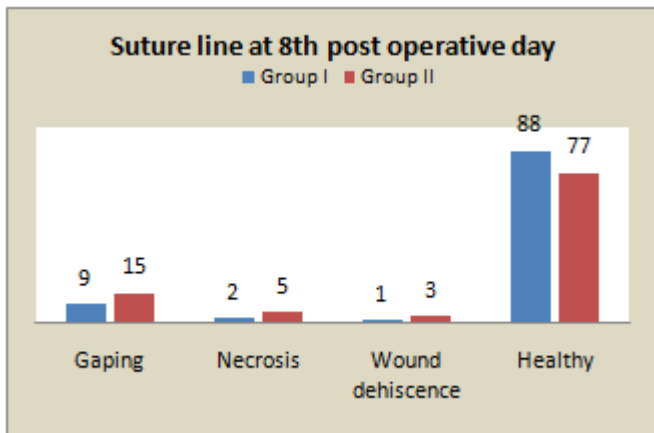
Overall wound complications were assessed for 8 days post operatively. Complications like seroma, haematoma and purulent collection were assessed and results shown in table 4. Although seroma formation was seen more in the scalpel group (23%), the difference is statistically not significant. (P = 0.184). Other post-operative complications like haematoma formation and purulent collection were similar in the two groups. Suture line was assessed at 8<sup>th</sup> post-operative day and results shown in table 5. The suture line at 8<sup>th</sup> post-operative day was found to be healthy in 88% of the subjects in Group I and 77% of the subjects in Group II.

**Table 4:** Post-operative Complications in Patients

Complications	Group I (Electrocautery)		Group II (Scalpel)		Total		Chi-square value	p- value
	No	%	No	%	No	%		
Seroma	19	19.0	23	23.0	42	21.0	4.84	P=0.184 NS
Haematoma	00	00	02	02.0	02	01.0		
Purulent	01	01.0	05	05.0	6	03.0		
Nil	80	80.0	70	70.0	150	75.0		
Total	100	100	100	100	200	100		

**Table 5:** Suture line at 8th Post-Operative day

	Group I (Electrocautery)		Group II (Scalpel)		Total		Chi-square value	p-value
	No.	%	No.	%	No.	%		
Gaping	09	09.0	15	15.0	24	12.0	1.70	P= 0.192 NS
Necrosis	02	2.0	05	05.0	07	3.5	1.01	P= 0.316 NS
Wound dehiscence	01	01.0	03	03.0	04	2.0	1.01	P= 0.321 NS
Healthy	88	88.0	77	77.0	165	83.5	4.11	P= 0.052 NS



## 5. Discussion

Surgeons have been always in search of an ideal method of making skin incision which would provide quick and adequate exposure with minimum loss of blood. Electrocautery is mainly used for hemostasis and less often for skin incision. Earlier days when explosive anaesthetic agents were in use, electrosurgical instruments had limited use because of explosive risks associated with anaesthetic agents. After the introduction of non explosive anaesthetic agents like halothane, electrosurgical instruments like diathermy are increasingly used for tissue dissections and control of bleeding.

However, it is still infrequently used for making skin incisions. The reluctance in the use of skin incision is due to the fear that electrosurgical instruments cause devitalisation of tissue and create increased amounts of necrotic tissue within the wound which may increase the chances of wound infection leading to delayed wound healing and excessive scarring [1], [6], [9], [10]. After the introduction of oscillator units, which produce pure sinusoidal current, there has been an increasing trend in the use of diathermy for making skin incisions. In the recent years, many studies have been conducted on both methods of skin incision, which showed less operating time, diminished blood loss, reduced pain and fewer requirements of analgesic drugs after surgery using the diathermy method of skin incision when compared to scalpel incision [1]. Skin incisions in general surgery were reported by Dixon and Watkin [11] in patients undergoing inguinal herniorrhaphy and cholecystectomy.

The shorter incision time and relatively less blood loss can be explained by the fact that achieving haemostasis with a scalpel incision requires several instrument exchanges with coagulation diathermy. This disadvantage is overcome with the use of cutting diathermy. Although the blood loss reduction may seem clinically irrelevant, frequent exchange of instrument that requires handing off the scalpel may result in an increase in the risk of 'sharps' injuries to the surgeon, assistant, nurse and patient. The risk of skin and soft tissue damage and also the potential for significant bleeding and exposure to blood borne infections is also well recognized [12].

The effect of cutting diathermy on wound healing is shown in previous experimental studies. These studies suggested that wounds created with diathermy have an increased infection rate, reduced tensile strength and also more wound necrosis [9], [13]-[15]. However, not all of these experimental studies differentiated between the use of cutting and coagulation modes of electrocautery. The reported effects appeared to be related more to the use of coagulation diathermy [14], [15]. Clinical studies have been conducted to investigate these concerns [3], [16], [17], the largest being a prospective non randomized multicentre trial of 964 patients, published in 2001. This study found no difference in the wound complication rates between cutting diathermy and scalpel [16]. It could be that cutting diathermy produces heat quickly and causes tissue vaporization, as opposed to the charring and necrosis associated with coagulation diathermy which predisposes to wound complications [13], [14], [18].

Injuries to the surgeon and patient owing to the use of diathermy have also been reported [18]. A burn injury may occur if the integrity of the surgeon's gloves is compromised. The patient may also be burnt inadvertently via conduction through the diathermy tip or other surgical instruments and also due to improper grounding. Concern has also been raised about diathermy smoke plumes and its long-term consequences of prolonged inhalation to the staff and patients. Diathermy smoke plume has been shown to contain a number of chemicals with a potential for carcinogenesis. Few organisms have been shown to be retrievable from the smoke plume, raising the possibility of disease transmission [19].

Some studies have reported reduced post-operative pain when cutting diathermy is used for skin incision [1], [2]. However, more recent studies found no such difference in postoperative pain perception [10]. This relationship between cutting diathermy versus scalpel and pain requires further investigation.

A prospective study has previously investigated the cosmetic outcome of skin incisions made by diathermy versus scalpel [11]. After 6 weeks follow-up, cosmetic rating was found favoring diathermy. In another study of 19 patients who underwent neck incisions, no significant difference was noted in subjective or objective cosmetic outcome or in patient satisfaction scores after 6 months follow-up [20]. A further recent retrospective study which investigated the cosmetic outcome of diathermy versus scalpel for skin incisions in head and neck surgery [6], found no difference

in the cosmetic outcome between the two groups. Although currently there is no evidence to suggest that diathermy results in a worse outcome, further research is required to elucidate the long-term effects of diathermy on cosmesis.

## 6. Conclusion

In our study 200 patients were randomized into two groups and depending on the group allotted incision was taken with either scalpel or electrocautery and evaluation done for blood loss during incision, time taken for incision and post-operative wound complications.

Although post-operative seroma, haematoma and purulent collection are seen more in scalpel group, difference is statistically not significant. ( $P = 0.184$ )

Based on the observations made in this study, it has been concluded that results of the both groups are similar in relation to post-operative wound complications while cutting diathermy resulted in significantly less blood loss (mean difference 0.36 ml/cm;  $P < 0.001$ ) and shorter incision times (mean difference 14 s;  $P < 0.001$ ), compared with a scalpel incision.

## 7. Summary

In our study, although results are similar in both the groups, we still recommend wider use of electrocautery in all surgical procedures to make skin incision as it is an alternative, attractive, easily available new method and this technique is quite safe. Traditional fear of wound strength and devitalisation are not reflected in this study.

Most importantly increased prevalence of blood borne diseases like Hepatitis C, Hepatitis B and HIV infection favors the use of electrocautery for skin incisions which thereby excludes scalpel away from the operative field and decreases the chances of transmission of these and other lethal diseases to the operating team [1].

We recommend further studies in this regard to confirm the reliability of this method of skin incision and if found fruitful, it may be adopted as a hospital policy for making skin incisions.

## References

- [1] Kearns SR, Connolly EM, McNally S, McNamara DA, Deasy J. Randomized clinical trial of diathermy versus scalpel incision in elective midline laparotomy. *Br J Surg* 2001; 88: 41–4.
- [2] Shamim M. Diathermy vs. scalpel skin incisions in general surgery: double-blind, randomized, clinical trial. *World JSurg* 2009; 33: 1594–9.
- [3] Ali Q, Siddique K, Mirza S, Malik AZ. Comparison of superficial surgical site infection following use of diathermy and scalpel for making skin incision in inguinal hernioplasty. *Niger J Clin Pract* 2009; 12: 371–4.
- [4] Eren T, Balik E, Ziyade S, Yamaner S, Akyuz A, Bugra D. Do different abdominal incision techniques play a role in wound complications in patients operated on for

- gastrointestinal malignancies? ‘Scalpel vs. electrocautery’. *Acta Chir Belg* 2010; 110: 451–6.
- [5] Ahmad NZ, Ahmed A. Meta-analysis of the effectiveness of surgical scalpel or diathermy in making abdominal skin incisions. *Ann Surg* 2011; 253: 8–13.
- [6] Kumar V, Tewari M, Shukla HS. A comparative study of scalpel and surgical diathermy incision in elective operations of head and neck cancer. *Indian J Cancer* 2011; 48: 216–9.
- [7] Chalya PL, Mchembe MD, Mabula JB, Gilyoma JM. Diathermy versus Scalpel incision in elective midline laparotomy: A prospective randomized controlled clinical study. *East and Central Afric J Surg*. 2013; 18(1): 71–7.
- [8] Aird LNF, Bristol SG, Phang PT, Raval MJ, Brown CJ. Randomized double-blind trial comparing the cosmetic outcome of cutting diathermy versus scalpel for skin incisions. *Br J Surg* 2015; 102: 489–94.
- [9] Ozgun H, Tuncyurek P, Boylu S, Erpek H, Yenisey C, Kose H. The right method for midline laparotomy: what is the best choice for wound healing? *Acta Chir Belg* 2007; 107: 682–6.
- [10] Siraj A, Gilani AAS, Dar MF, Raziq S. Elective midline laparotomy: comparison of diathermy and scalpel incisions. *Professional Med J* 2011; 18: 106–11.
- [11] Dixon AR, Watkin DF. Electrosurgical skin incision versus conventional scalpel: a prospective trial. *J R Coll Surg Edinb* 1990; 35: 299–301. Talpur AA, Khaskheli AB, Kella N, Jamal A. Randomized, Clinical Trial on Diathermy and Scalpel Incisions in Elective General Surgery. *Iran Red Cres Med J* 2015; 17(2): e14078.
- [12] Vose JG, McAdara-Berkowitz J. Reducing scalpel injuries in the operating room. *AORN J* 2009; 90: 867–72.
- [13] Kumagai SG, Rosales RF, Hunter GC, Rappaport WD, Witzke DB, Chvapil TA et al. Effects of electrocautery on midline laparotomy wound infection. *Am J Surg* 1991; 162: 620–2.
- [14] Rappaport WD, Hunter GC, Allen R, Lick S, Halldorsson A, Chvapil T et al. Effect of electrocautery on wound healing in midline laparotomy incisions. *Am J Surg* 1990; 160: 618–20.
- [15] Allan SN, Spitz L, Van Noort R, Black MM. A comparative study of scalpel and electrocautery incision on subsequent wound healing. *J Pediatr Surg* 1982; 17: 52–4.
- [16] Franchi M, Ghezzi F, Benedetti-Panici PL, Melpignano M, Fallo L, Tateo S et al. A multicentre collaborative study on the use of cold scalpel and electrocautery for midline abdominal incision. *Am J Surg* 2001; 181: 128–32.
- [17] Chrysos E, Athanasakis E, Antonakakis S, Xynos E, Zoras O. A prospective study comparing diathermy and scalpel incisions in tension-free inguinal hernioplasty. *Am Surg* 2005; 71: 326–9.
- [18] Massarweh NN, Cosgriff N, Slakey DP. Electrosurgery: history, principles, and current and future uses. *J Am Coll Surg* 2006; 202: 520–30.
- [19] Rimmer V. Diathermy smoke plume: why do we put up with it? *J Perioper Pract* 2009; 19: 424–7.
- [20] Chau JK, Dzigielewski P, Mlynarek A, Cote DW, Allen H, Harris JR et al. Steel scalpel versus electrocautery blade: comparison of cosmetic and patient satisfaction

- outcomes of different incision methods. *J Otolaryngol Head Neck Surg* 2009; 38: 427–33.
- [21] Ly J, Mittal A, Windsor J. Systematic review and meta-analysis of cutting diathermy versus scalpel for skin incision. *Br J Surg.* 2012; 99(5): 613–20.
- [22] Pearlman NW, Stiegmann GV, Vance V, Norton LW, Bell RCW, Staerkel R et al. A prospective study of incisional time, blood loss, pain, and healing with carbon dioxide laser, scalpel and electrocautery. *Arch Surg* 1991; 126: 1018–20.
- [23] Groot G, Chappell W. Electrocautery used to create incisions does not increase wound infection rates. *Am J Surg* 1994; 167: 601–3.
- [24] Chowdri NA, Wani NA, Ganai NA, Naqash SH, Peer GQ, Wani QA. Comparative study of electrocautery and scalpel incision in general surgery. *IJS* 2002; 63: 308–10.
- [25] Sheikh B. Safety and efficacy of electrocautery scalpel utilization for skin opening in neurosurgery. *Br J Neurosurg.* 2004; 18(3): 268–72.