

## A Prospective Randomized Comparative Study of Electrocautery versus Scalpel Skin Incisions in Patients Undergoing Elective Inguinal Hernia Repair

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### Abstract

*Background/aim:* Use of electrocautery in surgery for the skin incisions is rapidly gain popularity but still most surgeons are in doubt and fear of complications like scarring of tissues, post operative pain, wound infection and poor Cosmesis. Aim of this prospective study was to compare the outcome of electrocautery incisions versus scalpel incisions in open inguinal hernia surgery with regard to early postoperative pain, postoperative wound infection rate and scar assessment. *Material and Methods:* A prospective randomized study of 50 patients with inguinal hernia undergoing mesh repair was carried out over a period of one year. Patients were divided equally in to two groups. In Group A skin incision was taken with electrocautery, and in Group B incision was taken with scalpel. Postoperative pain, wound complication and requirement of analgesic and Cosmesis were compared between the two groups. *Results:* The post-operative pain is significantly less in electrocautery group. The requirement of analgesics dose were (mean 1.08 and 2.6) in electrocautery and scalpel group respectively which is significantly more with scalpel group. Only one case of seroma was noted in scalpel group while electrocautery group didn't had any complications, the difference was not statistically significant. Cosmesis was better in electrocautery incisions; Manchester scar score was higher in the group II. *Conclusion:* Electrocautery incision is safe, less time consuming with less blood loss during inguinal

hernia surgery and produces less postoperative pain no postoperative wound infection and better in term of Cosmesis.

**Keywords:** Electrocautery Incision; Scalpel Incision; Inguinal Hernia Surgery; Manchester Scar Score.

### Introduction

The art of performing surgeries have improved in recent years with the high-frequency electric surgical knife is one of the common instruments in surgical operations since its inception in 1929 [1]. Development of various electrosurgical devices assisting surgeons in performing safer surgeries with better outcomes. Skin incision has traditionally been made with a standard scalpel blade with good primary healing end results of the wound. Electrocautery was mainly used for homeostasis and less often for skin incision. Earlier days when explosive anaesthetics agents were in use, electrosurgical instruments had limited use because of explosive risks associated with anaesthetic agents. After the invention of non explosive anaesthetic agents like halothane, electrosurgical instruments are used increasingly for tissue dissection, cutting, and haemostasis, concerns about fear of deep burns, excessive scarring and poor wound healing have curtailed the widespread use of diathermy for skin incision [9]. These factors continues enforces surgeons to give skin incisions with the scalpel, which produces a clean, incised wound with minimal tissue destruction [2]. Hence this study was conducted at Sawai Man Singh (S.M.S) Government Medical College Jaipur, Rajasthan in the Department of Surgery, where fifty patients undergoing elective

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open inguinal hernia surgery were included, to compare the scalpel versus electrocautery in making the skin incision.

## Material and Method

After taking the informed consent, patients were randomized and divided in two groups A and B. Pre-medication was given injection- Ceftriaxone 1 gm stat one hour before surgery.

*In Group A:* Incision was taken with electrocautery pure cutting blunt knife using pulse sine wave current and power setting of 70 watts. Haemostasis was achieved with force coagulation.

*In Group B:* Skin incision was taken with scalpel, bleeding controlled by force coagulation using pulse sine wave on power supply 50 watts. All the procedures were carried under standardized spinal anaesthesia. Closure of the external aponeurosis with proline 2-0, intermittent Vicryl 2-0 for subcutaneous tissue and mattress suture with 3-0 Ethilon for skin closure were done.

Diclofenac 75 mg intramuscular injection was given 12-hourly for 24 hours, followed by diclofenac oral 50 mg 8-hourly for next 24 hours. Postoperative pain was measured using pictorial visual analogue scale at first post operative day at interval of 3, 6, 12 and 24 hours. Visual analog scale is represented by a straight line measuring 10 cm, the extremes of which corresponds to no pain at one end and worst pain at the other end. If pain score was  $>4$  injection diclofenac 75mg IM was given. Wound infection was graded according to Southampton wound scoring system: Grade I, normal healing with mild bruising or erythema; Grade II, erythema plus other signs of inflammation; Grade III, clear or serosanguinous discharge; and Grade IV, purulent discharge and Grade V, deep or serious wound infection with or without tissue breakdown [3]. Discharge was sending for culture and sensitivity. Cosmesis assessment was done using Manchester Scar Score at the 7<sup>TH</sup> postoperative day, one month and three months. The score ranges from 5 to 18, with higher the score, poorer the scar [Table 3].

*Study Area:* The present study was conducted in the Department of General Surgery, S.M.S Hospital, Jaipur, Rajasthan India.

*Study Design:* Hospital based Randomized Control Trial

*Study Period:* This study was carried out from May 2012 up to April 2013.

*Sample Size:* Accepting 0.63 difference of means to be detected in pain scores 24 hrs after surgery with 0.7 expected SD and assuming alpha error 0.05 and power 80%, the sample size was calculated 21 subjects for each group. For study purpose 25-25 cases needing Inguinal Hernia Repair was included for each group.

*Sample Technique:* Simple random technique through Chitbox method.

*Study Population:* Each and every eligible case attending outpatient Department of General Surgery in S.M.S Hospital, Jaipur and that were scheduled to undergo an Inguinal Hernia Repair.

### Inclusion Criteria

1. Patients undergoing elective Inguinal Hernia Repair in General Surgery Department, SMS Hospital, Jaipur.

### Exclusion Criteria

1. Preoperative use of analgesics for  $> 3$  days per week for  $>3$  months.
2. Paediatric [ $<12$  yrs] and geriatric [ $>55$  yrs] patients.
3. Patients with chronic pain  $>3$  months- tends to have a less robust response to treatment with analgesics.
4. History of drug or alcohol abuse- Assessment and treatment are particularly difficult in this group and referral to specialists is recommended.
5. Severe Hepatic, Renal, CVS, CNS dysfunction.
6. Diabetes mellitus, Immuno compromised Status, obesity - affects wound healing.
7. Complicated hernia like obstructed, strangulated, infected, irreducible hernia.

### Outcome Variables

1. Median Pain Scores
2. Mean Duration of hospital stay
3. Proportion of cases in various group

### Outcome Statistics

*The Results were Finally Analyzed and Compared*

For median pain scores in two groups Mann-Whitney U Test was used, for mean duration of hospital in two groups Unpaired 'T' Test was used, difference in proportions of cases in various groups was inferred with Chi-square Test.

## Results

Fifty patients with inguinal hernia were randomized prospectively divided equally to either electrocautery group [Group A] or scalpel group [Group B] for skin incision. There were no significant demographic differences between two groups noted. Mean age of patients in group A i.e Electrocautery group is  $40.20 \pm 13.21$  and in group B i.e Scalpel group is  $36.20 \pm 11.94$ .

Hospital stay was 3.32 and 3.40 in electrocautery and scalpel group respectively. Difference was not significant.  $P = .756$ .

Post operative pain was assessed by visual analogue scale at 3, 6, 12, 24 hours at the first post operative day of surgery. It was found that the mean

postoperative pain score was higher in the Group I which were statistically significant [Table 1].

Dose of analgesic i.e. injection diclofenac 75mg IM are recorded in both groups at first postoperative day. Dose requirements were 1.08 and 2.6 in electrocautery and scalpel group respectively which is significantly more with scalpel group [Table 2].

Overall wound complications are assessed for 7 days post operatively. Assessment of wound infection was done by sending wound discharge for culture. Wound infection was graded according to Southampton wound scoring system Only one case of seroma was noted in scalpel group while electrocautery group didn't had any complications.

It was seen that Cosmesis was better in electrocautery group. Cosmesis assessment was done

**Table 1:** Shows Assessment of pain at first post operative day at 3, 6, 12, 24 hours in inguinal hernia surgery by electrocautery/ scalpel incision

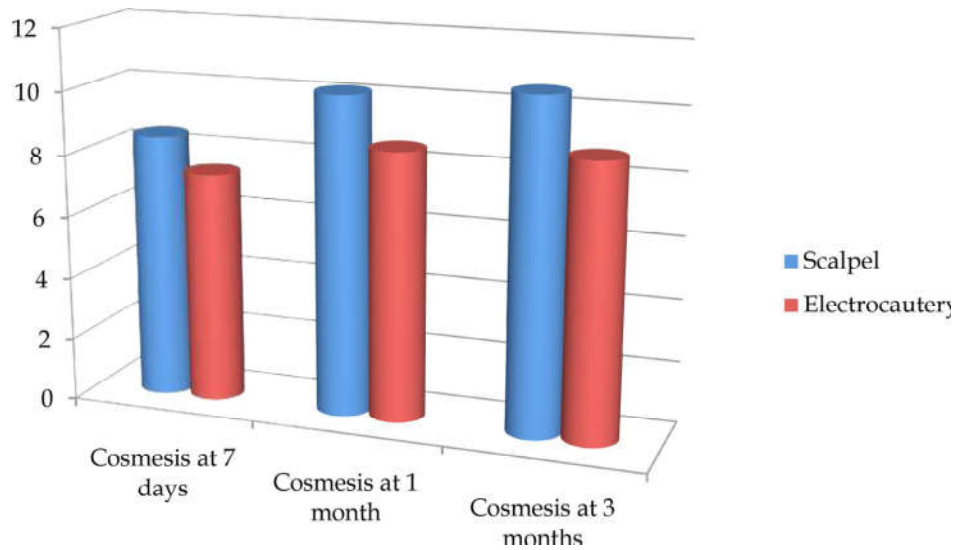
Assessment of pain at first POD	Incision	N	Mean	Std. Deviation	Std. Error Mean	P value
Pain at 3 hours	Scalpel	25	1.7	0.53	0.10	0.000
	Electrocautery	25	2.3	0.48	0.09	
Pain at 6 hours	Scalpel	25	1.12	0.33	0.06	0.002
	Electrocautery	25	1.5	0.50	0.10	
Pain at 12 hours	Scalpel	25	1.0	0.00	0.00	0.07
	Electrocautery	25	1.11	0.33	0.6	
Pain at 24 hours	Scalpel	25	0.84	0.37	0.07	0.038
	Electrocautery	25	1.0	0.00	0.00	

**Table 2:** Analgesic requirements post operatively

Incision	Doses of analgesic (Mean $\pm$ SD)	P value
Electrocautery	1.08 $\pm$ .75	0.000
Scalpel	2.6 $\pm$ 1.0	

**Table 3:** Manchester Scar Scale

	Visual Analog Scale	
	Excellent $\leftarrow$	$\rightarrow$ Poor
Colour	Perfect	1
	Slight mismatch	2
	Obvious mismatch	3
	Gross mismatch	4
Matte vs shiny	Matte	1
	Shiny	2
Contour	Flush with surrounding skin	1
	Slightly proud/ Indented	2
	Hypertrophic	3
	Keloid	4
Distortion	None	1
	Mild	2
	Moderate	3
	Severe	4
Texture	Normal	1
	Just palpable	2
	Firm	3
	Hard	4



Graph 1: Shows Cosmesis at 7<sup>th</sup> day, one month and three months

using Manchester Scar Score at the 7<sup>th</sup> post operative day and the follow-up schedule included weekly follow up to the first month than monthly up to three month. Manchester scar score was higher in the group II (8.5) than in group I (7.04) at 7<sup>th</sup> post operative day, group II (10.2) group I (8.6) at one month and group II (10.6) Group I (8.8) at three months [Graph 1].

## Discussion

Conventionally, scalpels have been used to make surgical incisions. However, since its introduction in the early part of the 20th century, electro surgery has been widely used as an alternative tool for creating incisions. Development of the first commercial electrocautery device is credited to Dr. William T. Bovie, who developed the device during the period 1914 to 1927 while, employed at Harvard University and is known as the father of electrocautery devices. [4] Two different surgical effects can be achieved with electrocautery, namely cutting and coagulating. In the cutting mode, a continuous current rapidly produces extreme heat causing intracellular water to boil and cells to explode into steam (vaporisation). In the coagulating mode, short bursts of electrical current are applied with a pause between each burst. As a result, the heat produced in the cells dries up the tissue, but is not intense enough to evaporate the intracellular water. The coagulating mode results in a greater degree of thermal damage and necrosis of adjacent tissues. In recent years after introduction of advanced electrocautery units (pure sinusoidal current), there is increasing trend in the use of electrocautery for making skin incision.

In our study, 50 patients were randomized in to two groups, incision is taken with either scalpel or electrocautery depending on the group allotted, and evaluated post operatively for pain, requirement of analgesic doses, post operative wound complications and Cosmesis.

The mean age of patients in electrocautery group was 40.20 and Scalpel group was 36.20. In a study by Patil shivgauda et al mean age was 47.7 years in electrocautery group and 47.8 in scalpel group [5].

Hospital stay was 3.32 and 3.40 in electrocautery and scalpel group respectively. Difference was not significant. In other studies too, not very much difference was noted in hospital stay.

Results are obtained in our study which clearly shows better pain scores with electrocautery group which were statistically significant [Table 1]. These results were similar with the Study in Department of General Surgery, Sher E. Kehir Institute of medical sciences Srinagar by Chowdri N.A. et al which also showed significantly less pain in electrocautery group [6]. Chrysos E. et al, compared diathermy and scalpel incision in tension free inguinal hernioplasty at department of general surgery in University hospital Herakhion Greece, they noted that Diathermy group received less analgesics with no difference noted in wound strength and infections were totally absent in both groups [7].

P.N. Meka et al, compared the superiority of electrocautery over scalpel incision in various abdominal surgeries. In the study they have found that less blood loss, less pain score and less time for incision in electrocautery group [8].

In a study entitled as "diathermy versus scalpel incision in patients undergoing midline laparotomy incision" done at Royal College of surgeon Ireland, by S.R.Kerans et al, also reports significantly less pain with electrocautery incision [9].

The lower visual analogue pain scores can be explained by the fact that cell vaporization caused by the application of pure sinusoidal current leads to immediate tissue and nerve necrosis without significantly affecting nearby structures [13].

In our study dose of analgesic i.e. injection Diclofenac 75 IM was given in both groups post operatively and doses were recorded according to requirement. Dose requirements were (mean 1.08 and 2.6) in electrocautery and scalpel group respectively which is significantly more with scalpel group.

In the study by Chowdri N.A. et al mean requirement of analgesic was less for electrocautery group [6]. In another study by Chrysos E. et al, Diathermy group received fewer analgesics [7]. Patil Shivagouda et al found that analgesic requirement is same in both the groups, this contradicts from our study [5].

Overall wound complications were assessed for 7 days post operatively. Assessment of wound infection was done by sending wound discharge for culture. Wound infection was graded according to Southampton wound scoring system Only one case of seroma was noted in scalpel group (Grade III) while electrocautery group didn't had any complications [3].

In the study by Patil Shivgauda et al Seroma in both groups are comparable. Although scalpel group shows more hematoma [20%], difference is not statistically significant. Other complication i.e. purulent collection in post operative wound is similar in two groups [5].

In study of Chowdri et al, wound hematoma and seroma is more scalpels in group but difference is not statistically significant. S.R. Kerans et al also didn't noted any significant difference in wound complications [6,9].

Franchi M. et al in their study of 964 patients undergoing midline laparotomy for malignancy found by univariate analysis done for analysis of results higher incidence of wound complication in scalpel group (8 from scalpel group and 1 from electrocautery group). But after adjusting confounding variables (age, BMI) no difference was found between two groups [10].

It was seen that Cosmesis was better in electrocautery group. Patients were more satisfied

with their scar in electrocautery group when compared to scalpel group. The assessment of Cosmesis at the 7<sup>TH</sup> postoperative day, one month and three months was done by Manchester Scar Score. The criteria assessed were color, nature, texture, contour and distortion [Table 3] [12]. The system is applicable to a wider range of scars and well suited for postoperative scars assessment. The score ranges from 5 to 18, with higher the score, poorer the scar. In the present study, it was found that the mean Manchester scar score was higher in the group II than group I.

In study of Chowdri et al and S.R.Kerans et al, the scar was better with electrocautery group [6,9]. P.N. Meka et al also found superior cosmetic appeal in electrocautery group [8].

Dixon and Watkin suggested that diathermy was quicker, gave better cosmetic results and resulted in no added discomfort to patients undergoing inguinal herniorrhaphy or cholecystectomy [11].

The findings of our present study are also in comparable with the studies done in the past. Enough evidence is available in the literature so far to suggest that all the fears of increased chances of post-operative complications due to skin incisions made by the electrocautery are undue and not justified at this moment. Use of electrosurgical instruments is gaining momentum. Removal of the scalpel from the operating field lessens the chances of spread of blood-transmitted diseases.

## Conclusion

Electro surgery has made huge progress ever since its inception in surgical use over last hundred years. Our conclusion also support the view that use of electrocautery is safe and it's use for making skin incisions in elective surgery does not increase the rate of post-operative pain or wound infections and even better in Cosmesis.

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## Conflict of Interest

All authors are declares no common competing conflict of interest.

## References

1. Lawrenson KB, Stephens FO. The use of electrocuting and electro coagulation in surgery. Aust NZ J Surg

- 1970;39:417-21.
2. Johnson CD, Serpell JW. Wound infection after abdominal incision with scalpel or diathermy. *Br J Surg* 1990;77:626-7.
  3. Bailey IS, Karran SE, Toyn K, Brough P, Ranaboldo C, Karran SJ. Community surveillance of complications after hernia surgery. *BMJ* 1992;304(6825):469-71.
  4. Carter, Preston L. The life and legacy of William T. Bovie. *The American Journal of Surgery*. 2013;205:488-491. doi:10.1016/j.amjsurg.2012.12.005. Retrieved March 28, 2015
  5. Patil S, Gogeri BV, Goudhi AS, Metgud SC. Prospective randomized controlled trial comparing the efficacy of diathermy incision versus scalpel incision over skin in patients undergoing inguinal hernia repair. *Rec Res Sci Tech* 2010;2:44-7.
  6. Chowdri NA, Wani NA, Ganai AA, Naqash. SH, Peer. GQ, Wani. QA. Comparative study of electro surgical and scalpel incision in general surgery. *IJS*. 2002;63:308-310.
  7. Chrysos E, Athanasakis E, Antnakakis S, Xynos E, Zoros O. A prospective study comparing diathermy and scalpel incision in tension free inguinal hernioplasty. *Am Surg* 2005 Apr;71(4):326-329.
  8. Meka, P.N., Khullar, P., Anand, V.J. To compare the superiority of electrocautery over the traditional scalpel for skin incision. *Journal of Surgical Research*, 2004;121:341.
  9. 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.
  10. Franchi, M., Ghezzi, F., Panici, L.B., Melpignano, M., Fallo, L., Tateo, S., Maggi, R., Scambia, G., Mangili, G. and Buttarelli, M. A multicentre collaborative study on the use of cold scalpel and electrocautery for midline abdominal incision. *The American Journal of Surgery*, 2001;181(2):128-132.
  11. Dixon AR, Watkin DF. Electrosurgical skin incision versus conventional scalpel: a prospective trial. *J R Coll Surg Edinb* 1990;35:299-301.
  12. Beausang E, Floyd H, Dunn KW, et al. A new quantitative scale for clinical scar assessment. *Plast Reconstr Surg*. 1998;102:1954-61.
  13. Bhupender Kadyan, Shahaji Chavan, Manisha Mann, Prashant Punia, Sachin Tekade. A Prospective study comparing diathermy and steel scalpel in abdominal incisions. *Medical Journal of Dr. D.Y. Patil University*. 2014 Sep-Oct;7(5).
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