

## A COMPARATIVE STUDY BETWEEN SCALPEL AND CUTTING DIATHERMY FOR SKIN INCISIONS

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### **ABSTRACT**

**Aim & Objective:** This prospective randomized clinical trial was conducted to compare the efficacy and safety of surgical diathermy incisions versus conventional scalpel incisions for Inguinal hernia incisions with an aim to evaluate the efficacy of diathermy as an alternative to scalpel incision.

**Methodology:** This study was done in the Department of General Surgery, Mamata General Hospital from October 2016 to September 2018. Total 60 patients were randomized into two groups. Group A (Electrocautery group) and Group B (Scalpel group). Skin incision in patients undergoing inguinal hernia repair were taken with either electrocautery or scalpel depending on their group.

**Results:** In the present study, Both the groups were comparable in terms of mean age, pain score, analgesic dose requirement post operatively, wound complications. The common age group affected was 41-50 years and least affected age group was 21-30. Most common gender in this study was males (97%) whereas females were 3% in this study. Post operative pain was statistically similar in both the groups at 6 hours, 12 hours and 24 hours ( $P=0.475$ ,  $P=0.556$ ,  $P=0.762$  respectively). Post operative analgesic requirement was statistically similar in both the groups ( $P=0.499$ ). Hematoma was seen in 3.3% case in electrocautery group whereas 20% cases developed hematoma in scalpel group. Seroma was seen in 30% cases in electrocautery group whereas 33.3% cases developed seroma in scalpel group, which was not statistically significant. Purulent collection was seen in 13.3% cases in electrocautery group and 16.6% in scalpel group, which was statistically not significant. Although results were similar in both groups, use of electrocautery for skin incision is recommended as it is an alternative, attractive and easily available new method. Traditional fear of wound strength and devitalisation are not reflected in this study. Scar formation was also less in electrocautery group. Most importantly recent increase in blood borne infections like Hepatitis C, Hepatitis

B, and Human immune deficiency virus infection makes exclusion of scalpel from operative field.

**Conclusion:** On the basis of this study a wider use of electrocautery in all surgical procedures for skin incision as this technique is quite safe. Results in this study were similar to many studies which were discussed above.

**Keywords:** Skin incision, Diathermy incision, scalpel incision, inguinal hernia repair

## INTRODUCTION

Incision is a cut or slit to gain access to underlying structures. Cauterization is a medical term describing burning of tissue to remove or close a part of it<sup>1</sup>. 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 and cavitron but the above said methods are costly and there is relative unavailability of these instruments in peripheries.<sup>1,2</sup>

Electrocautery which is available in all surgical theatres is less frequently used for skin incisions for the fear of tissue damage, post operative pain & scarring. Recent advances and studies have shown that electrocautery can be used for skin incision without any postoperative complications like wound infection, scarring and less post operative pain<sup>2-5</sup>.

It is considered to be an efficient mode of dissection being haemostatic and convenient. With the advent of modern electrosurgical units capable of delivering pure sinusoidal current, this technique is now becoming extremely popular because of rapid haemostasis, faster dissection and reduced overall operative blood loss.

In diathermy, a potential gradient dependent current is passed through the tissue at high frequency (greater than 100000 Hz) to excite tissue molecules such as water resulting in controlled tissue lyses, which can be used for employed to coagulate (modulated mode) or to cut (sinusoidal mode) the tissue. This principle allows the use of diathermy electrode without causing surrounding tissue damage. Diathermy incision is not a true cutting incision. This method heats cells within tissues so rapidly that they vaporize, leaving a cavity within cell matrix, heat created disappears as steam, rather than being transferred to adjacent tissues. As electrode is moved forward new cells are contacted and vaporized with creation of incision. This explains absence of scarring and subsequent healing with less scarring. Despite these findings and advantages, the idea of using diathermy as a 'cutting' instrument for skin and surgical incisions has been rejected by many surgeons for the fear of delay wound healing and the risk of infection and this has curtailed the widespread use of surgical diathermy for skin incisions.

Many randomized clinical trials have been conducted to compare diathermy incision with scalpel incision over skin and many of them showed diathermy incision is better than scalpel incision in terms of time taken for incision, lesser pain, better wound healing and little blood loss. However, despite this evidence in many randomized clinical trials in support of diathermy use in skin incision, many surgeons in many centres including ours are still reluctant in using diathermy for making skin incisions.

This prospective randomized clinical trial was conducted to compare the efficacy and safety of surgical diathermy incisions versus conventional scalpel incisions for Inguinal hernia incisions with an aim to evaluate the efficacy of diathermy as an alternative to scalpel incision.

### **AIMS AND OBJECTIVES**

1. To evaluate and compare the post operative pain in electrocautery incision and scalpel incision over skin in patients undergoing hernia repair.
2. To calculate percentage of post operative complications in two different types of incision viz. Seroma, Hematoma, and Pus collection.
3. To alleviate the fear of using electrocautery for skin incisions.

### **PATIENTS AND METHODS**

60 cases of primary inguinal hernia, satisfying the inclusion criteria among the patients admitted for surgery in the surgical wards in the Department of Surgery, Mamata General Hospital, Khammam over a period of two years from October 2016 to September 2018, were taken into consideration in this study.

#### **Study Design:**

This is a prospective randomized control trial where in, 60 sealed envelopes containing 30 each of group A or group B prepared. Informed consent from patients mentioning that the skin would be incised with either scalpel or electrocautery was taken. Later sealed envelope were put for lottery in operation theatre and one envelope was selected for that particular patient and operation was carried out as per the group norms.

#### **Sample Size: 60 Cases**

1. In 30 cases incision was taken with electrocautery over skin (EC / group A).
2. In 30 cases incision was taken with conventional scalpel (SC / group B).

Tissue dissection was done with electrocautery in both groups and Lichtenstein tension free hernioplasty was performed in all.

#### **Duration of the study: 24 months**

#### **Inclusion criteria:**

1. All cases of elective uncomplicated inguinal hernia.
2. Age group 16 to 75 irrespective of sex.
3. Patients willing to participate in the study.

#### **Exclusion Criteria:**

1. Preoperative use of analgesics for more than 3 days per week for more than 3 months.
2. Paediatric [less than 16 yrs.] and geriatric [>75yrs] patients.

3. Patients with chronic pain >3 months.
4. History of alcohol or narcotic abuse.
5. Severe hepatic, renal, cardiac dysfunction.
6. Diabetes mellitus and immunocompromised status.
7. Previous scars over the incision site and recurrent inguinal hernia cases.
8. Patients unwilling for the study.

#### **OUTCOME:**

Postoperative pain was measured using pictorial visual analogue scale at 6,12 and 24 hours. If pain score was more than 4, injection Diclofenac 50 mg intramuscular would be given.

During post operative period (up to 7 days) complications noted in hospital stay were measured like,

1. Seroma- collection of serous discharge in suture site.
2. Haematoma- collection of blood.
3. Purulent- collection of purulent discharge.

#### **METHOD:**

After taking the informed consent, patients were randomized and divided into two groups A and B.

In Group A-Skin incision was taken with electrocautery needle using pulse sine wave current and power setting of 70 watts (Electrosurge 250 EB). Haemostasis would be achieved with forceps coagulation. In Group B-Skin incision is taken with scalpel, bleeding controlled by forceps coagulation using pulse sine wave on power supply 30 watts (Electrosurge 250 EB).

#### **Technique of the Operation:**

A 5-to 6-cm skin incision, which starts from the pubic tubercle and extends laterally within the Langer line was given. After skin incision, the external oblique aponeurosis was opened and its lower leaf was freed from the spermatic cord. The upper leaf of the external oblique was then freed from the underlying internal oblique until the internal oblique aponeurosis was exposed.

To explore the internal ring, for indirect hernia sacs the cremasteric sheath was incised longitudinally at the level of the deep ring to access the cremasteric compartment. Indirect hernial sacs were freed from the cord to a point beyond the neck of the sac and ligated, removed. In the event of direct hernias sacs were inverted with an absorbable suture.

A sheet of 15×7.5 cm polypropylene mesh was used in all the cases. The medial corner of the mesh was tailored to its standard shape which resembles the tracing of a foot print with a lower sharper angle to fit into the angle between the inguinal ligament and the rectus sheath and an upper wider angle to spread over the rectus sheath.

The sharper corner of the mesh was secured with a nonabsorbable monofilament suture to the insertion of the rectus sheath to the pubic bone overlapping the bone by

1 to 2 cm. lower edge of the patch to the inguinal ligament up to a point just lateral to the internal ring. A slit was made at the lateral end of the lower edge of mesh, creating two tails: a wide one (two thirds) above and a narrower one (one third) below. The wider upper tail was grasped with forceps and passed toward the head of the patient from underneath the spermatic cord. The upper edge of the patch was sutured in place with two interrupted non-absorbable sutures.

Closure of abdominal layers were done with continuous vicryl 2-0 for external oblique aponeurosis, intermittent vicryl 2-0 for subcutaneous tissue and mattress suture with 2-0 prolene for skin closure.

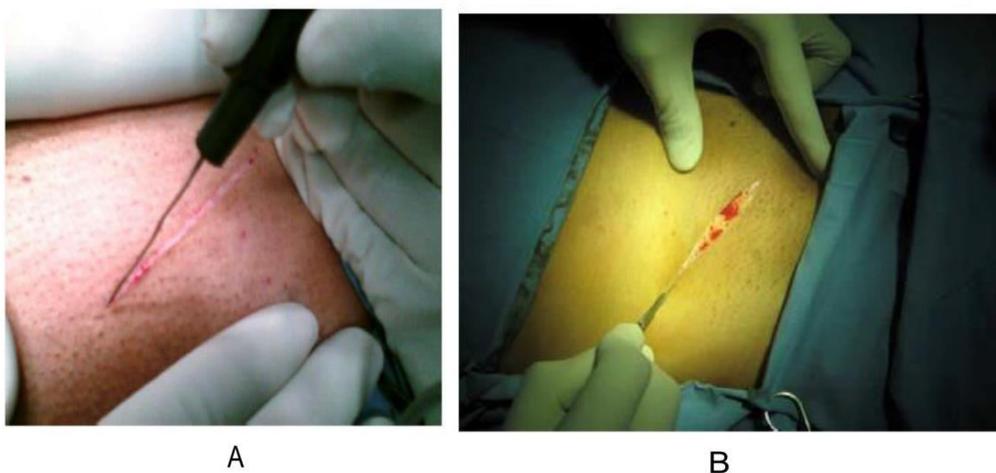
**Post operatively:** All wound were examined according to southampton wound scoring system<sup>6</sup>, and identified hematoma, seroma and pus and placed in respective categories.

### **STATISTICAL ANALYSIS:**

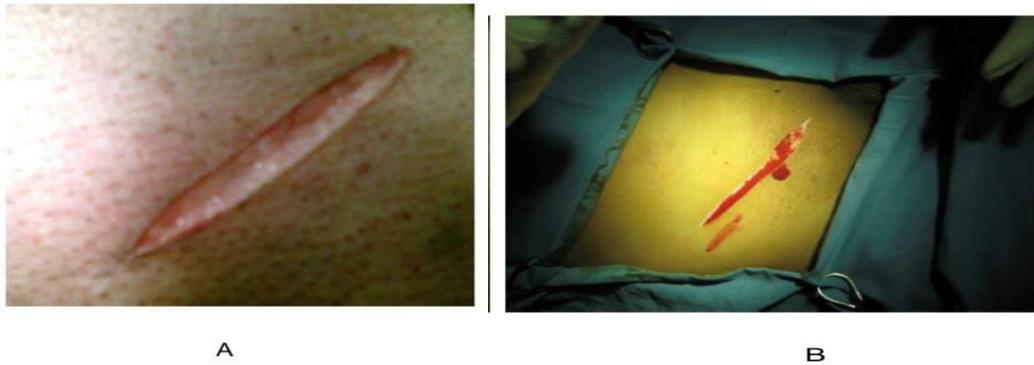
The results are finally analyzed and compared for the two groups using Mann Whitney U Test and percentage of type of complication at incision site is measured.

### **OBSERVATIONS AND RESULTS**

This was a prospective study comprising of 60 cases of inguinal hernias undergone tension free mesh hernioplasty over a period of 02 years from October 2016 to September 2018. There were 30 patients in each arm of the study group. Group-A consisting of 30 cases underwent skin incision by electrocautery (EC) and Group-B consisting of 30 cases were subjected to a standard skin incision by scalpel (SC).



**Fig.1: Incision with A-Electrocautery B-Scalpel**



**Fig.2: Incision wound site after incision with A-Electrocautery B-Scalpel**

The following observations and results were found in the present study.

The following observations and results were found in the present study.

### 1. Age distribution:

In the present study age, most of the inguinal hernias were observed in 41-50 years of age group. The details of age group distribution has been depicted in table 3 figure 12.

Age group	Electrocautery group(EC)	Scalpel group(SC)	Total (n=60)
21-30	2	2	4
31-40	7	6	13
41-50	9	11	20
51-60	9	8	17
61-70	3	3	6

**Table 1: Age wise distribution in study groups**

### Mean age

	EC	SC
Age in years	47.8±16.21	47.7±13.95

**P=0.97, not significant, unpaired t-test**

**Table 2: Mean age in study groups**

There were no significant demographic difference between two groups noted which is depicted in table-3 and fig-12. Mean age of patients in group A i.e., Electrocautery group is 47.8±16.21 and in group B i.e. Scalpel group is 47.7±13.95. There was no statistical difference between two groups (P=0.97).

**Sex distribution:**

Out of 60 patients 59 patients(97%) were males and 1 female patient(3%) which is depicted in table 4 and figure 13 .

Sex	Electrocautery group (EC)	Scalpel group(SC)	Total (n=60)
Males	29	30	59(97%)
Females	1	0	1(3%)

**Table 3:Sex distribution in study groups**

**Comparison of pain score**

Post operative pain is assessed by visual analogue scale at 6, 12, 24 hrs after the surgery. In this study results are analyzed with Mann Whitney U Test. Results are shown in Table 8. There is no significant difference between two groups. Post operative pain was assessed by visual analogue scale at 6,12 and 24 hours after the surgery. In this study at 6 hours pain score was  $6.6\pm 0.81$  in electrocautery group,  $6.7\pm 0.53$  as depicted in table 5 and fig 14 in scalpel group, which is statistically not significant( $P=0.475$ ).

Pain score at 12 hours post operatively was  $3.8\pm 0.83$  in electrocautery group and  $3.7\pm 0.64$  in scalpel group as depicted in table-5 and fig-14, which is statistically not significant( $P=0.556$ ). Pain score at 24 hours post operatively was  $2.5\pm 0.86$  in electrocautery group and  $2.4\pm 0.51$  in scalpel group as depicted in table-5 and fig-14, which is not statistically significant ( $P=0.762$ )

Time	EC	SC	Mann-Whitney U test (Adjusted for ties)
6 hours	$6.6\pm 0.81$	$6.7\pm 0.53$	$P=0.475$
12 hours	$3.8\pm 0.83$	$3.7\pm 0.64$	$P=0.556$
24 hours	$2.5\pm 0.86$	$2.4\pm 0.51$	$P=0.762$

**Table 4: Comparison of pain score**

### Post operative analgesic requirements

Injection Diclofenac 50mg IM was given in both groups post operatively. There was no difference in requirement of analgesics postoperatively. Results analyzed using Mann Whitney U test.

In electrocautery group analgesic dose requirement was  $1.8 \pm 0.66$ , whereas, in scalpel group it was  $1.6 \pm 0.48$  as depicted in table-6 and figure 15, which is not significant ( $P=0.499$ ).

	Doses of analgesics (Mean $\pm$ SD)
EC	<b><math>1.8 \pm 0.66</math></b>
SC	<b><math>1.6 \pm 0.48</math></b>

**$P=0.499$ , Not significant, Mann-Whitney U test (Adjusted for ties)**

**Table 5: Comparison of dose of analgesics**

### Local wound complications

Overall wound complications are assessed for 7 days post operatively. In this study complications like seroma, hematoma and purulent collection were assessed.

#### A. Hematoma

Wound complication like hematoma was compared in both the groups. In electrocautery group only one patient (3.3%) developed hematoma. In 29 cases there was no evidence of hematoma. In scalpel group 6 cases (20%) developed hematoma, whereas, in 24 cases there was no evidence of hematoma. The details are depicted in table-7 and fig-16. There was no statistically significant difference observed between both groups ( $P=0.108$ ).

Group	Hematoma		Total (n=60)
	Present	Absent	
EC	<b>1 (3.3%)</b>	<b>29</b>	<b>30</b>
SC	<b>6 (20%)</b>	<b>24</b>	<b>30</b>

**$P=0.108$ , not significant, chi-square test**

**Table 6: Comparison of wound complications - hematoma**



**Fig.3: Hematoma in scalpel group**

**A. Seroma**

Wound complication like seroma was compared in both electrocautery and scalpel group. In the electrocautery group 9 cases(30%) developed seroma, whereas other 21 cases did not show any evidence of seroma formation. The details are depicted in table 11 and fig 18.

In scalpel group seroma was observed in 10 cases(33.3%) and not observed in 20 cases as depicted in table 8, fig 18. This variable is not statistically significant between two groups(P=0.108).

Group	Seroma		Total n=60
	Present	Absent	
EC	9(30%)	21	30
SC	10(33.3%)	20	30

**P=0.108, not significant, chi-square test**

**Table 7: Comparison of wound complications - seroma**



**Fig.4: Seroma**

**A. Purulent collection**

Purulent collection was compared in both groups. In electrocautery group purulent collection was observed in 4 cases(13.3%), whereas in scalpel group it was seen in 5 cases(16.6%). The details are depicted in table 9 and fig 20, which is not statistically significant (P=1.000).

Group	Purulent collection		Total n=60
	Present	Absent	
EC	4(13.3%)	26	30
SC	5(16.6%)	25	30

P=1.000, not significant, chi-square test

**Table 8: Comparison of wound complication - purulent collection**



**Fig 5: Purulent collection**

**SCAR FORMATION:**

In electrocautery group, post operatively 5 cases developed complications like seroma, hematoma and purulent collection. Few sutures were removed to drain them, following which they healed by secondary intension.

In scalpel group 11 cases developed complications like seroma, hematoma and purulent collection, after opening few sutures they healed by secondary intension. Remaining all cases were healed by primary intension.

**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.

Electrosurgery has been used extensively since its introduction in 1929, and has now become an indispensable tool in every operating room. Before the advent of non explosive anaesthetic agents, electrosurgical units had limited application other than in underwater transurethral work, minor skin procedures and neurosurgery where regional or nitrous anaesthesia was appropriate.

Following the introduction of halothane, electrosurgery was used to achieve haemostasis and, to a lesser extent, for cutting. Despite this, few surgeons use diathermy to incise skin. This reluctance to incise skin with diathermy is partly attributable to the belief that electrosurgical instruments increase devitalized tissue within the wound, which consequently lead to wound infection, increased scar formation and delayed wound healing. However, the development of oscillator units capable of delivering pure sinusoidal current has generated renewed interest in electrosurgery.

The fear of tissue injuries was first unfolded when this technique was used by Peterson in reconstructive and cosmetic faciomaxillary surgery<sup>7</sup>, Mann and Klippel in paediatric surgery<sup>8</sup>, Kamer in rhytidoplasty<sup>9</sup>, Tabin in blepharoplasty<sup>10</sup>, with minimum scarring and excellent results.

Various studies were undertaken to evaluate the efficacy of electrocautery over scalpel in making skin incision and results are varying. Some showing better results with electrocautery, some showing similar results.

Early studies with primitive diathermy machines suggested that electrosurgical incisions were associated with just such charring and poor wound healing. Subsequent animal studies suggested increased wound infection rates but no difference in wound bursting strengths. It has been suggested that local tissue heating increases subcutaneous oxygen tension, thus enhancing the resistance of the surgical wounds to infection. The various aspects of this study including the results are compared with that of the other relevant studies as follows.

### **1. AGE DISTRIBUTION:**

The mean age in this study was 47.8 in electrocautery group and 47.7 in scalpel group with standard deviation of 16.21 in electrocautery group and 13.95 in scalpel group. There was no statistical significance between both the groups(0.97). This was comparable with other studies.

Umesh et.al<sup>10</sup>, in their study, Electrocautery versus scalpel incision in open cholecystectomy; A randomised prospective study, conducted in Dr. R.P Govt. medical college, Kangra, India for 1 year over 100 patients, undergoing elective open cholecystectomy observed the mean age of patients in electrocautery group to be 41.4years, whereas the mean age of patients in scalpel group was 41.8 years, which was statistically not significant as in this present study.

### Comparison of pain score

In this present study, Post operative pain was assessed by visual analogue scale at 6, 12, 24 hrs after the surgery. There was no significant difference between two groups. In the electrocautery group at 6 hours, pain score was 6.6 with standard deviation of 0.81, In scalpel group mean pain score was 6.7 with standard deviation of 0.53 which was statistically not significant ( $p=0.475$ ).

At 12 hours mean pain score in electrocautery group was 3.8 with standard deviation 0.83, in scalpel group mean pain score was 3.7 with standard deviation of 0.64 which was statistically not significant ( $P=0.556$ ).

At 24 hours mean pain score in electrocautery group was 2.5 with standard deviation of 0.86, in scalpel group mean pain score was 2.4 with standard deviation of 0.51, which was statistically not significant ( $P=0.762$ ).

Umesh et.al<sup>10</sup>, conducted a randomised prospective study on Electrocautery versus scalpel incision in open cholecystectomy in Dr. R.P Govt. medical college, Kangra India for 1 year. In their study mean pain score at 6 hours was 6.590 with standard deviation of 2.11 in electrocautery group. In scalpel group mean pain score at 6 hours was 8.010 with standard deviation of 1.33.

Vikranth S N et.a<sup>11</sup>., conducted a comparative study on Diathermy versus scalpel incisions in elective abdominal surgery, in R.L Jalapa hospital and research centre, Kolar for 12 months. In their study mean pain score in electrocautery group was grade 2 in all cases, where as in scalpel group grade 2 in 88.1% cases, which was statistically not significant ( $P=0.021$ ).

Post op mean pain score in present study was comparable with other previous studies. These pain score results were correlating with other studies discussed above. Comparison of mean pain score of present study with other studies.

### Comparison of analgesic requirement

In this present study, post operative analgesic dose in electrocautery group was 1.8 with standard deviation of 0.66, whereas in scalpel group post operative analgesic dose was 1.6 with standard deviation of 0.48, which was statistically not significant ( $P=0.499$ ).

Chauhan H.R et.al<sup>12</sup>, in their study; A comparative study to evaluate the outcome between electrocautery versus scalpel skin incision in tension free inguinal hernioplasty conducted in a tertiary care hospital, Ahmedabad for 1 year, included 196 patients and divided into 2 groups electrocautery and scalpel groups. In electrocautery group parenteral analgesic dose was required for 1 day whereas in scalpel group parenteral analgesia was given for 3-4 days post operatively. Post op analgesic requirement in the present study was correlating with their findings..

### Comparison of local wound complications

In this present study Overall wound complications were assessed for 7 days post operatively. In this study complications like seroma, hematoma and purulent collection were assessed.

Hematoma was observed in 1 case in electrocautery group, and in 6 cases in scalpel group which was not significant ( $P=0.108$ ). Seroma was observed in 9 cases in electrocautery group and 10 cases in scalpel group which was not statistically significant ( $P=0.108$ ). Purulent collection was observed in 4 cases in electrocautery group and 5 cases in scalpel group, which was statistically not significant ( $P=1.000$ ).

Omobolaji O A et.al<sup>13</sup>, in their study observed that in groin region local wound infection was observed in 2 cases in electrocautery group whereas in 4 cases in scalpel group, which was statistically not significant ( $P=0.251$ ).

Chauhan H.R et.al<sup>11</sup>, in their study observed local wound complications in 2 cases in electrocautery group and in 3 cases in scalpel group.

In this present study local wound complications were correlating with other studies which was not significant in both the electrocautery and scalpel groups. Comparison of wound complications this study with other studies are depicted in table.12.

Chrysos E. et al<sup>3</sup>, compared diathermy and scalpel incision in tension free Inguinal hernioplasty at department of general surgery in University hospital Herakhion, Greece. Total 125 patients undergoing hernioplasty were randomized into either scalpel (n -60) or diathermy (n-57) groups. Among them 8 had bilateral hernia in which 5 of them were allotted to scalpel group and 3 to diathermy group.

Results of the study showed 30% of operative blood loss in scalpel group as compared to diathermy group which had 18.5% of blood loss. No infection and wound dehiscence in either group were noted.

Study recommended use of diathermy for hip hemiarthroplasty which reduces significant blood loss and incidence of post operative wound collection. Routine use of diathermy to make incision around hip was effective in reducing wound related bleeding without adverse effect on wound healing and infection rate.

There was no evidence of increased infection rates in diathermy group, similarly in our study also there was no evidence of increased infection rates compared to scalpel group.

Cervantes-Sanchez C R et al<sup>14</sup>, in 2002 conducted study on rats; Skin incision: Scalpel vs. electrocautery. In this study they compared the healing of midline fascial incisions made with either scalpel or electrocautery and inoculated with *Escherichia coli* in 57 Sprague- Dawley rats. At 7th day, tensile strength was significantly less when incisions were made with electrocautery than with a scalpel. Additionally, wound strength was inversely related to the concentration of the inoculum of *E coli*. The use of electrocautery was also associated with more frequent bacteraemia at 48 hours and higher mortality at 7th day. Their results suggested that the technique used to incise the abdominal fascia influenced subsequent

wound healing, particularly in contaminated wounds. In the above study wound complications were increased in contaminated cases, whereas in our study we excluded contaminated cases.

In both the groups there was a significant change in pain over time. In the electrocautery group there was a reduction in the median pain score the first postoperative day fifth postoperative day. However, there was no significant difference in pain on any of the postoperative days between the two groups.

Increased wound infection rate was found in emergency cases compared to elective cases. However no significant difference in the wound infection rate was seen between electrocautery group and the scalpel group. They concluded that electrocautery could be safe and effective in making skin incision in midline laparotomy compared to scalpel incision.

In the present study also there was no significant difference between scalpel and diathermy group in wound infections which was comparable to above study.

Post operative pain was measured at 6,12 and 24 hours using visual analogue scale. There was no statistical difference in the pain score ( $p=0.4, p=0.5, p=0.7$ ). Even the analgesic requirement didn't vary much ( $p=0.4$ ). Post operative wound complications like seroma and pus formation was comparable between two groups. Even though hematoma formation was less in cautery group (20%) it was not significantly different.

They concluded that Improper use of electrocautery has led to fear of decrease wound strength and devitalisation of tissue. Proper usage with correct frequency adjustment and general instructions mentioned above and by proper training by manufacturer (as each company machine is unique) will definitely give better result than scalpel skin incision. In the present study also results were similar to above study.

### **LIMITATION OF THE STUDY**

The main limitation of this study is the small sample size which made analysis for statistical significance among different variables difficult.

### **CONCLUSION**

Based on observations made in this study, it has been concluded that results of both group's i.e. electrocautery group and scalpel group were similar in relation to:

1. Postoperative pain
2. Requirement of analgesics
3. Postoperative wound complications.
4. Electrocautery can be safely used for skin incisions.

### **Acknowledgment**

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### Conflict of Interest

None

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Nil

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