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Original Research Article

A COMPARATIVE STUDY TO DETERMINE THE EFFICACY OF ELECTROCAUTERY SKIN INCISION AND CONVENTIONAL SCALPEL SKIN INCISION IN REPAIR OF INGUINAL HERNIA

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ABSTRACT

Background: Inguinal hernia repair surgeries hinge on effective skin incision methods. This prospective comparative study, conducted from January 2023 to June 2025 at Bundelkhand Medical College & Hospital, Sagar, meticulously compares the outcomes of electrocautery assisted and conventional scalpel skin incisions.

Materials and Methods: Adult patients undergoing inguinal hernia surgery were randomly assigned to electrocautery (Group I) and scalpel (Group II) skin incisions. Parameters assessed included intraoperative bleeding, postoperative pain, surgical site infection.

Results: Electrocautery exhibited notable advantages, significantly reducing blood loss compared to scalpel incisions ($p < 0.05$). Postoperative pain was markedly lower in the Electrocautery group, aligning with efficient wound healing.

Conclusion: Based on our study findings it is concluded that electrocautery can be utilized as a successful substitute for making skin incision as an effective alternate to scalpel. It does not affect any tissue damage that could interfere healing of wound while using monopolar diathermy in power setting of 30 watt. Furthermore lower incidence of less incision time and minimal blood loss are the encouraging facts supporting routine use of diathermy for skin incision after tacking adequate precaution. Postoperative discomfort and wound infection rate were insignificant in both incision technique. Electrocautery can be considered safe and effective in making skin incision compared to scalpel incision.

Keywords: Scalpel, Diathermy, Hernia repair, Skin Incision.

INTRODUCTION

Surgical incision using a scalpel was the gold standard method for creating surgical wounds.[1] Traditionally, surgical skin incisions have been made with steel blade. This technique of creating skin incisions is outdated, and surgeons have always looked for innovative ways to create surgical skin wounds because incisions made by scalpel were supposed to be more painful, time-consuming, and bloody.[2]

To get past such issues Despite the recent development of laser and cavitron electronic surgical aspirators, these three devices are expensive.[3] It is currently an essential and developing aspect of the practice of surgery. Still, the majority of surgeons use a scalpel to cut the skin and use coagulation diathermy to separate the four deeper tissues.[4]

Tissue cleavage is made possible by rapid cell vaporization during a cutting diathermy incision utilizing an electrode that supplies pure sinusoidal current without endangering the surrounding

regions. In addition to saving the operating room time, cutting diathermy can result in a wound that heals similarly to one made with a cold scalpel and speed up and satisfy haemostasis.[5]

Additionally, electrocautery reduces the risk of infections transmitted to surgeons and nurses during instrument handling compared to scalpels.[6] The introduction of electrocautery in surgery in the early 20th century significantly reduced various intraoperative and postoperative complications.[7]

This study aims to compare the efficacy and safety of skin incisions made by scalpel versus electrocautery in inguinal hernia repair surgeries. The primary objective is to evaluate the comparison between both types of skin incision (electrocautery and conventional scalpel) on the basis of these parameters Incision time (Total time taken in performing incision), Incision related blood loss post-operative pain.

MATERIALS AND METHODS

This prospective comparative study was conducted at Bundelkhand Medical College & Hospital, Sagar, spanning from February 2023 to February 2025, after taking approval from institutional ethics committee, letter no. IECBMC/2023/116 dated 03/02/2023.

Aim: To assess the efficiency and safety of electrocautery skin incision in comparison to conventional scalpel skin incision in repair of inguinal hernia.

Eligibility Criteria-

Inclusion Criteria

1. All patients presenting with uncomplicated inguinal hernia
2. All patients of age more than 20 years, irrespective of sex
3. Patients willing to participate in study

Exclusion Criteria

1. Age group <20 yrs.
2. Recurrent inguinal hernia cases.
3. Patients not willing to participate in study.
4. Complicated inguinal hernia.
5. Any chronic illness.

Method of Collection of Data

This study included adult patients scheduled for clean surgeries, with a rigorous preoperative evaluation. Thorough medical history, clinical examinations, and a battery of laboratory and radiological tests were conducted to ensure comprehensive patient information.

Data were collected from patients undergoing inguinal hernia surgery repair. Skin incision was made about 1 cm above and parallel to the inguinal ligament starting from the pubic tubercle and extending 5-6 cm laterally up to mid inguinal point and depth up to exposure of external oblique aponeurosis.

In Group A, those cases were studied in whom skin incision is made using Electrocautery with monopolar cutting mode and Blend mode with power setting of 30 Watts.

Figure 1: Electrocautery incision

In Group B, the cases studied were comprise of those in whom skin incision would be made by Stainless Steel Surgical blade, the incisions were made with No. 15 and 22 Blade depending on condition of the skin. Incision of the skin made by the belly of the blade.

Figure 2: Scalpel incision

Incision dimension was measured using a sterilized flexible ruler in cm. The incision length was measured and depth of incision was taken as thickness of skin and subcutaneous tissue.

The incision time (in seconds) was calculated from the start of incision in the skin up to exposure of External Oblique Aponeurosis, with the aid of stop-watch.

Blood Loss during the incision was measured by weighing the gauze swab used. Gauze used was weighed before and after the procedure by Electronic Weighing Scale. Each gram difference in dry and soaked gauze was taken as equal to 1 mL

blood. Density of blood is similar to water and hence, 1 gm of blood = 1 mL of blood loss. Then the amount of blood loss in grams acquired using the weighing method is to be converted to mL using this principle.

The comparison between both types of skin incision (electrocautery and conventional scalpel) was done on the basis of following parameters

1.Incision time (Total time taken in performing incision)

2. Incision related blood loss

3. Post-operative pain

4. Post-operative wound complication

A- Surgical Site Infection

B- Haematoma

C- Seroma

RESULTS

Incision time

The median (inter-quartile range) incision time in Group B was significantly longer than that in Group A [129.5 (125.0- 135.0)] vs. 104.0 (96.0- 109.0)] (p-value<.05).

Table 1: Inter-group comparison of incision time in Group A and Group B

Variable	Group A		Group B		Z-value	p-value
	Median (inter-quartile range)	Mean rank	Median (inter-quartile range)	Mean rank		
Incision time (in seconds)	104.0 (96.0- 109.0)	40.50	129.5 (125.0- 135.0)	120.43	10.904	<.001*

Mann-Whitney U test. P-value<.05 was statistically significant.

Incision related blood loss

The median (inter-quartile range) incision related blood loss was significantly more in Group B compared to Group A [6.0 (5.0- 6.0) mL vs. 2.0 (1.0- 2.0) mL] (p-value<.05).

Table 2: Inter-group comparison of incision related blood loss in Group A and Group B

Variable	Group A		Group B		Z-value	p-value
	Median (inter-quartile range)	Mean rank	Median (inter-quartile range)	Mean rank		
Incision related blood loss (in mL)	2.0 (1.0- 2.0)	40.50	6.0 (5.0- 6.0)	120.50	-11.186	<.001*

Mann-Whitney U test. P-value<.05 was statistically significant.

Pain

At days 6 and 7, in both the groups, most of the subjects had no pain. There was no significant difference between the groups (p-value>.05).

Table 3: Inter-group comparison of post-operative pain

Time interval	Severity of pain		Group A	Group B	Total	Chi-square test	Df	p-value
Day 1	No pain (Score '0')	Number	0	0	0	-	-	-
		Percentage	0.0%	0.0%	0.0%			
	Mild pain (Score '1' to '3')	Number	0	0	0			
		Percentage	0.0%	0.0%	0.0%			
	Moderate pain (Score '4' to '6')	Number	0	0	0			
		Percentage	0.0%	0.0%	0.0%			
	Severe pain (Score '7' to '10')	Number	80	80	160			
		Percentage	100.0%	100.0%	100.0%			
Day 2	No pain (Score '0')	Number	0	0	0	10.000	1	.002*
		Percentage	0.0%	0.0%	0.0%			
	Mild pain (Score '1' to '3')	Number	0	0	0			
		Percentage	0.0%	0.0%	0.0%			
	Moderate pain (Score '4' to '6')	Number	14	2	16			
		Percentage	17.5%	2.5%	10.0%			
	Severe pain (Score '7' to '10')	Number	66	78	144			
		Percentage	82.5%	97.5%	90.0%			
Day 3	No pain (Score '0')	Number	0	0	0	58.803	1	<.001*
		Percentage	0.0%	0.0%	0.0%			
	Mild pain (Score '1' to '3')	Number	0	0	0			
		Percentage	0.0%	0.0%	0.0%			
	Moderate pain (Score '4' to '6')	Number	80	37	117			
		Percentage	100.0%	46.3%	73.1%			
	Severe pain (Score '7' to '10')	Number	0	43	43			
		Percentage	0.0%	53.8%	26.9%			
Day 4	No pain	Number	0	0	0	1.006	1	.316

	(Score '0')	Percentage	0.0%	0.0%	0.0%			
	Mild pain (Score '1' to '3')	Number	79	80	159			
		Percentage	98.8%	100.0%	99.4%			
	Moderate pain (Score '4' to '6')	Number	1	0	1			
		Percentage	1.3%	0.0%	0.6%			
	Severe pain (Score '7' to '10')	Number	0	0	0			
		Percentage	0.0%	0.0%	0.0%			
Day 5	No pain (Score '0')	Number	50	37	87	5.665	2	.059
		Percentage	62.5%	46.3%	54.4%			
	Mild pain (Score '1' to '3')	Number	29	43	72			
		Percentage	36.3%	53.8%	45.0%			
	Moderate pain (Score '4' to '6')	Number	1	0	1			
		Percentage	1.3%	0.0%	0.6%			
	Severe pain (Score '7' to '10')	Number	0	0	0			
		Percentage	0.0%	0.0%	0.0%			
Day 6	No pain (Score '0')	Number	57	48	105	3.294	2	.193
		Percentage	71.3%	60.8%	66.0%			
	Mild pain (Score '1' to '3')	Number	22	31	53			
		Percentage	27.5%	39.2%	33.3%			
	Moderate pain (Score '4' to '6')	Number	1	0	1			
		Percentage	1.3%	0.0%	0.6%			
	Severe pain (Score '7' to '10')	Number	0	0	0			
		Percentage	0.0%	0.0%	0.0%			

Surgical site infection

The incidence of SSI was higher in Group B compared to Group A, however, the difference was statistically non-significant (p-value>.05).

Table 4: Inter-group comparison of occurrence of surgical site infection

Surgical site infection		Group A	Group B	Total	Chi-square test	Df	p-value
Day 1	Number	0	0	0	-	-	-
	Percentage	0.0%	0.0%	0.0%			
Day 2	Number	5	8	13	.754	1	.385
	Percentage	6.3%	10.0%	8.1%			
Day 3	Number	5	8	13	.754	1	.385
	Percentage	6.3%	10.0%	8.1%			
Day 4	Number	5	8	13	.754	1	.385
	Percentage	6.3%	10.0%	8.1%			
Day 5	Number	4	8	12	1.441	1	.230
	Percentage	5.0%	10.0%	7.5%			
Day 6	Number	0	1	1	1.019	1	.313
	Percentage	0.0%	1.3%	0.6%			

Chi-square test

Hematoma formation

At days 1 and 2, the incidence of hematoma was significantly greater in Group B compared to Group A [6.3% vs. 0.0%] (p-value<.05). At the following days, none of the subjects in either group showed hematoma. Overall, none of the subjects in Group A develop hematoma and 5 (6.3%) subjects had hematoma formation in Group B.

Table 5: Inter-group comparison of occurrence of hematoma formation

hematoma formation		Group A	Group B	Total	Chi-square test	Df	p-value
Day 1	Number	0	5	5	5.161	1	.023*
	Percentage	0.0%	6.3%	3.1%			
Day 2	Number	0	5	5	5.161	1	.023*
	Percentage	0.0%	6.3%	3.1%			
Day 3	Number	0	0	0	-	-	-
	Percentage	0.0%	0.0%	0.0%			
Day 4	Number	0	0	0	-	-	-
	Percentage	0.0%	0.0%	0.0%			
Day 5	Number	0	0	0	-	-	-
	Percentage	0.0%	0.0%	0.0%			
Day 6	Number	0	0	0	-	-	-
	Percentage	0.0%	0.0%	0.0%			

Chi-square test. *p-value<.05 was statistically significan

Seroma formation

The incidence of seroma was higher in Group B compared to Group A [11.3% vs. 6.3%], however, the difference between the groups was statistically non-significant (p-value>.05).

Table 6: Inter-group comparison of occurrence of seroma formation

Seroma formation		Group A	Group B	Total	Chi-square test	Df	p-value
Day 1	Number	0	0	0	-	-	-
	Percentage	0.0%	0.0%	0.0%			
Day 2	Number	0	0	0	-	-	-
	Percentage	0.0%	0.0%	0.0%			
Day 3	Number	5	0	5	5.161	1	.023*
	Percentage	6.3%	0.0%	3.1%			
Day 4	Number	5	9	14	1.252	1	.263
	Percentage	6.3%	11.3%	8.8%			
Day 5	Number	5	9	14	1.252	1	.263
	Percentage	6.3%	11.3%	8.8%			
Day 6	Number	5	9	14	1.252	1	.263
	Percentage	6.3%	11.3%	8.8%			

Chi-square test. *p-value<.05 was statistically significant.

DISCUSSION

Electrocautery was less frequently used for skin incisions and more frequently for haemostasis. The use of electrocautery for incisions mostly depended on the surgeon's preference. Conversely, there was no haemostatic element in the surgical scalpels.[8]

Nowadays, electrocautery is used for more than only general surgery; in fact, numerous clinical studies have evaluated the effectiveness of scalpels versus electrocautery in creating skin incisions in different specialties.[9]

Furthermore, removing the scalpel from the operating area is a desirable alternative given the recent rise in blood-borne illnesses including hepatitis C and human deficiency virus infection.[10]

According to Dixon et al., diathermy incision is quicker than scalpel incision.[11]

Our study found that conventional scalpel incisions were associated with higher rates of SSI, incision time, and incision-related blood loss than electrocautery.

Another study by Hussain and Hussain found that the diathermy group experienced much reduced postoperative discomfort.[12]

Ninety patients in all were recruited for this trial and randomly assigned to either group. Scar evaluation, postoperative wound infection, postoperative pain, and incision time were used to assess the incisions. The findings of this study are 70 in line with the research done by Shamim, showing that diathermy incisions were quicker and linked to noticeably less blood loss.[13]

In 2009, Ali et al. suggested that diathermy could be used safely for all kinds of skin incisions. Additionally, they said that SSI was 17.5% in the scalpel group and 12.5% in the diathermy group. P = 0.378 indicated that this difference was not statistically significant.[15]

In our study incidence of SSI was higher in Group B compared to Group A, however, the difference was statistically non-significant (p-value>.05).

Electrocautery has been demonstrated to reduce postoperative discomfort and complications such as seroma, hematoma, and wound dehiscence when utilized for skin incisions during elective inguinal hernia surgery, hence reducing hospital stays.[16]

CONCLUSION

Based on our study findings it is concluded that electrocautery can be utilized as a successful substitute for making skin incision as an effective alternate to scalpel. It does not affect any tissue damage that could interfere healing of wound while using monopolar diathermy in power setting of 30 watt.

Furthermore lower incidence of less incision time and minimal blood loss are the encouraging facts supporting routine use of diathermy for skin incision after tacking adequate precaution.

Postoperative discomfort and wound infection rate were insignificant in both incision technique. Electrocautery can be considered safe and effective in making skin incision compared to scalpel incision.

REFERENCES

1. O'Connor JL, Bloom DA. William T. Bovie and electrosurgery. Surgery. 1996 Apr 1;119(4):390–6.
2. (PDF) Electrosurgery: History, Principles, and Current and Future Uses [Internet]. [cited 2025 Apr 29]. Available from: https://www.researchgate.net/publication/7277726_Electrosurgery_History_Principles_and_Current_and_Future_Uses
3. 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 Apr;71(4):326–9.
4. Prospective randomized control trial comparing the efficacy of diathermy incision versus scalpel incision over skin in patients undergoing inguinal hernia repair [Internet]. [cited 2025 Apr 29]. Available from: https://www.researchgate.net/publication/267366589_Prospective_randomized_control_trial_comparing_the_efficacy_of_diathermy_incision_versus_scalpel_incision_over_skin_in_patients_undergoing_inguinal_hernia_repair
5. Stolz AJ, Schützner J, Lischke R, Simonek J, Pafko P. [Is a scalpel required to perform a thoracotomy?]]. Rozhl V ChirMesicnikCeskoslovenskeChirSpolecnosti. 2004 Apr;83(4):185–8.
6. Ismail A, Abushouk AI, Elmaraezy A, Menshawy A, Menshawy E, Ismail M, et al. Cutting electrocautery versus scalpel for surgical incisions: a systematic review and meta-analysis. J Surg Res. 2017 Dec; 220:147–63.
7. Hajilo P, Imani B, Zandi S, Mehrafshan A. Comparing the intraoperative and postoperative complications of the scalpel and electrocautery techniques for severing the inner layers of the lumbar disc during discectomy surgery. Front Surg. 2023; 10:1264519.

8. Assiotis A, Christofi T, Raptis DA, Engledow A, Imber C, Huang A. Diathermy training and usage trends among surgical trainees--will we get our fingers burnt? Surg J R CollSurgEdinbIrel. 2009 Jun;7(3):132–6.
9. Groot G, Chappell EW. Electrocautery used to create incisions does not increase wound infection rates. Am J Surg. 1994 Jun;167(6):601–3.
10. 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 Jan;88(1):41–4.
11. Dixon AR, Watkin DF. Electrosurgical skin incision versus conventional scalpel: a prospective trial. J R CollSurgEdinb. 1990 Oct;35(5):299–301.
12. Hussain SA, Hussain S. Incisions with knife or diathermy and postoperative pain. Br J Surg. 1988 Dec;75(12):1179–80.
13. Shamim M. Diathermy vs. scalpel skin incisions in general surgery: double-blind, randomized, clinical trial. World J Surg. 2009 Aug;33(8):1594–9.
14. Wilson APR, Gibbons C, Reeves BC, Hodgson B, Liu M, Plummer D, et al. Surgical wound infection as a performance indicator: agreement of common definitions of wound infection in 4773 patients. BMJ. 2004 Sep 25;329(7468):720.
15. 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 ClinPract. 2009 Dec;12(4):371–4.
16. Goh SSN, Sanghvi KA, Koura AN, Rao JK, Oo AM. Elective incisional hernia repair: lower risk of postoperative wound infection with laparoscopic versus open repair. Singapore Med J. 2023 Feb;64(2):105–8.