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Research Paper

Scalpel versus electrocautery for Herniorrhaphy Incision: A randomized controlled trail☆

Farshad Zarei, Mohammad Kazem Shahmoradi*

Faculty of Medicine, Department of Surgery, Lorestan University of Medical Science, Khorramabad, Iran

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ABSTRACT

Background: Electrocautery is widely used for incision and is considered safe, irrespective of the surgical procedure.
Objective: The aim of this study is to compare postoperative scar complications following scalpel and electrocautery incision in patients who underwent herniorrhaphy.
Method: This study was a randomized controlled trail performed on 120 patients referred to (XXX) for herniorrhaphy. Sixty patients underwent hernia repair using scalpel and electrocautery incision. Postoperative pain, wound infection and scar-associated complications were assessed in all the patients at the time of suture removal and follow-up. The data were analyzed using SPSS v 18 and p-value < 0.05 was considered to be statistically significant.
Result: The two groups were age-matched, and no significant difference was reported in terms of hypertrophic and colloidal scar among the two groups. Additionally, the differences in the pain intensity were also not significant among the groups. No postoperative infection was reported in our study.
Conclusion: According to our findings, electrocautery incision is as safe as scalpel incision for herniorrhaphy with regard to scar complication and wound infection. The detailed study including intraoperative parameters can give better conclusions.

1. Introduction

For a long period of surgical practice, scalpel has been known as a gold-standard tool for making surgical incision [1]. It enables surgeons to easily obtain an incision of the desired depth without any electrical burn injuries and damage to the neighboring tissues [2,3]. Nonetheless, excessive blood loss and incidence of the injuries to the working staffs have been extensively reported [4,5]. The diathermy/electrocautery was first used in the 1900s as a surgical incision tool that relies on an alternating current source that causes cleavage and coagulation, without harming adjacent tissues [6]. In addition to making muscular and fascial incisions, the instrument also regulates homeostasis [7].

Studies have shown that electrocautery is associated with reduced blood loss and postoperative pain [8,9], however, wound infection, complication, hospitalization duration and wound characteristics do not differ with scalpel incision method [7,10]. To it, larger scars and improper tissue healing are also reported with electrocautery incision [11].

Diathermy has also been successfully used in inguinal hernia repair surgeries and is considered safe [12]. Findings have indicated that its usage can reduce the need of postoperative analgesics [13,14]. The aim of this study is to compare pain and wound-associated postoperative outcomes among scalpel and electrocautery incision surgical patients undergoing hernia repair.

2. Methods

In this randomized-controlled clinical study, patients undergoing herniorrhaphy at (XXX) were enrolled. Patients with the age of 15–60 years, meeting ASA I (American Society of Anesthesiologists) criteria were included in this study. Our exclusion criteria included patients who had to undergo emergency surgeries, pregnant, immunocompromised, diabetic patients and those under any kind of wound healing-associated medications. A detailed description of

☆ This study was approved by the Research Ethics Board of Lorestan University of Medical Sciences. (IR.LUMS.REC.1387.138).

* Corresponding author. Lorestan University of Medical Sciences, Khorramabad, Iran.
E-mail address: shahmoradi.m@lums.ac.ir (M.K. Shahmoradi).

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the study was provided to all the participants and written consent was obtained.

Sampling was sequential and an equal number of patients were assigned to each group. The patients underwent herniorrhaphy where, an incision was either made using scalpel or electrocautery. In scalpel group (group A), the skin incision was made using disposable blade of the desired size. In electrocautery group (group B), diathermy pen electrode was used for making an incision in the skin and deeper tissue. Erbe VIO 300D Electrosurgery Unit provided by Erbe Medical India Pvt Ltd. was set at the pure-cutting mode with 350 kHz of sinusoidal current. Diathermy was used in coagulation mode, in both the groups, for the regulation of hemostasis of bleeding vessels.

The surgery was performed in the same surgical unit for all the patients. All the patients underwent same general anesthesia along with prophylactic antibiotics in the form of 1 g of Ceftriaxone. This dose was repeated every 12 h for 3 days. Intramuscular diclofenac was given, within immediate 24 h, postoperatively, followed by 50 mg tablet 8 hourly for another 24 h. The subcutaneous tissue repair was performed using vicryl (polyglactin 910 Suture) 2/0 and skin closure was achieved using ethilon 2/0 stitches.

The postoperative intensity of pain was measured using the numeric rating scale (NRS) and was recorded in a questionnaire. The patient was referred to the clinic at the end of the first week for suture opening where, wound infection was assessed by the means of the culture of wound discharge. Furthermore, the patients were re-examined at the end of the third month and the results of cosmetic surgery (based on the formation of colloidal or hypertrophic scars) were reviewed. The loss of patients' follow-up resulted in the exclusion from the study. For follow-up patients were reported to the clinic of the hospital where scar of the surgery was evaluated along with pain and infection-related complications.

The data were presented in tables in the form of data regarding infection, incidence of colloidal or hypertrophic scars. All preoperative, postoperative and follow-up parameters were recorded in a single questionnaire for each patient.

The data were analyzed by SPSS v18 where, independent *t*-test was used to evaluate continuous variables, Mann-Whitney for the comparison of variables among the groups and chi-square tests were used for continuous variables. Statistical analysis was conducted at 5% level of significance where, p-value < 0.05 was considered statistically significant.

This study was approved by the Research Ethics Board of (XXX).

The work has been reported in line with the CONSORT criteria [15].

3. Results

In this study, 120 patients who referred to (XXX) Hospital were included and were classified into ASA class 1 and 2 with the aim of evaluating and comparing post-operative scar complications using scrotal incision and scalpel incision. Patients with any underlying disease with a history of previous surgery were excluded.

Of 120 patients included in this study where 34 were female (28.3%) and 86 were male (71.7%). In electrocautery group (A), 42 patients (70%) were male and 18 were female (30%) whereas, in scalpel incision group (B) there were 44 males (73.33%) and 16 females (26.66%).

The minimum age of the subjects was 15 years and the maximum age was 60 years and the overall mean age was 33 years. The mean age in group A was 32.8 years and group B was 34.87 years. There was no significant difference in the mean age of the two groups (p-value = 0.35) (Table 1).

Group B was presented with two cases (3.3%) of the colloidal scar, however, group A was presented with none. There was no statistically significant difference between the two groups in regards with colloidal scar (p-value = 0.49) (Table 2).

Table 1
Comparison of mean age (in years) in patients with electrocautery and scalpel incision.

Group	Number	Standard deviation age average	p-value
electrocautery incision	60	32.8 ± 11.7	0.35
scalpel incision	60	34.87 ± 12.5	

Hypertrophic scars were also reported in the electrocautery group in 2 (3.3%) patients, but there was no such case in group B (Table 3). This difference was also not statistically significant (p-value = 0.49).

The mean pain intensity in the electrocautery group was 3.45 ± 1.18 and in the scalpel group was 3.31 ± 1.3. There was no significant difference between the two groups in the mean pain intensity (p-value = 0.32) (Table 4). Postoperative infection was not reported in any of the follow-up cases.

4. Discussion

Electrocautery is one of the important incision tools in the surgical room, irrespective of the procedure performed [16]. Efficacy of electrocautery is well-defined for subcutaneous and muscular opening however [17], its safety for skin incision is still debatable with respect to the concerns regarding wound healing and infection [18,19].

Excessive heat is used to direct incision in the electrocautery, which can lead to postoperative pain with necrosis and severe tissue damage [20], delaying the wound healing process and increasing the scaring and wound infection [21]. This study was designed to compare electrocautery incision with scalpel incision in patients undergoing hernia repair surgery. Our findings conclude that there is no significant difference between the two groups in terms of pain severity, site of infection, and the incidence of colloidal or hypertrophic scar.

In a retrospective study, Mecca and his colleagues showed that the rate of bleeding and pain in electrocautery group was lesser, invariant with the scalpel incision [22]. Furthermore, there was no difference between the two groups regarding wound infection after surgery. In our study, there was no significant difference between the two groups in terms of mean pain intensity, incidence of infection, and postoperative scar.

Garcia et al. [23] examined abdominal wall aponeurosis in 12 post-incisional rats with scalpel and electrocautery and they reported that there was no significant difference in the histological finding of the two groups. In our study, similar results were obtained in terms of post-operative repair. Ansari et al. [13] reported that among 60 patients undergoing inguinal repair, postoperative pain, wound-associated complications and need of analgesics were more in scalpel group than diathermy.

Carrie Suss et al. reported that diathermy incision in inguinal herniorrhaphy is also associated with significantly lesser use of

Table 2
Comparison of the ratio of colloidal scar in incision group with cutter and incision group with Bistori.

Group	Keloid scars		
	Yes	No	Total
electrocautery incision	0 (0)	60 (%100)	60
scalpel incision	2 (%3.3)	58 (%96.7)	60

Table 3
Comparison of the ratio of hypertrophic scar in electrocautery and scalpel group.

Group	Hypertrophic scar		
	Yes	No	Total
electrocautery incision	2 (%3.3)	58 (%96.7)	60
scalpel incision	0 (0)	60 (%100)	60

Table 4
Comparison of mean pain intensity in patients with incision group with cutter and incision group with distortion.

Group	Number	Standard deviation age average	p-value
electrocautery incision	60	3.45 ± 1.18	0.32
scalpel incision	60	3.31 ± 1.3	

analgesia on postoperative days 1 and 2. They also concluded that the use of diathermy was approximately as effective as scalpel in wound healing. Although the results of this study were inconsistent with the results of our study, scar-associated complication and infection rate were similar to our findings. Similarly, findings from Prakash et al. [18] study have been reported, that electrocautery incision is associated with significantly lower blood loss however, postoperative pain and wound infection were not different in the two groups.

5. Conclusion

The results from this study are based on a relatively larger sample size, as compared to the other studies discussed; in exception to a study. Furthermore, different sizes of hernia and herniorrhaphy with different incisions such as midline, cochlear, etc., were not segregated in the study, which may indicate bias in our findings. Our study did not include intraoperative parameters, which limit the data provided in this study. The pain bearing threshold in different age-groups could differ that might have caused discrepancies in the pain score. Therefore, age-adjusted analysis is required.

The findings of our study indicated that electrocautery is presented with similar effects as that of scalpel method. Scaring was lesser in electrocautery group, however, was not significantly different. Furthermore, we did not report postoperative infection in either group.

Ethical approval

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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No funding was secured for this study.

Author contribution

Dr. Mohammad kazem Shahmoradi: conceptualized and designed the study, drafted the initial manuscript, and reviewed and revised the manuscript. Designed the data collection instruments, collected data, carried out the initial analyses, and reviewed and revised the manuscript.

Dr. Farshad Zarei**:** Coordinated and supervised data collection, and critically reviewed the manuscript for important intellectual content.

Conflict of interest statement

The authors deny any conflict of interest in any terms or by any means during the study.

Guarantor

Farshad Zarei.

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Consent

Not applicable.

Human and animal rights

No animals were used in this research. All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

Consent for publication

Informed consent was obtained from each participant.

Availability of data and materials

All relevant data and materials are provided with in manuscript.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijso.2020.12.005.

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