



EFFECTIVENESS OF CUTTING DIATHERMY OVER SURGICAL SCALPEL INCISION IN ABDOMINAL AND SCROTAL SURGERIES – A COMPARATIVE STUDY

General Surgery

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ABSTRACT

Background and aims: Even though diathermy is used extensively for tissue dissection and hemostasis, it is not used routinely for skin incisions for the fear of deeper burns and risk of scarring. The present study estimated the effectiveness of cutting diathermy over surgical scalpel incision among patients undergoing abdominal and scrotal surgeries.

Materials and methods: This was a prospective cross sectional study conducted at the Department of General surgery, Government Villupuram Medical College Hospital from January to December 2018. Patients undergoing lower abdominal, inguinal and scrotal surgeries of the age group 19–78 years were chosen randomly after obtaining informed consent. Statistical analysis was done using SPSS software.

Results: A total of 100 patients were selected, 50 patients in each group. The time taken and the blood loss during skin incision, post operative pain experienced, incidence of complications and scarring were significantly better with diathermy incision when compared to scalpel incision.

Conclusion: Skin incisions made by cutting diathermy are quicker with less blood loss than those made by scalpel. There is no increased risk of wound infection, less post-operative pain, gives cosmetically acceptable results and hence recommended for abdominal skin incisions.

KEYWORDS

Diathermy, incision, lower abdominal surgery

INTRODUCTION:

In surgical practice, incisions are made with stainless steel scalpel to gain access to the underlying tissues.¹ These incisions are supposed to be more bloody and painful. Although diathermy is one of the most useful instruments in surgeon's armamentarium and is being increasingly used for underlying tissue dissection, cutting and hemostasis; its use for making skin incisions is not gaining favor. Fear of deep burns and resultant scarring continues in surgeons with diathermy, when compared to scalpel incision which produces a clean, incised wound with minimal tissue destruction.²

In monopolar modality of electrosurgical instruments, the surgeon uses a single-pointed probe to make contact with tissue. The electrical current flows from probe tip through the body and returns to the electrode, rapidly spreads out laterally as it enters the body, causing a dramatic decrease in current density. But bipolar instruments resemble surgical forceps with an active electrode and return electrode. The electrical current does not travel through the patient but is confined to the tissue between the forceps, flowing through the intervening tissue.^{3,4}

This study was undertaken to observe if skin incisions by electrocautery prolonged surgical operating time and to assess the incidence of wound complications and cosmetic results, when compared to skin incision by surgical scalpel.

MATERIALS AND METHODS

This was a prospective cross sectional study comparing the efficacy of cutting diathermy over scalpel incision in patients undergoing lower abdominal, inguinal and scrotal surgeries at the Department of General Surgery, Government Villupuram Medical College and Hospital, Villupuram between January 2018 and December 2018. Patients of both sexes between the age group of 19 to 78 year undergoing elective lower abdominal, inguinal and scrotal surgeries were included in the study after obtaining informed consent. The study was approved by the Institutional ethics committee. Patients admitted for emergency surgeries, surgery for malignancy, pregnant females, patients with chronic illness and those who did not give informed consent were excluded from the study. Simple random sampling method was used to select patients. Blood loss was calculated by measuring the weight of swabs used exclusively during incision until complete hemostasis was achieved.² Incision time was defined as the time from the beginning of skin incision until subcutaneous tissue was reached with complete hemostasis and expressed in seconds. Necrosis was assessed from the incision site and sent for histopathological analysis. Wound

complication was measured after opening the sterile dressings on 5th post operative day or when required. Intensity of pain was assessed on post-operative days 1, 3 and 5 using verbal, numerical rating scale. Patients were followed up for cosmetic assessment of scar.

After getting informed consent, patients were randomly categorized into two groups. One group underwent surgical incision with diathermy (cutting mode, 5W and 515 kHz) while the other group underwent surgical scalpel incision. Incision time and blood loss was measured intra-operatively. Pain assessment was done on days 1, 3 and 5. Wound complication assessment was done on day 5. Cosmetic scar assessment was done at the end of one month and 6 months.

Data entry and analysis was done using SPSS software version 17. Continuous variables were given as mean and standard deviation while categorical variables were expressed as percentages and proportions. $p < 0.05$ will be considered significant.

RESULTS

A total of 100 patients were included in the study and followed up (50 patients in each study group). Patients were enrolled in the study for 6 months and followed up for another 6 months. Most of the patients were in the age group of 41-50 years ($n = 42$) (42%), the range being 19 to 78 years. The mean age of the study group was 51.41 ± 15.50 . All the patients included in the study were males ($n = 100$).

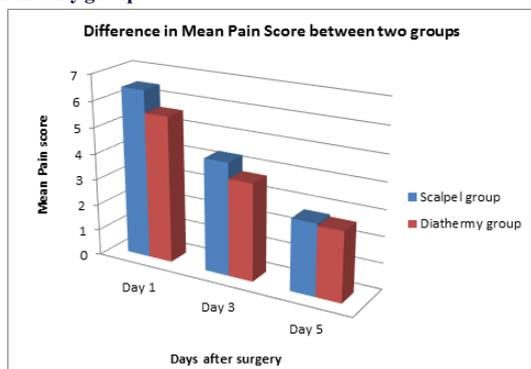
The minimum time for skin incision was 12 seconds and the maximum time was 78 seconds ($n = 100$). The mean time taken for skin incision ($n = 100$) was 38.71 ± 12.97 seconds. The mean time taken for skin incision by scalpel incision ($n = 50/100$) was 42.48 ± 16.23 seconds while the mean time for skin incision by cutting diathermy ($n = 50/100$) was 31.52 ± 13.26 seconds and this difference was statistically significant ($p < 0.01$).

The blood loss during skin incision had a range between 1 mL and 9 mL ($n = 100$) with a mean blood loss of 5.0 ± 2.35 mL. Mean blood loss during skin incision with scalpel was 6.84 ± 0.82 mL while the mean blood loss was 2.45 ± 0.86 mL when using cutting diathermy and this difference was statistically significant ($p < 0.05$). Histopathological analysis of skin edge removed during surgery in both groups did not show evidence of necrosis.

Pain score, which is a measure of patient's pain tolerance, was found to be higher in patients undergoing skin incision with scalpel. The mean

pain score in the scalpel incision group was 6.46 ± 0.97 on day 1, 4.32 ± 0.79 on day 3 and 2.74 ± 0.69 on day 5 while the mean pain score in diathermy group was 5.62 ± 1.01 on day 1, 3.72 ± 0.90 on day 3 and 2.66 ± 0.91 on day 5 (Fig 1). The difference in pain score was statistically significant.

Fig 1. Difference in mean pain score between scalpel group and diathermy group



Wound complications were seen in 33% of study group patients ($n = 33/100$). The complications analyzed were hematoma ($n = 17, 17\%$), seroma ($n = 8, 8\%$), pus collection ($n = 8, 8\%$) and wound dehiscence (nil). Scalpel incision group had more complications ($n = 23/50, 46\%$) while diathermy group had fewer complications ($n = 11/50, 22\%$). Hematoma was seen more in scalpel incision group ($n = 9/50, 20\%$) than in diathermy group ($n = 7/50, 14\%$). Seroma was seen more in scalpel incision group ($n = 9/50, 18\%$) than in diathermy group ($n = 1/50, 2\%$). Pus collection was also seen more in scalpel incision group ($n = 5/50, 10\%$) than in diathermy group ($n = 3/50, 6\%$).

Even though all the scars were healthy with acceptable cosmetic appearance for a healing wound at one month, the follow up at the end of 6 months showed cosmetic disfigurement in 14% ($n = 7/50$) of patients who underwent scalpel incision when compared to patients who underwent diathermy incision 6% ($n = 3/50$).

DISCUSSION

Lower abdominal and scrotal surgeries are some of the most common surgeries performed in any surgical centre. Patients have become more aware and conscious about the cosmetic outcomes of these surgeries. There are several studies comparing surgical scalpel incision and cutting cautery incisions worldwide, which have shown the superiority of cutting diathermy incision. But there are fewer studies from south India and this study was conducted to study the superiority of cutting cautery in south Indian patients.

In the present study involving 100 patients, diathermy incision for all types of lower abdominal, inguinal and scrotal surgery was associated with a shorter incision time and reduced incisional blood loss compared to scalpel incision, largely due to the intrinsic hemostatic effect of diathermy and also achieving hemostasis with scalpel incision requires several instrument exchanges. This was similar to the results obtained in the studies by Dixon and Watkin (90 ± 22 seconds against 126 ± 25 seconds), Johnson and Serpell (196.5 ± 26 seconds against 214.50 ± 29.6 seconds) and Pearlman et al. (420 ± 180 seconds against 540 ± 300 seconds).^{5,2,6}

The present study showed lesser blood loss with cutting diathermy compared to scalpel incision and the result was similar to those obtained in the studies by Kearns et al. (0.80 ± 0.10 mL against 1.70 ± 0.30 mL) and Ayandipo et al. (6.53 ± 3.84 mL against 18.16 ± 7.36 mL).^{7,8}

There was a significant reduction in post operative pain with cutting diathermy when compared to scalpel incision. This may be explained by the localized sensory nerve destruction with the subsequent disruption of transmission of nerve impulses resulting from diathermy ablation. Cell vaporization caused by application of pure sinusoidal current leads to immediate tissue and nerve necrosis without significantly affecting the nearby structures.⁹ This reduction of pain is consistent with meta-analysis and the studies by Hussain and Hussain (4.35 ± 2.02 against 6.75 ± 2.29), Shamim et al (3.20 ± 0.10 against 5.00 ± 0.10).^{10,11,12}

The wound complications encountered in the present study were hematoma, seroma and pus collection which were higher in scalpel incision than diathermy group.¹³ This was in contrast to the study by Yilmaz et al. who found seroma incidence to be higher in diathermy group than scalpel incision group.¹⁴ In the present study ($n = 100$), skin edge necrosis was assessed by histopathology in all patients and there was no evidence of necrosis in any specimen. This suggests that diathermy incision did not cause charring and damage to adjacent tissues and thus a safer alternative to conventional scalpel incision. This was similar to the results obtained by Farnworth et al. who found that microneedle cautery was better than hemostatic scalpel.¹⁴

In this study, both the groups were comparable in terms of age, sex, nature of surgical procedure, mode of anesthesia and analgesia, clean and clean-contaminated wound and length of incision. Based on the results, it can be concluded that skin incisions made by cutting diathermy were quicker with reduced blood loss, compared to incisions made with scalpel. Cutting diathermy is a cosmetically acceptable technique for abdominal skin incisions. There was no increased risk of wound infection, and diathermy may be beneficial in terms of reduced postoperative wound pain. Based on the present findings and recent data from meta-analysis, we support the efficacy of diathermy for skin incisions, and hence recommend the use of diathermy for abdominal skin incisions.

EA conceptualized the study, collected data and prepared manuscript. PM edited the manuscript and approved it. JR analyzed data and edited manuscript.

DECLARATIONS:

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Conflict of interest: None declared

REFERENCES:

- Zinner MJ, Schwartz SI, Ellis H. Incisions, closures and management of the wound. In: Maingot EH, editor. *Maingot's Abdominal Operations*. 10th ed. New Jersey: Prentice Hall International Inc.; 1997. p. 395-426
- Johnson CD, Serpell JW (1990) Wound infection after abdominal incision with scalpel or diathermy. *Br J Surg* 1990; 77: 626-627
- Massarweh NN, Cosgriff N, Slakey DP. Electrosurgery: History, principles, and current and future uses. *J Am Coll Surg* 2006; 202: 520-30.
- Cushing H. Electro-surgery as an aid to the removal of intracranial tumors. *SurgGynecolObstet* 1928; 47: 751-84.
- Dixon AR, Watkin DF. Electrosurgical skin incision versus conventional scalpel: A prospective trial. *JR Coll Surg Edinb* 1990; 35: 299-301.
- Pearlman NW, Stiegmann GV, Vance V, Norton LW, Bell RC, Staerkel R, et al. A prospective study of incisional time, blood loss, pain, and healing with carbon dioxide laser, scalpel, and electrosurgery. *Arch Surg* 1991; 126: 1018-20.
- 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.
- Ayandipo OO, Afuwape OO, Irabor D, Oluwatosin OM, Odigie V. Diathermy versus scalpel incision in a heterogeneous cohort of general surgery patients in a Nigerian teaching hospital. *Niger J Surg* 2015; 21: 43-7.
- Chrysos E, Athanasakis E, Antonakakis S, Xynos E, Zoras O. A prospective study comparing diathermy and scalpel incisions in tension-free inguinal hernioplasty. *Am J Surg* 2005; 71: 326-9.
- Aird LN, Brown CJ. Systematic review and meta-analysis of electrocautery versus scalpel for surgical skin incisions. *Am J Surg* 2012; 204: 216-21.
- Hussain SA, Hussain S. Incisions with knife or diathermy and postoperative pain. *Br J Surg* 1988; 75: 1179-80.
- Shamim M. Diathermy vs. scalpel skin incisions in general surgery: Double-blind, randomized, clinical trial. *World J Surg* 2009; 33: 1594-9.
- Priya N, Lamture YR, Luthra L. A comparative study of scalpel versus surgical diathermy skin incisions in clean and clean-contaminated effective abdominal surgeries in AVBRH, Wardha, Maharashtra, India. *J Datta Meghe Inst Med Sci Univ* 2017; 12: 21-5.
- Yilmaz KB, Dogan L, Nalbant H, Akinci M, Karaman N, Ozaslan C, et al. Comparing scalpel, electrocautery and ultrasonic dissector effects: The impact on wound complications and pro-inflammatory cytokine levels in wound fluid from mastectomy patients. *J Breast Cancer* 2011; 14: 58-63.
- Farnworth TK, Beals SP, Manwaring KH, Trepeta RW. Comparison of skin necrosis in rats by using a new microneedle electrocautery, standard-size needle electrocautery, and the Shaw hemostatic scalpel. *Ann Plast Surg* 1993; 31: 164-7.