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Original Research Article

Scalpel versus diathermy skin incision: a randomised clinical trial

Monali Patole Mukherjee[1]*, Mandar Madhukar Patole[2]

[1]Department of Paediatric Surgery, [2]Department of Oral and Maxillofacial Surgery, Godrej Memorial Hospital, Mumbai, Maharashtra, India

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***Correspondence:**
Dr. Monali Patole Mukherjee,
E-mail: drmonalimp@gmail.com

ABSTRACT

Background: Scalpel skin incision produces a clean, incised wound with minimal tissue destruction. Cutting diathermy also produces an incised wound that heals as well as the one that is created by cold scalpel but with an added advantage of achieving quick hemostasis and saving operative time. The main thing of the present study is to verify and compare the usefulness of diathermy skin incision vs. scalpel skin incision in general surgical patients.
Methods: The study was conducted in Medical College and Hospital, in 60 patients randomly selected for diathermy and scalpel incision, between 14-65 years age group, between January 2011-June 2012. Post operative pain, seroma, hematoma, discharge were observed and results were analyzed and compared for the two groups using Mann-Whitney U Test.
Results: Diathermy group, with incision related time of 6.20±0.97 sec/cm, was significantly quicker (p=0.003) than scalpel incision, with incision time of 6.76±0.84 sec/cm. Postoperative pain scores, recorded daily over five days, showed insignificant difference between the two groups.
Conclusions: We demonstrate that the diathermy provides efficient cutting of skin, with no superior wound-healing profile, comparable to that of the traditional scalpel blade.

Keywords: Scalpel skin incision, Diathermy incision, Post operative wound infections, Hypertrophied scar, Keloid, Intestinal obstruction

INTRODUCTION

Scalpel skin incision produces a clean, incised wound with minimal tissue destruction. Cutting diathermy also produces an incised wound that heals as well as the one that is created by cold scalpel but with an added advantage of achieving quick hemostasis and saving operative time.[1]

The use of electrode delivering pure sinusoidal current however allows tissue cleavage without damage to surrounding areas.[2] Incision using electrocautery is not true cutting incision. This method heats cell within tissues so rapidly that they vaporize, leaving cavity within cell matrix. The heat created disappears as steam, rather than being transferred to adjacent tissues.[3] As electrode is moved forward new cells are contacted and vaporized with creation of an incision. This explains absence of scaring and subsequent healing with less scarring. Many studies have been conducted to compare electrocautery incision with scalpel incision over skin and many of them showed electrocautery incision to be better than scalpel incision in terms of time taken for incision, lesser pain, better wound healing and little blood loss. The following study was undertaken in Department of Surgery, medical college, Kolkata, to compare diathermy skin incision and scalpel skin incision in general surgical operations conducted under general anesthesia.

The main thing of the present study is to verify and compare the usefulness of diathermy skin incision vs scalpel skin incision in general surgical patients. To achieve this goal, patients was taken up for study in medical college, Kolkata with informed consent. All the patients were operated under general anaesthesia. Antibiotics prophylaxix was given as schedule.

Objective

The aims and objectives of our study were to compare the healing of incision in both procedures, to compare the operative time, to compare incidence of post operative wound infection, to compare post operative pain and to follow up (upto 6 months) to evaluate cosmesis, scar status and whether any evidence of keloid or hypertrophic scar.

METHODS

This is a prospective study conducted in medical college and hospital, Kolkata, the study Population was between 14-65 years age group, between January 2011 to June 2012. A total 60 patients was studied. Among them 30 patients were randomly selected for diathermy skin incision and another 30 patients for scalpel skin incision. Post operative pain, seroma, hematoma, discharge were observed and results were analyzed and compared for the two groups using Mann-Whitney U Test. Ethical approval was obtained from the medical college and hospital medical research committee

Method of collection of data

The sample size was 60 cases, in 30 cases incision was taken with electrocautery over skin and in 30 cases incision was taken with conventional scalpel. After taking the informed consent, patients were randomized and divided in two groups A and B. In group A-incision was taken with electro cautery needle using pulse sine wave current and power setting of 70 watts. Heamostasis 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 30 watts. All standardized incision will be midline incision.

Inj ceftriaxone (1gm) was given 15 minute before procedure.

Closure of the abdominal layer was done with continuous proline 1. interrupted suture and 2-0 ethilon with curved cutting needle used for skin closure

Inclusion criteria

All general surgical operations with midline incision; surgery performed under general anaesthesia; no history of previous laparotomy; clean contaminated cases also were included this study.

Exclusion criteria

Patients with chronic scar pain >3 months; blood coagulation disorders; severe hepatic, renal, cardiovascular dysfunction; diabetes mellitus; immunocompromised patients; pregnent women were excluded in this study.

Outcome

- Postoperative pain was measured using pictorial visual analogue scale at 6, 12 and 24 hours.
- During post operative period (up to 7 days) complications noted in hospital stay
- Seroma- collection of serous discharge in suture site.
- Hematoma-collection of blood clots
- Purulent – collection of purulent discharge

The results were finally analyzed and compared for the two groups using Mann-Whitney U Test, and percentage of type of complication at incision site is measured. After taking the informed consent, patients are randomized and divided in two groups A and B.

In Group A-Incision is taken with electrocautery needle using pulse sine wave current and power setting of 70 watts. Heamostasis is achieved with force coagulation.

In group B-skin incision is taken with scalpel, bleeding controlled by forcef coagulation using pulse sine wave on power supply 30 watts. All standardized incision will be midline incision. All the procedures are carried under standardized general anesthetia. Premedication is given inj ceftriaxone (1 gm) 15 minute before procedure.

Closure of the abdominal layer are done with continuous proline 1 inturrupted suture with 2-0 ethilon with curved cutting needle for skin closure

Common procedures for both techniques: dry surgical mops used exclusively for the incision were weighed pre and post-operatively in a sterile manner using weighing scales with a resolution of two grams. No suction was used while making the incision; time was recorded using a second's stopwatch. The time taken from initial skin incision with total hemostasis, was recorded; incision length was recorded after 24-48 hours when the primary dressing was removed; wound infection was defined as the discharge of pus or fluid containing pathogenic organisms at any stage after operation. Documentation was done by sending this discharge for culture; all cases were done in a single surgical unit under controlled conditions.

RESULTS

The mean age in the diathermy group was 42.10 yrs compared with 41.40 years in the scalpel group as shown in Table 1.

Table 1: Differences between diathermy and scalpel groups with respect to age.

	Diathermy	Scalpel	P value
Age (in years) (mean)	42.1 (SD=12.2625)	41.4 (SD=11.7741)	0.822388

Operative parameters

The two groups did not differ significantly in relation to the size of the wound area. The use of diathermy to create midline incision caused significantly less blood loss (p=0.001) and total blood loss per cm^2 (p=0.0004) than scalpel incisions.

The time taken to achieve haemostasis per cm^2 wound area was significantly less in the diathermy group compared to the scalpel incision group (p=0.003).

Overall there was no difference of post-operative wound related complications. Six patients in the scalpel group developed persistent post-operative serous discharge from their wounds compared with six in the diathermy group. There were no wound infections or haematomas in either group.

Wound complications

The rate of postoperative wound complications was no different between the cutting diathermy and scalpel groups (p=0.373)

Incision time

In this analysis cutting diathermy resulted in a statistically significant shorter incision time than scalpel (p=0.003).

Pain

There was no significant difference in postoperative pain scores at 24 h between incisions made with cutting diathermy andscalpel: mean difference 0·89 (p=0.2187) as shown in Table 2.

Table 2: Differences between diathermy and scalpel groups with respect to pain.

	Scapel	Diathermy	P value
No pain	14	18	0.218779
Pain	16	12	

DISCUSSION

This randomized clinical trial demonstrated that a skin incision can be made more quickly by cutting diathermy than by scalpel (mean=40.6, p=0.0034) and no increase in the rate of wound complications (p=0.3734) or postoperative pain (p=0.218779). Scalpel incision as shown in Figure 2, requires several instrument exchanges with coagulation diathermy that can be overcome with the use of cutting diathermy. Although the reduction in blood loss may seem irrelevant clinically, frequent instrument exchanges that require handling of the scalpel may result in an increase in the risk of 'sharps' injuries to the surgeon. The risk of skin and soft tissue damage, as well as the potential for significant bleeding and exposure to blood borne infections, is well recognized in scalpel usage. Sharps injuries have been estimated to occur at a rate of about 6.4 per 1000 surgical procedures in the operating room (in this study only one sharp injury occurred during scalpel use) second to injuries from suture needles which occur at a rate of about 41 per 1000. Perhaps the most compelling reason for the routine use of cutting diathermy for skin incisions as shown in Figure 2, therefore, is removal of the scalpel from the operating theatre and elimination of an important cause of injury. We did not find any difference in the rate of wound complications between cutting diathermy and scalpel in our study. It may be that cutting diathermy produces heat so quickly that tissue vaporization occurs, as opposed to the charring and necrosis associated with coagulation diathermy that may predispose to wound complications.

Figure 1: Diathermy incision.

Injuries to the operating surgeon and patient owing to the use of diathermy have been reported in approximately two per 1000 surgical procedures. Burn injury may occur if the integrity of the surgeon's gloves is compromised. The patient may also be burnt inadvertently via conduction through the length of the diathermy tip, other surgical instruments or improper grounding. Increasing concern has also been raised about diathermy smoke plumes and the potential long-term consequences of prolonged inhalation to theatre staff and patients. Diathermy smoke plume has been shown to contain a number of chemicals that have the potential for carcinogenesis, and organisms have been shown to be retrievable from the plume, raising the possibility of disease transmission. Proper precautions must be taken to address this issue, including use of smoke extraction systems.

Figure 2: Scalpel skin incision.

Postoperative pain scores at 24 h were not significantly different between cutting diathermy and scalpel groups in the present analysis. Some clinical studies have reported reduced pain at 48 h when cutting diathermy is used for skin incision. However, more recent studies found no difference in postoperative pain perception. The relationship between cutting diathermy versus scalpel in reference to pain has not been elucidated clearly, and requires further investigation.

A prospective controlled study has previously investigated the cosmetic outcome of skin incisions made by diathermy versus scalpel.[4-6] After follow-up of 6 weeks after operation, no significant difference in cosmetic rating was found favoring diathermy. Worse cosmetic outcome and keloid formation were not found. No difference in subjective or objective cosmetic outcome or in patient satisfaction scores was noted between cutting diathermy and scalpel groups after 6 months. Further research is required to elucidate the long-term effects of diathermy on cosmesis, although currently there is no evidence to suggest that diathermy results in a worse outcome.

Kearns studied that there is no controlled clinical study of wound healing after different techniques of abdominal incision.[7] The scalpel produces a clean, incised wound with minimal tissue destruction. Diathermy produces a burn of variable depth in the tissue, but may reduce bleeding and make the incision quicker.

The shorter incision time and lower blood loss are most likely explained by the fact that achieving haemostasis with a scalpel incision requires several instrument exchanges with coagulation diathermy, a disadvantage that is overcome with the use of cutting diathermy. Although the reduction in blood loss may seem irrelevant clinically, frequent instrument exchanges that require handing off the scalpel may result in an increase in the risk of 'sharps' injuries to the surgeon, assistant nurse and patient. The risk of skin and soft tissue damage, as well as the potential for significant bleeding and exposure to blood borne infections, is well cognized. Sharps injuries have been estimated to occur at a rate of about 6.4 per 1000 surgical procedures, which equates to potentially more than a dozen times among the number of procedures in the present meta-analysis. Injuries due to the scalpel itself are estimated to account for 18 per cent of all sharps injuries in the operating room, second to injuries from suture needles which occur at a rate of about 41 per cent. Perhaps the most compelling reason for the routine use of cutting diathermy for skin incisions, therefore, is removal of the scalpel from the operating theatre and elimination of an important cause of injury.

Clinical studies have been conducted to investigate these concerns, the largest being a prospective nonrandomized multicentre collaborative trial of 964 patients, published in 2001, this study found no difference in the rate of wound complications between cutting diathermy and scalpel, as confirmed in the present meta-analysis.[8] It may be that cutting diathermy produces heat so quickly that tissue vaporization occurs, as opposed to the charring and necrosis associated with coagulation diathermy that may predispose to wound complications. Injuries to the operating surgeon and patient owing to the use of diathermy have been reported in approximately two per 1000 surgical procedures. A burn injury may occur if the integrity of the surgeon's gloves is compromised.

Diathermy smoke plume has been shown to contain a number of chemicals that have the potential for carcinogenesis, and organisms have been shown to be retrievable from the plume, raising the possibility of disease transmission. Proper precautions must be taken to address this issue, including use of smoke extraction systems. In contrast to the results of a previous meta-analysis, postoperative pain scores at 24 h were not significantly different between cutting diathermy and scalpel group in the present analysis. Some clinical studies have reported reduced pain at 48 h when cutting diathermy is used for skin incision. However, more recent studies found no difference in postoperative pain perception. The relationship between cutting diathermy versus scalpel and pain has not been elucidated clearly, and requires further investigation. A prospective controlled study has previously investigated the cosmetic outcome of skin incisions made by diathermy versus scalpel.[9] After follow-up of 6 weeks after inguinal hernia repair a significant difference in cosmetic rating was found favouring diathermy. Further research is required to elucidate the long-term effects of diathermy on cosmesis, although currently there is no evidence to suggest that diathermy results in a worse outcome**.**

Although some surgeons will insist on their freedom to choose, the efficiency, safety and patient benefits of incising the skin with cutting diathermy, and using the same instrument to divide fascia and muscle, may sway some surgeons towards retiring the scalpel

The diathermy is a promising new surgical instrument that provides atraumatic, scalpel-like cutting precision and electrosurgical-like hemostasis, resulting in minimal bleeding, tissue injury, and scar formation.

Siraj et al studied to compare the diathermy incision with scalpel incision in patients undergoing midline elective laparotomy.[10] A total of 100 patients were included in the study, and equally divided into 2 groups. Group A received scalpel incision while in group B diathermy was employed to incise all layers. Preoperative parameters including, incision time and blood loss were equal in both grouups postoperatively, pain was assessed by visual analogue score and wound infection documented.. The mean incision related blood loss in Scalpel group was 1.53±0.20 ml/cm and in Diathermy group was 1.43±0.20 ml/cm, showing significantly less bleeding in diathermy group (p=0.014). Diathermy group, with incision related time of 6.20±0.97 sec/cm, was significantly quicker (p=0.003) than scalpel incision, with incision time of 6.76±0.84 sec/cm. Postoperative pain scores, recorded daily over five days, showed insignificant difference between the two groups.

Mehmet et al studied with Patients undergoing modified radical mastectomy were assigned to flap dissection with either electrocautery (n=18) or scalpel (n=20).[11] The electrocautery group had significantly reduced blood loss and total drain volume, but increased seroma formation rate. Significantly elevated levels of TNF-α were measured in drain fluids of patients with electrocautery dissection.

A study by Byrne et al favoured diathermy incision in respect of intra-operative blood loss and duration of surgery.[12]

In our study 60 patients are 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 and post operative wound complications. This study showed no difference between the two groups in post-operative pain, analgesic requirement and no difference in wound complication.

CONCLUSION

In summary, we demonstrate that the diathermy provides efficient cutting of skin, with no superior wound-healing profile, comparable to that of the traditional scalpel blade. Diathermy incisions heal in a manner similar to that of scalpel incisions with respect to inflammation, wound strength, and scarring. These results suggest that the diathermy has tremendous potential in surgical fields including midline laparotomy surgery. There is no difference in post operative pain between two groups. The skin incision time is less in diathermy group (p=0.003).

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Ethical approval: The study was approved by the Institutional Ethics Committee

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