

ELECTIVE MIDLINE LAPAROTOMY; COMPARISON OF DIATHERMY AND SCALPEL INCISIONS

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ABSTRACT.. Objectives: To compare the diathermy incision with scalpel incision in patients undergoing midline elective laparotomy. **Design of Study:** A prospective, experimental comparative study. **Place and Duration:** Department of surgery, PNS Shifa Karachi, from March 2007 to June 2008. **Patients and Methods:** 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. Peroperative parameters including, incision time and blood loss were calculated. Postoperatively, pain was assessed by visual analogue score and wound infection documented. **Results:** Both groups included fifty patients each out of the total 44 females and 56 were males, with similar gender preposition in both the groups. Mean age of patients in scalpel group was 48.78 (± 14.47) while it was 44.92 (± 15.87) in diathermy group. The mean incision related blood loss in Scalpel group was 1.53 (± 0.20) ml/cm² and in Diathermy group was 1.43 (± 0.20) ml/cm², showing significantly less bleeding in diathermy group (p-value= 0.014). Diathermy group, with incision related time of 6.20 sec/cm² (± 0.97 sec/cm²), was significantly quicker (p-value= 0.003) than scalpel incision, with incision time of 6.76 sec/cm² (± 0.84 sec/cm²). Postoperative pain scores, recorded daily over five days, showed insignificant difference between the two groups. **Conclusions:** Diathermy, employed for midline laparotomy, is quicker and hemostatic, compared to the scalpel. The two are, however, similar in terms of wound infection and postoperative pain.

Key words: Midline Laparotomy, Diathermy, Scalpel.

INTRODUCTION

Traditionally scalpels with disposable knives are used for various skin and tissue incisions¹. The advent of electro-surgical instruments was a leap in the field of surgery and since their introduction in 1920's it has increasingly been used for tissue dissection². It is considered to be an efficient mode of dissection³, being haemostatic and convenient⁴. With the increasing incidence of blood-transmitted diseases such as Hepatitis B⁵, Hepatitis C⁶ and Human immunodeficiency Virus (HIV)⁷ the risk of transmission to both doctor and patient is quite significant. Its use in lieu of the conventional sharp instruments has the advantage as a precautionary measure, there by avoiding and possibly even completely replacing the scalpel from the operative fields, looks an attractive option. As an alternate, use of diathermy instead of scalpel for skin incision is gradually gaining wide acceptance⁸.

In diathermy, a potential gradient dependant current is passed through the tissue at high frequency (greater than 100000 Hz) to excite tissue molecules such as

water resulting in controlled tissue lysis, which can be employed to coagulate (modulated mode) or to cut (sinusoidal mode) the tissue. This principle allows the use of diathermy electrode without causing surrounding tissue damage⁹. Despite these findings and advantages, the idea of using diathermy as a 'cutting' instrument for skin and surgical incisions has met the skepticism of many surgeons¹⁰. And although many studies indicate a safe profile of diathermy, there is conflicting data to support the opposite as well, showing impaired healing and increased scarring with diathermy use¹¹. This has generated enough debate and recently there has been renewed interest to study the diathermy with comparison to scalpel. Moreover, recent introduction of newer power tools, such as harmonic scalpel, also instigated researchers to compare their efficacy and safety vis-à-vis the more traditional steel scalpel and diathermy¹².

Midline laparotomy provides quick, easy and wide access to nearly all the structures of abdomen and retroperitoneum. However, it is associated with significant morbidity when compared to other abdominal

incisions¹³. The proper surgical technique has been a major concern among surgeons as it has been shown to affect healing following midline laparotomy¹⁴. Diathermy can be used in midline laparotomy incisions as internationally carried out studies have shown it to have significant advantage over traditional scalpel incision on the basis of incision related blood loss, incision time and post operative pain. Moreover they also show that there is no difference between the two in terms of postoperative wound complications¹⁵.

Purposive significance of the present study was to compare these two methods for midline laparotomy in our local set up with an aim to evaluate diathermy as an effective alternative to scalpel incision.

PATIENTS AND METHODS

A quasi experimental study was carried out at department of surgery, PNS Shifa, Karachi for a period of 16 months from March 2007 to June 2008. A total of hundred patients undergoing elective midline laparotomy, were included in the study. Only clean or clean contaminated cases were included and none of the cases had previous midline laparotomy, concurrent anticoagulant or corticosteroid therapy.

On hundred patients fulfilling the inclusion and exclusion criteria were recruited in the study after taking informed consent.

They were randomized by coin toss method into two equal groups.

Group 'A' was the group receiving scalpel incision where scalpel with disposable blade was used to incise skin till peritoneum. In group 'B' incision was made through the skin and deeper tissues with diathermy using standard diathermy pen electrode. Electrosurgical unit (ESU), brand Sabre 2400 by Conmed Corporation, set at pure cutting mode and delivering 417 kHz sinusoidal current, was employed to incise skin and all the layers. In both groups diathermy was used in coagulation mode for hemostasis.

Incision dimensions were measured with a sterile flexible ruler. The length of the incision at the end of the

procedure was taken as incision length while the depth of the incision was taken as the total thickness of the abdominal wall taken in centimeters. "Wound area" was calculated as the product of the above two variables. Incision Time (from the initial skin incision till complete opening of peritoneal cavity, including haemostasis), calculated in seconds per unit wound area (sec/cm^2), was also noted.

Blood loss during the surgery was calculated by weighing the swabs used exclusively in making the incision and during haemostasis with each gram taken as equal to one milliliter of blood. Suction was not used meanwhile. The amount of blood was calculated as ml/cm^2 .

All patients were administered prophylactic intravenous antibiotics (1.5 grams Cefuroxime + 500 mg Metronidazole) at the time of induction and then two doses post op 8 hours apart.

Wound related pain was assessed using visual analogue scales at each post op morning. The score was noted on the proforma.

Wound was assessed clinically for wound infection for the first five postoperative days. The presence or absence was noted on proforma.

DATA ANALYSIS AND STATISTICAL METHODS

The data was fed in Statistical Package for Social Sciences (SPSS) version 10. Descriptive statistics were applied to calculate mean and standard deviation for age, and frequency for gender. The amount of wound related blood loss, incision time and the severity of wound related pain in both groups was compared using Student t-test, while post-op infection in two groups were compared using Fisher's exact test.

RESULTS

The study was conducted on 100 patients undergoing elective laparotomy who were prospectively assigned either the scalpel group (A) or diathermy group (B) with equal number in each group. The range of age of patients in this study was from 18 years to 87 years with a mean age of 46.85 ± 5.38 years. Mean age of patients in Scalpel

Table-I. Comparison of Scalpel Group (A) with Diathermy Group (B).

	Group A	Group B	Test	P-value
Mean age	48.78(14.77)	44.92 (15.87)	T-Test	0.211
Wound infection	3	2	Fisher-exact test	0.172
Operative Parameters				
1. Incision-related blood loss (ml/cm ²)	1.53(±0.201)	1.43 (±0.201)	T-Test	0.014
2. Incision time (sec/cm ²)	6.76(±0.84)	6.20 (±0.97)	T-Test	0.003

group was 48.78±14.47, while it was 44.92± 15.87 in Diathermy group (table-I) There was no significant difference between two groups with respect to age (p value 0.211). Out of these 44 were females and 56 were males. In both groups there were 28 males (56%) and 22 Females (44%) each. In both groups, peroperative and post operative findings were noted and endorsed. Peroperative parameters included incision related blood loss (calculated in ml/cm²) and incision time (in seconds/cm²).

The mean incision related blood loss was 1.53 ml/cm² in scalpel group with a standard deviation of 0.20 ml/cm². While it was 1.43 ml/cm² with a standard deviation of 0.20 ml/cm² in diathermy group. Diathermy incision group had significantly less bleeding than the scalpel group (p=0.014).

The mean time taken for incision in scalpel group was 6.76 sec/ cm² with a standard deviation of 0.84 sec/cm². In diathermy group, the mean incision-related time was 6.20 sec/cm² with a standard deviation of 0.97 sec/cm². There was significant difference between the two groups with regards to the incision-related time (p=0.003).

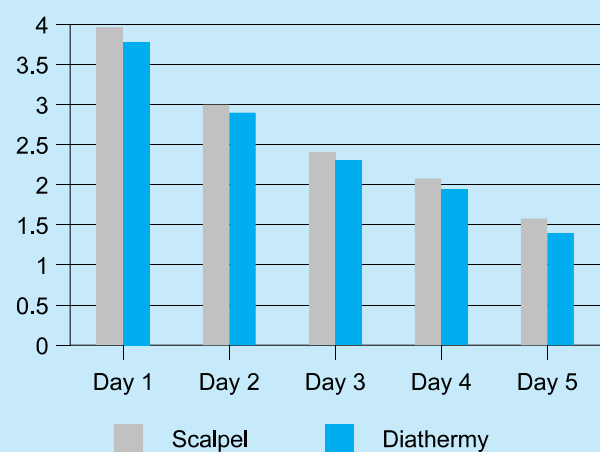
The overall frequency of wound infection in our study was 5%, of which, three cases were seen in the scalpel group and two in diathermy group. This difference between the two groups was statistically insignificant (p=0.17).

Postoperatively, patients in both groups were assessed on each post operative morning for pain. It was done by linear visual analogue score and values for 5 days were endorsed. The mean values of pain scores of each

postoperative day from day one till day five, in scalpel group (A) were 3.96, 3.00, 2.40, 2.08 and 1.58. While the corresponding values were 3.78, 2.90, 2.30, 1.94 and 1.40 in the diathermy group (B). These values were compared using t-test. There was insignificant difference between the two groups in terms of pain on any of the daily scores on the five post operative days (table-II).

Table-II. Postoperative pain scores

Postop Day	Scalpel Group	Diathermy Group	P-value
Day 1	3.96	3.78	0.24
Day 2	3.00	2.90	0.51
Day 3	2.40	2.30	0.51
Day 4	2.08	1.94	0.33
Day 5	1.58	1.40	0.13

Fig-1. Postoperative pain scores.

DISCUSSION

The use of electro-surgical devices has been in vogue for a long time and has seen introduction of modern safer versions. The surgeons, however, continue to be skeptical and reluctant when it comes to the use of these devices for making an incision of skin and fascia. This reluctance, which stems partly from previous studies showing impaired healing associated with the use of diathermy, has been seriously challenged by newer research work, which suggests diathermy to be safe option with definitive advantages and no added risk profile. So our work was aimed to investigate this alternative method of incision with comparison to the scalpel incision with regards to advantages, like time and bleeding, as well as alleged complications i.e. postoperative pain and wound infection.

The findings of present study are supported by Kearns et al¹⁵, who compared electro-surgical and scalpel methods in hundred patients undergoing elective midline incision. The diathermy was associated with significantly lesser incision related blood loss and was quicker. Similarly, there was no significant difference in terms of wound complications, including wound infection, as evidenced by present study. However, their study showed that diathermy was associated with significantly less early postoperative pain and lower analgesic requirements on patient-controlled analgesia. The results of this study are also in concordance with the results of Telfer et al¹⁶ which compared 101 patients undergoing midline Laparotomy, by either diathermy or scalpel, for intestinal resection. Diathermy was associated with significantly less blood loss and an insignificant difference in postoperative pain. Contrary to present study, however, their study showed that there was no advantage with diathermy in relation to the incision related time.

The findings of a large (n=964) multicenter, collaborative study by Franchi et al¹⁰ also supports the findings of present study. They studied early and late wound related complications in patients undergoing elective midline laparotomy by the two modalities under discussion and concluded that there was no difference between the two groups with respect to early and late wound complications including wound infection. The study by

Chryso E et al⁸, where either electro-surgical scalpel or steel scalpel were employed for skin and underlying tissues incision while carrying out prosthetic mesh inguinal hernioplasties. Their results showed no difference in terms of wound infection. Their results differed from the present study in that insignificant difference was found in terms of total operative time where as only incision related time was studied in the present study. Moreover, the control of bleeding in an inguinal incision is dependent upon ligation or control of larger vessels compared to the small vessels encountered in laparotomy incision. The findings of Pearlman et al¹⁷, comparing the two methods of incision for cholecystectomy incision, support the results of present study. That study concluded that diathermy incision was associated with significantly less incision time and incision-related blood loss. It also showed no difference with regards to postoperative pain. Similar results were reported by Stolz et al¹⁸ for elective thoracotomy incision by the two modalities, with regards to wound-related complications. They concluded that there was no effect of the type of incision used, on the early and late wound complications, including infection.

This study did not compare incision time, bleeding or postoperative pain. Dixon et al¹⁴ compared conventional scalpel and diathermy incision using modified (needle) electrode. They concluded that the later was consistently quicker and that no difference between the two groups was found with regard to wound healing and complications. The study by Dixon et al, did not study other variables of interest like blood loss and postoperative pain.

It is worthwhile to mention the results of the experimental models studying the effects of these incision techniques in animals. Various experimental studies have shown that the use of scalpel to perform an abdominal incision resulted in better outcomes in terms of wound healing as compared to the diathermy¹⁹. Allan et al²⁰ studied the mechanical strength of healing laparotomy wound in Wister rats and concluded that, compared to diathermy; scalpel incision was associated with significantly increased strength. Kim et al²¹, studied in albino male rabbits, found an increased infection rate related to the

use of diathermy, though they used diathermy in coagulation mode. This difference observed between the animal experimental studies and present study, along with human studies described previously, may be partly attributed to the difference in inoculum size of bacteria in animals that may not correspond to the one occurring postoperatively in humans. The use of prophylactic antibiotics, which is not done in animals, may also modify the response. Also as compared to the humans, in smaller animals the diathermy may proportionately cause much greater tissue disruption and damage with relation to the total abdominal wall surface area.

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Article received on: 22/03/2010

Accepted for Publication: 15/04/2010

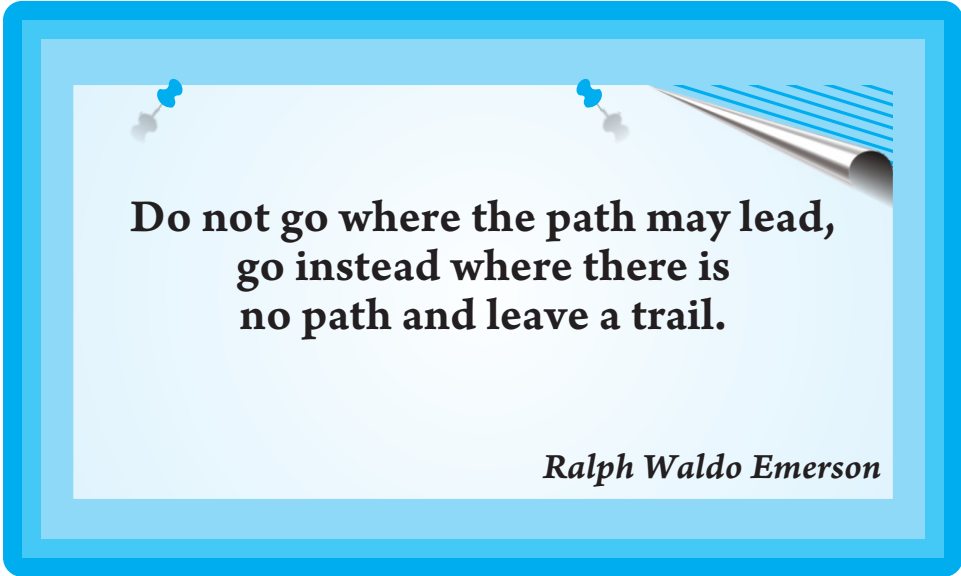
Received after proof reading: 00/00/0000

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Article Citation:

Siraj A, Gilani ABS, Dar MF, Raziq S. Elective midline laparotomy; Comparison of diathermy and scalpel incisions. Professional Med J Mar 2011;18(1):106-111.



**Do not go where the path may lead,
go instead where there is
no path and leave a trail.**

Ralph Waldo Emerson