ORIGINAL RESEARCH ARTICLE

A Comparitive Study on Diathermy Vs Scalpel Skin Incisions in Abdominal Surgeries at a Tertiary Care Teaching Hospital

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A B S T R A C T

Introduction: Skin incisions for laparotomy surgeries have been regularly performed with scalpels, disposable knives; these incisions are associated with more blood loss and pain. Recently, diathermy is considered as an efficient mode of incision due to convenience, haemostatic nature, rapid separation of the tissue, and decreased risk of unintentional damage caused by the scalpel to working personnel. This study compares diathermy and scalpel skin incisions in terms of incision time, blood loss, wound character and scar assessment in midline laparotomy surgeries.

Material and methods: A prospective comparative clinical study was conducted in the surgical wards of a tertiary care teaching hospital in Madurai, Tamil Nadu. Total of 90 subjects were equally allocated into cases and controls. Cases received skin incision with diathermy and controls received scalpel incision. Wound infection was graded according to asepsis wound score, and the scar assessment was evaluated by Manchester scar score at the time of discharge. IBM SPSS version 22 was used for statistical analysis.

Results: The median age was 55 years among cases and 51 years among controls. Majority of the subjects had gastric (32.2%) laparotomy surgeries. The median blood loss was 10ml (IQR 9 to 14) among cases and 15ml (IQR 14 to 15) among controls, the difference was statistically significant. Time taken for incision among cases (3.68 ± 0.66) was comparatively less than controls (4.48 ± 0.51). (p=0.900). Wound healing and scar score were comparatively better in diathermy group compared to scalpel group.

Conclusion: Diathermy is considered to be safe, efficient incision technique which has tremendous potential in surgical fields, including abdominal laparotomy surgeries.

Keywords: Diathermy, Scalpel Skin Incisions, Laparotomy Surgeries, Manchester Scar Score

INTRODUCTION

Conventionally skin incisions for laparotomy surgeries have been regularly performed with scalpels, disposable knives, these incisions are associated with more blood loss and pain. Recently, there is a change in trend from this method to electrosurgical skin incisions.[1] Surgical diathermy was introduced at the beginning of the 20th century to preclude the drawbacks of surgical steel scalpels. The term usually knows surgical diathermy as "electrosurgery" or "electrocautery". Diathermy was considered to be an efficient mode of dissection because of its convenience and haemostatic nature. It is not considered as an actual cutting incision as it involves the usage of high frequency alternating electric current. Diathermy is used mainly for three purposes- coagulation, fulguration, and cutting.[2] Reduced blood loss, dry and rapid separation of the tissue, and a possible decreased risk of unintentional damage caused by the scalpel to working personnel are the potential advantages of electrosurgery.[3,4]

In diathermy, a potential gradient dependent current is passed through the tissue at high frequency (greater than 100000Hz) to excise tissue resulting in precise tissue lyses. It can be employed to coagulate (modulated mode) or to cut (sinusoidal pattern) the tissue. This principle permits the use of diathermy electrode without causing adjacent tissue injury. This method heats cell within tissues so rapidly that they vaporize, leaving cavity within cell-matrix, heat generated evaporates as steam, rather than being transferred to adjacent tissues. As the electrode is moved forward, new cells are contacted and vaporized with the creation of incision. This clarifies absence of scaring and successive healing with less scarring.[5,6]

Despite its several advantages, the idea of diathermy as a cutting instrument instead of a conventional scalpel for making a surgical incision has met with scepticism by majority of the surgeons, because of its unnecessary scarring, elevated wound infection rate and reduced wound healing have declined the extensive use of surgical diathermy for skin incisions.[7,8] Huang et al. conducted an experimental and clinical study and reported that diathermy incision results in

slower wound healing and increased infection than scalpel incision.[9] Similarly, in a study by Nandurkar et al reported that use of electrocautery resulted in significantly reduced mean incision time (27±10.1 s vs 38.8±8.8 s; p<0.001) and significantly lowered blood loss (2.6 ml versus 3.4 ml; p = .021) when compared with scalpel.[10]

Many randomized clinical trials have been conducted to compare diathermy incision with scalpel incision over the skin in midline laparotomy, and many of them showed diathermy incision is better than scalpel incision in terms of time taken for incision, lesser pain, better wound healing and minimal blood loss.[11,12] Despite this evidence in many randomized clinical trials in support of diathermy use in skin incision, many surgeons in many hospitals are unwilling to using diathermy for making skin incisions. This study compares diathermy and scalpel skin incisions in terms of incision time, blood loss, wound character and scar assessment in midline laparotomy surgeries.

MATERIAL AND METHODS

A prospective comparative clinical study was conducted in the surgical wards of a tertiary care teaching hospital in Madurai, Tamil Nadu between September 2017 and December 2018. Total of 90 cases were included by simple random sampling method. The inclusion criteria were all patients more than 18 years undergoing midline laparotomy during the period took part in the study. The patients below 18 years of age, who had previous midline laparotomy, on concurrent anticoagulant or corticosteroid therapy were excluded. All patients who met the inclusion criteria were, after informed written consent, consecutively enrolled in the study.

Subjects were randomly divided into cases and controls with 45 participants in each group. Cases received skin and deeper tissues incision with diathermy using diathermy pen electrode (Alan electrocautery brand ELSY 360 M). It was set at pure cutting mode and delivered 417kHz sinusoidal current. Controls received scalpel incision till peritoneum with a disposable blade.

All the patients were operated under spinal or general anaesthesia. All the patients received 1gram of ceftriaxone 30 minutes before surgery preoperatively and repeated 12 hourly for three days. Injection tramadol 100 mg were given eighth hourly for two days. Subcutaneous layers were closed with vicryl and skin with 2-0 ethilion. Skin sutures were removed postoperatively on day10 after checking the tensile strength.

Incision time: Incision time was recorded using seconds stopwatch clock. It is the time taken from initial skin incision to complete the opening of the peritoneum.

Incisional blood loss: Blood loss during skin incision was calculated by weighing the swabs used exclusively in making the incision and during haemostasis with each gram taken as equal to one millilitre of blood (i.e. 1g=1ml).

Wound infection was graded according to asepsis wound score, 0-10 = satisfactory wound healing; 11-20 = disturbance of healing; 20-30 = minor wound infection; 31-40 = moderate wound infection;> 40 = severe wound infection. The scar assessment was evaluated by Manchester scar score at the time of discharge.

Blood loss, scar assessment on a postoperative day (POD) and at the time of discharge, and suture removal on POD were considered as primary outcome variables. Study group (cases Vs controls) was considered as the primary explanatory variable. Qualitative outcomes were compared between study groups using Mann- Whitney- U test and categorical outcomes were compared using the Chi square test. P value < 0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.

RESULTS

A total of 90 subjects were considered into the analysis. There were 45(50%) cases and 45 (50%) controls. There was no statistically significant difference between the two groups in other baseline parameters like age, gender hypertension and diabetes mellitus type 2 (P value >0.05). (Table 1)

There was no statistically significant difference between two groups in other outcome parameters like length of incision, wound assessment and POD suture removal (P value >0.05).

Among the participants in the study group, median blood loss was 10ml (IQR 9 to 14) of cases and 15ml (IQR 14 to 15) of controls, the difference in the blood loss between study group was statistically significant (P Value less than 0.001). (Table 2)

There was no statistically significant difference between the two groups in other clinical parameters like BMI, incision time and scar assessment POD (P value >0.05). The mean of Haemoglobin for the cases was 10.89 ± 0.91, and it was 10.98 ± 0.81 for the controls, the difference between the two groups was statistically significant. (p value <0.001). (Table 3).

Among the study population, 29(32.2%) participants had gastric surgeries, 22(24.4%) participants had biliary surgeries, 10(11.12%) participants had pancreatic surgeries, 24(26.67%) participants had intestinal surgeries, and the remaining 5(5.56%) participants had other types of treatment as a part of their laparotomy (Table 4).

Among the gastric surgeries, 7 (7.8%) participants had anterior GJ, 13 (14.4%) participants had subtotal gastrectomy, 1(1.1%) participant had transhiatal esophagectomy, 4 (4.4%) participants had a total gastrectomy, and 3 (3.3%) participants had truncal vagotomy and gastrojejunostomy.

Among the Biliary Surgeries, 13 (14.4%) participants had CBD Exploration, 6 (6.7%) participants had Cholecystectomy, and 3 (3.3%) participants had an open cholecystectomy.

Among the Pancreatic Surgeries, 1 (1.1%) participant had Cystogastrostomy, 3 (3.3%) participants had Frey's procedure, 1 (1.1%) participant had triple bypass, 1 (1.1%) lateral pancreatectomy and 4 (4.4%) participants had Whipple's procedure.

Among the Intestinal Surgeries,5 (5.6%) participants had Anterior Resection, 2 (2.2%) participants had APR, 3 (3.3%) had to feed jejunostomy, 5 (5.6%) participants had hemicolectomy, 1 (1.1%) participant had open rectopexy, 2 (2.2%) participants had rectopexy, 5 (5.6%) participants had resection anastomosis and 1 (1.1%) participant had subtotal colecystecotomy.

Among the other methods of laparotomy, 3 (3.3%)

Baseline Parameters	Study group		p-value
	Cases	Controls	
Age in years - Median (IQR)	55(44 to 58)	51 (43.5 to 55)	0.104#
Gender			
Male	26 (57.8%)	27 (60%)	0.830*
Female	19 (42.2%)	18 (40%)	
Hypertension	12 (26.7%)	10 (22.2%)	0.624*
Diabetes Mellitus Type 2	15 (33.3%)	13 (28.9%)	0.649*
*Indicates p-value for the chi-square test. #indicates p-value for Mann Whitney U Test.			

Table-1: Comparison of the median value for various baseline parameters between study groups (N=90)

Outcome Parameters	Study group		Mann Whitney U Test (P value)
	Cases Median (IQR)	Controls Median (IQR)	
Length of the incision (in cm)	12(12 to 13)	12 (12 to 13)	0.900
Blood loss (ml)	10 (9 to 14)	15 (14 to 15)	<0.001
Wound Assessment POD (7 days)	10 (8 to 12)	18 (8 to 12)	0.742
POD Suture Removal (days)	12 (10 to 12)	12 (10 to 12)	0.673

Table-2: Comparison of the median value for outcome parameters between study groups (N=90)

Clinical Parameters	Study group		Independent sample test P-value
	Cases (N=45) Mean ± SD	Controls (N=45) Mean ± SD	
BMI (kg/m^2)	21.98 2.62	21.42 ± 2.65)	0.900
Haemoglobin (g/dl)	10.89 ± 0.91	10.98 ± 0.81	<0.001
Incision Time (hours)	3.68 ± 0.66	4.48 ± 0.51	0.742
Scar Assessment POD	13.67 ± 2.68	14.16 ± 3.15	0.673

Table-3: Comparison of mean clinical parameters between study groups (N=90)

Laparotomy	Frequency	Percent
Gastric surgeries	29	32.2%
Biliary surgeries	22	24.4%
Pancreatic surgeries	10	11.12%
Intestinal surgeries	24	26.67%
Others	5	5.56%

Table-4: Descriptive Analysis of Laparotomy in the Study population (N=90)

participants had Diagnostic Laparotomy, 1 (1.1%) participant had Mesenteric cyst excision, and 1 (1.1%) participant had an umbilical hernia repair. (Table 4)

DISCUSSION

At the beginning of the twentieth century, diathermy was introduced to overcome the inherent disadvantages of scalpel such as lack of haemostasis leading to unwanted blood loss, indistinct tissue planes, increased operative time, use of suture material in the wound leading to infection risk, and potential for tumour metastasis. With the advent of modern electrosurgical units capable of delivering pure sinusoidal current, this technique is now becoming extremely popular because of rapid haemostasis, faster dissection, and reduced overall operative blood loss.[13,14] The present study also highlighted that diathermy is the ideal method of incision with minimal time requirement for incision and reduced blood loss.

The current study demonstrated that blood loss was significantly minimal in the diathermy group (15 ml) compared to the scalpel group (10 ml). Similar results were reported by Siraj et al., Pandey et al., Talpur et al., where the average blood loss was in the range of 2 ml to 8 ml in the diathermy group compared to the surgeries done with a scalpel.[8,15,16] The well- recognized reason being the increased risk of skin and soft tissue damage with scalpel leading to significant bleeding and exposure to bloodborne infections. Scalpel usage requires frequent instrument exchanges resulting in an increased risk of 'sharps' injuries to the surgeon. Sharps injuries have been estimated to occur at a rate of about 6.4 per 1000 surgical procedures in the operating room second to injuries from suture needles which occur at a rate of about 41 per 1000.[17]

The present study highlighted that the time required for incision was less in diathermy group (3.68 ± 0.66) compared to the controls (4.48 ± 0.51) hours. Our findings corroborated with Chau JK et al., (210.33±68.82 in electrocautery group and 239±82.99 in scalpel group) and Dixon AR et al., (90±22 in electrocautery group and 126±25 in scalpel group) that the diathermy incision required less time compared to scalpel incision.[18,19]

In the present study, no significant difference was found in postoperative wound healing between the two groups however diathermy group had adequate healing compared

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to scalpel group. Chrysos et al. while performing prosthetic mesh inguinal hernioplasties found no change in wound complication rates with the use of electrocautery, declaring it as safe as the scalpel in terms of wound healing.[20] Stoltz et al. stated that scalpel and electrosurgical thoracotomy incision were similar in terms of early and late wound healing rate.[21]

When assessing the scar formation postoperatively, no significant difference was observed between the scalpel and diathermy group. Keloid formation was not found. Further research is required to elucidate the long- term effects of diathermy on scar formation. However, currently there is no evidence to suggest that diathermy resulted in low cosmetic scar scores. Dixon comparing skin incision by scalpel with electrosurgical needle incision had shown the later technique to be highly effective, to be consistently quicker, and to give better cosmetic results with minimal complications.[19] It is a convenient technique and well tolerated by patients with no added discomfort.

A systemic review and meta-analysis of cutting diathermy versus scalpel for skin incision conducted by J. Ly et al. included 14 randomized trials for a total of 2541 patients (1267 by cutting diathermy and 1274 by scalpel). The study concluded that skin incisions made by cutting diathermy are quicker and associated with less blood loss than those made by scalpel. There are no differences in the rate of wound complications or postoperative pain.[22]

The critical limitation of the present study was a smaller sample size. However, the results of this study are comparable with international studies and support the use of electrocautery in performing skin incisions. Further large-scale randomized trials with larger sample size

are recommended to assess the clinical and cosmetic outcome between diathermy and scalpel groups.

CONCLUSION

This present study concludes that diathermy is the ideal method of incision in high-risk patients, where both the blood loss and operating time are at a premium. Diathermy incisions heal like that of scalpel incisions concerning inflammation, wound strength, and scarring. These results suggest that the diathermy is safe and efficient and has tremendous potential in surgical fields, including abdominal laparotomy surgeries.

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