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Original Research Article

Comparison between scalpel incision and electrocautery incision in midline abdominal surgery: a comparative study

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ABSTRACT

Background: Fear of poor wound healing have curtailed the use of diathermy for making skin incision. Scalpel produces little damage to surrounding tissue but causing more blood loss. Our aim of study was to compare electrocautery incision with scalpel incision in terms of incision time, blood loss, postoperative pain and wound infection.
Methods: Total of 104 patients were included in the study undergoing midline abdominal surgery. Patients were randomized into electrocautery (group A) and scalpel (group B). The incision dimension, incision time and blood loss were noted intraoperatively. Postoperative pain was noted on postoperative day 2 using visual analog scale. Wound complications were recorded on every postoperative day till the patient was discharged.
Results: 52 patients in each of the two groups were analyzed. There was significant difference found between group A and group B in terms of mean incision time per unit wound area, 8.16±1.59 s\cm^2 and 11.02±1.72 s\cm^2 respectively (p value=0.0001). The mean blood loss per unit wound area was found to be significantly lower in group A (0.31±0.04 ml\cm^2) as compared to group B (1.21±0.21), p value=0.0001. There was no significant difference noted in terms of postoperative pain and wound infection between both groups.
Conclusions: Electrocautery can be considered safe in making skin incision in midline laparotomy compared to scalpel incision with comparable postoperative pain and wound infection with less intraoperative blood loss and less time consuming.

Keywords: Electrocautery incision, Midline laparotomy, Scalpel incision

INTRODUCTION

According to centers for disease control and prevention data, about 27% of all sharp injuries occur in the operating room.[1] National surveillance system for health care workers reports shows that scalpel injuries are the most frequent cause for such injuries second only to needle injuries. Health care workers handle sharp objects in close proximity in operating room which increases the chances of injury in emergency situations. Scalpel was considered as a gold standard for making skin incision until the inception of diathermy. Scalpel precludes the possibility of burn injuries and hence reduces the chances of excessive scarring and poor wound healing. But due to increased seroconversion rate in health care workers due to handling of sharp instruments led to the development of sharpless alternative for making skin incision. Perry et al reported that scalpel was responsible for 8% of all injuries that occurred in the hospital setting and there have been reports of surgeon contracting HIV infection after scalpel injury.[2,3] So, reducing the use of scalpel not only decrease the transmission of infection but also the

loss of manpower days that occur due to significant mechanical injury.

But due to fear that electrocautery will induce burn related wound complications and inadvertent injury to deeper structures, electrocautery is yet to get wide popularity in making skin incision. Nowadays, electrodes used in making diathermy incision generate a pure sinusoidal current which produces cleavage in the tissue planes without creating damage to surrounding areas thus leading to minimal burn related wound complications.[4]

Hence, this study was carried out to determine whether electrocautery is safe and effective for making skin incision as compared to scalpel for midline abdominal surgery. Aim of the study was to compare electrocautery incision with scalpel incision in terms of incision time, blood loss, postoperative pain and wound infection. Objective was to determine whether electrocautery is safe and effective for making skin incision as compared to scalpel for midline abdominal surgery.

METHODS

This was a prospective observational comparative study conducted from October 2019 to November 2020 at SMS Medical college and attached hospitals, Jaipur, a tertiary care center. Patients scheduled for midline abdominal surgeries and willing to participate in the study were randomized into two groups- group A (electrocautery group) and group B (scalpel group).

Inclusion criteria

Patients scheduled for midline abdominal surgery and willing to participate in the study were included in the study.

Exclusion criteria

Patients with previous midline laparotomy, patients on concurrent anticoagulant or corticosteroid therapy, patients with chronic medical illness like diabetes mellitus, anemia, tuberculosis and patients with active wound infection elsewhere in the body were excluded from the study.

Sample size and sampling technique

Sample size calculated at 95% confidence interval with 80% power of 0.05 α- error, sample size of 52 required in each group to verify expected minimum difference of 0.35 with standard deviation of 0.64 is required to compare electrocautery incision with scalpel incision in midline abdominal surgery. All the patients during study period falling in inclusion criteria undergoing mid line abdominal surgery are included and randomized into two groups- group A (electrocautery group) and group B (scalpel group).

Methods

All patients were randomized into two groups group A and group B. In group A, abdominal incision was made using electrocautery while in group B, abdominal incision was made using scalpel. All the patients in both the groups were given intravenous 1g ceftriaxone at the time of induction as a preoperative prophylaxis.

Incision dimensions were measured using a sterile flexible ruler in centimeters. The incision length was measured and depth of incision was taken as thickness of the abdominal wall. Then using length and depth of incision, wound area was calculated as the product of these two variables. Incision time (from the start of skin incision till complete opening of peritoneal cavity including hemostasis) was noted in seconds and then time taken per unit wound area (s\cm^2) was calculated.

Blood loss during the incision was measured by weighing the gauze swabs used. Gauze used were measured before and after the procedure by electronic weighing scale. Each gram difference in the dry and soaked gauze was taken as equal to 1 ml of blood. Suction was not used while making the incision. Then, amount of blood loss was calculated in ml and blood loss per unit wound area as ml\cm^2.

Postoperatively, patients were evaluated clinically for pain at postoperative day 2 using visual analog scale (a score of 0 - 10, 0 being no pain and 10 being worst pain). Clinical assessment of wound was done on each postoperative day for surgical site infection till the patient is discharged and on the first follow up visit to the hospital. Any abnormality was noted. Wound infections were considered grade 1 in the presence of erythema, induration and pain; grade 2 in the presence of grade 1 findings with serous fluid discharge; grade 3 in the presence of contaminated fluid in less than half wound; grade 4 in the presence of contaminated fluid in more than half wound.[5,6]

Analysis

Categorical variables such as gender, co-morbid conditions, type of surgery (elective or emergency) were presented as frequencies or percentages and compared between the two groups using Fisher's exact test. Continuous variables such as age, incision time, blood loss, incision size were represented as mean or standard deviation and compared between the two groups using independent student's t test. Statistical analysis was carried out at 5% level of significance and p value of<0.05 was considered statistically significant.

RESULTS

A total of 104 patients were included in the study, 52 were in group A and 52 were in group B (Table 1). Gender and age distribution in both the groups was

similar. There were 29 males and 23 females in group A and 28 males and 24 females in group B. there was no significant difference in the number of elective and emergency cases in the two groups.

Table 1: Demographic profile and case distribution.

	Group A	Group B	P value
Age	42.56±15.62	38.85±16.14	0.2364
Sex			
Male	29 (55.77%)	28(53.85%)	1.000
Female	23 (44.23%)	24 (46.15%)	
Type-elective	39 (75%)	36 (69.23%)	0.66
Emergency	13 (25%)	16 (30.77%)	

There was no statistically significant difference in incision length between the two groups (13.73±2.07 in group A whereas 13.28±2.33 in group B), p value=0.30. Incision depth (2.8±0.32 in group A while 2.62±0.29 in group B), p value=0.003 and wound area (38.55±7.63 in group A while 34.79±7.29 in group B), p value=0.0116 showed statistically significant difference (Table 2).

There was statistically significant difference in incision time (308.65±60.30 s in group A, 371.44±41.75 s in group B: p value=0.0001) and incision time per unit wound area (8.16±1.59 s\cm^2 in group A; 11.02±1.72 s\cm^2 in group B: p value=0.0001) between the two groups. Intraoperative blood loss also showed significant difference among the two groups (11.69±1.82 ml in group A; 40.94±4.85 ml in group B: p value=0.0001). The mean blood loss per unit wound area was significantly lower in group A (0.31±0.04 ml\cm^2) as compared to group B (1.21±0.21 ml\cm^2); p value=0.0001 (Table 2).

Table 2: Comparison of incision time and blood loss.

Parameters	Group A (mean±SD)	Group B (mean±SD)	P value	CI
Length (cm)	13.73±2.07	13.28±2.33	0.30	-0.41 to 1.31
Depth (cm)	2.8±0.32	2.62±0.29	0.003	0.061 to 0.298
Wound area (cm^2)	38.55±7.63	34.79±7.29	0.0116	0.857 to 6.662
Incision time (s)	308.65±60.30	371.44±41.75	0.0001	-82.96 to -42.616
Incision time\wound area (s\cm^2)	8.16±1.59	11.02±1.72	0.0001	-3.504 to -2.215
Blood loss (ml)	11.69±1.82	40.94±4.85	0.0001	-30.675 to -27.825
Blood loss\wound area (ml\cm^2)	0.31±0.04	1.21±0.21	0.0001	-0.9588 to -0.8412

Pain score was calculated in both the groups on post-operative day 2 which was found to be statistically insignificant between the two groups (4.63±0.88 in group A whereas 4.83±0.55 in group B); p value=0.1676 (Table 3).

Table 3: Comparison of pain score and wound infection.

	Group A	Group B	P value
Pain score	4.63±0.88	4.83±0.55	0.1676
Wound infection			
Yes	2	3	
No	50	49	1.0000

Wound infection was noted in 2 patients in group A and in 3 patients in group B which statistically not significant (p value=1.0000) (Table 3).

DISCUSSION

Ever since Dr. Harvey Cushing performed the first surgery using electrosurgical instrument in1926, electrocautery has become an essential component in the operating room irrespective of the surgical procedure carried out. Safety and efficacy of the electrocautery for dividing subcutaneous tissue and muscle layers is well established and some studies have shown that it can be safely used for bowel resection as well. However use of electrocautery in making the initial skin incision is still a debated issue.

Though few randomized studies have shown the efficacy of electrocautery for making skin incision, others have raised concern about wound healing and showed more wound infection in the electrocautery group.[7-11] Franchi et al. reported that scalpel and diathermy were similar in terms of early and late wound complications when used to perform midline abdominal incisions in gynaecologic oncologic patients.[12] However, Papay et al. and Ozdogan et al. have shown contradictory results.[13,14]

In the present study, time required to complete the incision was significantly lower in group A. Chrysos et al in a study on elective hernioplasty and Johnson et al. in a study on elective laparotomy showed quicker completion of the incision by electrocautery.[15,16]

In our study, mean blood loss was significantly lower with the use of electrocautery in making skin incision as compared to scalpel. Coagulation and cutting mode property of electrocautery leads to less blood loss to cause coagulation. Similar results were found by Kearns et al and Rappaport et al in their on patients undergoing midline laparotomy.[17,18] Chrysos et al. in their study noted that the electrocautery group required only half dose of

parenteral analgesics in the postoperative period.[15] Similarly Kearns et al. and Shamim also documented a significantly less postoperative pain score on postoperative day 1 and 2.[17] However in our study, there was no significant difference found in the postoperative pain score between the two groups on postoperative day 2. Our results are comparable with the study by Telfer et al. who found no difference in the postoperative pain at any stage after operation in their 101 patients of midline laparotomy incision.[10]

Earlier studies using electrocautery for skin incision raised major concern for wound healing and have reported an increase in the wound complications by electrocautery skin incision.[19-21] However, studies over the last decade extensively analyzed this issue and established the safety of electrocautery for making skin incisions. Franchi et al in a multicentre collaborative trial on midline laparotomy patients found no increase in the early or late wound complications using electrocautery.[12] In our study, 2 patients in group A and 3 patients in group B reported with wound infection but majority of these cases were operated in emergency where risk of infection exceeds 30%. However, wound infection rates were similar in both electrocautery and scalpel groups.

Limitation

All surgeries were performed by different surgeon with different years of experience, so outcomes may differ.

CONCLUSION

The use of electrocautery for making skin incision in midline abdominal surgery was associated with less intraoperative blood loss, less incision time as compared to scalpel. There was no difference in postoperative pain and wound complications between the two groups. So, with above advantages of electrocautery, we conclude that electrocautery is safe and effective alternative to scalpel in making skin incision in midline laparotomy.

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