

Comparison of Tissue Selective Use of Electrocautery cum Steel Scalpel versus Conventional Steel Scalpel Alone in Abdominal Incisions - A Prospective Randomized Study of 100 Cases

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Abstract: ***Background:** Surgeons have been in constant debate to identify the best method for abdominal incisions. Nowadays, there is a shift in trend from steel scalpel to electrosurgical incisions. However, the use of electrocautery is still limited due to concerns regarding poor wound healing and inadvertent injury to deeper structures. The present study was focused on combined use of electrocautery and steel scalpel in a tissue selective approach for abdominal incisions and compare the post-operative wound infection rate and early post operative complications with those of steel scalpel incisions for better patient outcome. **Aims and objectives:** This prospective study aimed to compare the outcome of abdominal incisions using tissue selective combination of electrocautery cum steel scalpel versus conventional use of steel scalpel alone with regards to incision time, total blood loss, early post-operative pain, wound healing, scar formation and hematoma/Seroma formation. **Materials and method:** Patients were randomly divided into two groups of 50 each. In one group, abdominal incision was given using tissue selective combination of electrocautery and steel scalpel and in second group, abdominal incision was given using conventional Steel scalpel only. Both groups were compared with regards to incision time, total blood loss, post-operative pain, post-operative wound infection rate and wound healing. **Results:** On comparison, the difference in time required to complete the incision between both the groups was highly significant ($p=0.001$) with mean incision time in group A at 683 ± 95 secs and group B at 871 ± 68 secs. A highly significant difference ($p=.000$) was observed in the amount of blood loss between the two groups (20.20 ± 6.773 ml in group A vs. 42.22 ± 7.778 ml in group B). The mean duration of hospital stay in cautery group was 6.26 ± 2.73 days and in scalpel group was 8.08 ± 3.56 days ($p=0.001$). No significant intergroup difference was found in VAP score at Post-op Day 1 ($p=0.137$), at week 1 ($p=0.741$), week 3 ($p=0.631$) and week 4 ($p=0.757$). However, statistically significant intergroup difference in VAP score was seen on Post-op Day 2 ($p=0.002$), Post-op Day 3 ($p=0.000$). However, no difference in terms of wound characteristics and complications was noted between the two groups. **Conclusion:** The study results revealed that the tissue selective use of combination of electrocautery and scalpel is superior in terms of incision time, duration of post operative hospital stay and amount of blood lost during the incision. Since no difference in wound characteristics was noted between the two groups, tissue selective use of electrocautery is a safe alternative to scalpel for gaining access to the abdominal cavity.*

Keywords: Electrocautery, Scalpel, Abdominal incisions, incision time, wound healing

1. Introduction

Steel scalpels have been used to make surgical incisions since a long time to produce clean incisions with minimum tissue destruction. However, use of scalpels has been associated with more skin bleeding which obscure the operating field resulting in wastage of operating time and more blood loss. Electrosurgery involves manipulating electrons through living tissue using an alternating current with a current density high enough to generate heat within tissue and destroy it. Though it is better in terms of reduction in blood loss, dry and quick tissue separation and a probable reduction in the danger of unintentional scalpel injury to the operative personnel due to frequent instrument changes, worries about poor wound healing, extensive scarring and adhesion development have kept electrosurgery from being used for surgical incisions¹. Incisions are meticulously planned to provide adequate access and cosmesis. However, in case of massive trauma, removal of a large organ or exploratory laparotomy, a larger incision remains the best approach to gain the most exposure possible.²⁻⁴The focus of this study is to combine the benefits of both electrocautery

and steel scalpel by using a tissue selective combination and compare it with conventional use of steel scalpel alone in abdominal incisions for better patient outcome.

2. Materials and Method

Present study was undertaken in Department of General surgery of Government medical college, Amritsar. 100 patients undergoing elective abdominal surgeries were randomly divided into two groups of 50 each.

Group A – Patients were given abdominal incision using combination of electrocautery and steel scalpel. The skin incision was given using steel scalpel and underlying abdominal layers up to peritoneum were cut using cautery.

Group B – Patients were given abdominal incisions using conventional Steel scalpel only.

Both groups were compared with regards to incision time, total blood loss, post-operative pain, post-operative wound infection rate and wound healing. Patients requiring

incisions over previous surgical scars, on anti-coagulant therapy, uncontrolled diabetes and hypertension, pregnant females, with severe organ dysfunctions and patients not willing to participate in study were excluded from the study. The study was conducted after approval from Institutional Ethical and Thesis Committee. A written informed consent was taken from all the patients.

3. Results

The results were analysed using IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp. On analysis, it was found that the mean of age in Group A was 44.18 ± 13.00 years and in Group B were 48.58 ± 12.80 years. Depending upon the gender distribution in each group, the results showed that 21 (42%) patients in Group A were males and 29 (58%) were female in comparison to group B which showed distribution of 34.0% males and 66% females.

For post operative hospital stay, intergroup statistically significant difference ($p=0.005$) was found where the mean duration of hospital stay in group B was 8.08 ± 3.56 days and was higher than group A which was 6.26 ± 2.73 days.

The results showed no statistically significant difference in intergroup SBP ($p\text{-value}=0.35$), DBP ($p\text{-value}=0.27$), Pulse rate ($p\text{-value}=0.33$), temperature ($p\text{-value}=1.00$), RR ($p\text{-value}=0.88$). No intergroup statistically significant difference was found with comorbidities in the study population.

Out of 50 patients in Group A, 26 subjects were diagnosed with Cholelithiasis, 9 subjects with paraumbilical hernia, 2 subjects diagnosed with Cholelithiasis with Choledocholithiasis, and 2 with gastric outlet obstruction. Other miscellaneous operative diagnosis were also observed but were less common. Similarly, out of total 50 subjects in Group B, 28 subjects were diagnosed with Cholelithiasis, 8 subjects with paraumbilical hernia, 2 subjects diagnosed with Cholelithiasis with Choledocholithiasis, and rest presented with other miscellaneous operative diagnosis.

No intergroup statistically significant difference was found when groups were compared for type of anesthesia used. (General anesthesia ($p\text{ value}=0.448$), spinal anesthesia ($p=0.315$))

The mean approximate incision time in seconds in Group A was 683.00 ± 95.61 and in Group B was 871.00 ± 68.10 . Statistically highly significant difference ($p=0.001$) was found. The mean approximate blood loss during incision in ml in Group A was 20.20 ± 6.77 and the approximate blood loss in the scalpel method is 42.22 ± 7.78 ml. On statistical analysis, highly significant difference was found ($p=0.000$).

The results showed that the mean in VAP score for Group A at Post-op Day 1, Post-op Day 2, Post-op Day 3, at week 1, week 3 and week 4 was 7.26 ± 0.82 , 3.92 ± 1.24 , 2.56 ± 0.99 , 2.3 ± 0.88 , 1.00 ± 0.83 , 0.48 ± 0.64 respectively. And the mean in VAP score for Group B at Post-op Day 1, Post-op Day 2, Post-op Day 3, at week 1, week 3 and week 4 was 7.00 ± 0.90 , 4.76 ± 1.34 , 3.82 ± 1.26 , 2.36 ± 0.92 , 0.92 ± 0.82 ,

0.44 ± 0.64 respectively. On statistical analysis, no significant intergroup difference was found at Post-op Day 1 ($p=0.137$), at week 1 ($p=0.741$), week 3 ($p=0.631$) and week 4 ($p=0.757$). However, statistically significant intergroup difference was found at Post-op Day 2 ($p=0.002$), Post-op Day 3 ($p=0.000$)

No statistical significant intergroup difference was found in Manchester Scar Scale for color changes at POD 1 ($p=1.00$), week 1 ($p=0.90$), week 3 ($p=0.77$), and week 4 ($p=0.77$). No statistical significant intergroup difference was found in mean in Manchester Scar Scale for finish at POD 1 ($p=1.00$), week 1 ($p=0.40$), week 3 ($p=0.75$). No statistical significant intergroup difference was found in the mean in Manchester Scar Scale for contour changes at POD 1 ($p=1.00$), week 1 ($p=0.83$), week 3 ($p=0.88$), and week 4 ($p=0.89$). No statistical significant intergroup difference was found in the mean in Manchester Scar Scale for distortion changes at POD 1 ($p=1.00$), week 1 ($p=0.72$), week 3 ($p=0.87$), and week 4 ($p=0.76$). No statistical significant intergroup difference was found in the mean in Manchester Scar Scale for texture changes at POD 1 ($p=1.00$), week 1 ($p=0.80$), week 3 ($p=0.81$), and week 4 ($p=0.72$).

No statistical significant intergroup difference was found in the mean in South Hampton scoring at week 1 ($p\text{ value}=0.48$), week 3 ($p\text{ value}=0.66$), and week 4 ($p\text{ value}=0.51$). It was also observed from the results that no patient in both the groups required reoperation or had any complications.

4. Discussion

Ever since Dr. Harvey Cushing performed the first surgery using electrosurgical instrument in 1926, electrocautery has become an essential component in the operating room irrespective of the surgical procedure carried out. It provides quick and adequate exposure with minimum loss of blood^{5,6}.

On comparison in the present study, no significant difference was found in terms of distribution of age, gender, diagnosis, comorbidities, the mean values for pre-operative investigations, type of anesthesia and surgical procedure performed between the two groups. Patients with comorbid conditions like diabetes mellitus, hypertension, obesity, HIV, Hepatitis B and HCV were the included in this study to observe if these diseases have any effect on the wound healing, but no significant difference was found on comparison between two groups.

This study compared the two methods for creating abdominal incision in terms of effect on duration of post operative hospital stay, incision time, blood loss during incision and post-operative pain, scar formation and Wound healing. Wound infection was graded according to Southampton wound scoring system and pain was assessed using Visual Analog Pain (VAP) score with a score 0 representing no pain and a score of 10 representing worst pain. Scar characterization was done using Manchester scar scale which included parameters like color, finish, contour, distortion and texture of scar.

In the present study, the difference in time required to complete the incision between both the groups was highly

significant ($p=0.001$) where the mean incision time in group A was 683+95 secs and in group B which was 871+68 secs. The frequent instrument exchanges and need for individual ligation of each bleeding vessel during scalpel incision can result in increase in time required for incision. This was in accordance with previous studies which have reported the time taken to make the incision as mean^{7, 8, 9, 10}. Dixon et al., have shown that diathermy incision is more rapid than scalpel incision⁷. Similar findings were noted by Siraj et al¹¹, in 2011, who reported that incision time in the electrocautery group is significantly less than in the steel scalpel group. On the contrary Charoenkwan et al¹². in a recent systematic review concluded that there is insufficient reliable evidence to say that electrocautery decreases the incision time.

In our study, the amount of blood loss during incision was measured by weighing swabs exclusively without using suction with minimum calibration of weighing machine at 10 grams (Wet swab weight in grams – Dry swab weight in grams = Milliliters of Blood within the swab). We found a highly significant difference ($p=.000$) in the amount of blood loss between the two groups (20.20±6.773 ml in group A vs.42.22±7.778 ml in group B). Scalpel incision requires frequent instrument exchanges that may result in an increase in amount of blood loss. Many other previous studies have also reported wound-related blood loss (Kearns 2001⁸; Pearlman 1991⁹; Prakash 2015¹⁰ as means. Certain studies on the contrary (Siraj 2011)¹¹ has measured blood loss as mean wound-related blood loss per wound area. Telfer 1993¹³ measured blood loss by weighing swabs using a standardized technique. This study demonstrates that electrocautery incisions were faster and were associated with significantly lower blood loss.

In our study, the mean duration of post operative hospital stay was significantly higher (p value=0.005) in group B than in group A (8.08±3.56 days in group B vs.6.26±2.73 days in group A). The more damage to adjacent tissue caused by frequent instrumentation and tissue handling while using scalpel and increased postoperative pain may account for this observation. Similar results were found in previous studies by Dixon AR (1990)⁷, Kearns SR (2001)⁸ and Prakash LD (2015)¹⁰. Dixon et al in their studies have shown that diathermy incisions were associated with shorter duration of hospital stay compared to scalpel incisions⁷.

In our study we compared post operative pain in patients undergoing scalpel incision (group B) and incision using combination of electrocautery and scalpel (group A), using visual analogue pain scores at 1st, 2nd and 3rd post-operative day, the pain was also analysed at week 1, 3 and 4 weeks postoperatively. Hussain 1988¹⁴ used visual analogue scale to assess pain every four hours during the first 24 hours after surgery. Shivagouda 2010¹⁵ employed a visual analogue scale to evaluate pain at 6, 12, and 24 hours after surgery. In our study we found significant difference in postoperative pain between both study groups at post-op day 2 and day 3. The patients in Group B had more reading on VAP score at day 2 and day 3 when compared to Group A. This was probably due to less tissue damage caused by electrocautery as compared to scalpel incision. Our results are comparable with by study done by Bhupender Kadyan et al¹⁶ who found that there is decrease in visual analogue pain score in first 24

hours. Similarly, in study by Muhammad Shamim² there is decrease pain perception in first 48 hours in diathermy group. In another study by Hussain and Hussain¹⁴, it was concluded that postoperative pain is significantly less in the electrocautery group. Kearns also found that postoperative pain was significantly lower in the diathermy group for first 48 hours after operation⁸. Ahmad et al¹⁷. Also noted similar findings that postoperative pain was significantly less with diathermy incisions in first 24 hours.

In our study we did assessment of the scar using Manchester scar scale (color, finish, contour, distortion and texture). All the criteria of the scale were comparable in both group A and group B. We assessed all the criteria at 1st post-operative day, at week 1, 3 and 4 post operatively. In the present study, there was no statistically significant difference in the mean Manchester scar score between group A and group B. Many previous studies have used Vancouver Scar Scale (VSS) and the Patient and Observer Scar Assessment Scale (POSAS) as the scales to assess scar. Similar to our study other studies have shown no significant difference in scar characteristics.¹⁸

Southampton wound grading system for wound healing was also assessed in the present study at post operative day 1, week 1, 3 and 4 post operatively. On analysis no significant intergroup difference was found in the present study ($p=0.48$ at week 1, 0.66 at week 3 and 0.51 at week 4). However, certain studies have shown significant difference in post operative wound infection when measured by Southampton grading system. (Tiwari S 2014)¹⁹. Many studies have used ASEPSIS score in the assessment of wound healing and have found significant results (Siraj et al¹¹, Galal AN²⁰, and Groot et al.²¹

In our study we found no reoperations and no wound complications in both the groups. This was comparable to study by Franchi et al²², who in a multicentre collaborative trial on midline laparotomy patients found no increase in the early or late wound complications using electrocautery.

5. Conclusion

The tissue selective use of electrocautery and scalpel is superior in terms of incision time, duration of post operative hospital stay and amount of blood lost during the incision. Since no difference in wound characteristics was noted between the two groups, tissue selective use of electrocautery is a safe alternative to scalpel for gaining access to the abdominal cavity.

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