

Efficacy of Electrocautery Skin Incision over Scalpel Incision - A Comparative Study

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Abstract: *Background:* The anecdotal fear of using cautery for surgical incisions is still common in surgical practice despite recent evidences. The aim of this study is to compare the results of electrocautery and the scalpel in skin incisions. *Materials and Methods:* This is a prospective randomized double blind study conducted in the Department of Surgery, of JSS Hospital, Mysuru. Patients were randomized to have either scalpel or electrocautery incisions. The duration used in making the skin incision; the incisional blood loss and the ensuing length and depth of the wound were noted. Postoperative pain; duration of wound healing and the occurrence of surgical site infection were also noted. *Results:* There were 193 patients consisting of the scalpel group (n = 100) and the electrocautery group (n = 93). The ages ranged from 16 to 73 years. The demography, case distribution and body mass index were similar in both groups. The mode of presentation was predominantly elective. The incision time was shorter in the electrocautery group. The blood loss was less with the diathermy compared to the scalpel. Postoperative pain is more in scalpel incision as compared to cautery. There was no statistically significant difference in wound infection and wound closure (epithelialization time) (P = 0.237). *Conclusion:* The method of electrosurgical incision can be easily learned, safe, highly effective technique associated with lesser complications. Comparatively less pain and less bleeding were noted with use of electrocautery and no delay in healing of wounds incised by diathermy was noted with good acceptable scar. Concluding that use of electrocautery is a suitable method of skin incision

Keywords: Electrocautery, Scalpel, surgical incision, blood loss

1. Introduction

Despite the introduction of electrocautery (diathermy) about a century ago,[1,2] it is still used mostly for underlying dissection and hemostasis.[3] Skin incisions with electrocautery are not frequent because of the fear of deep burns; poor wound healing and excessive scarring.[4] These presumptions stem from experimental and clinical studies that yielded varied reports.[5,6,7]

Modern electrosurgical units capable of delivering pure sinusoidal currents have evolved a change in this concept. The advantages are rapid hemostasis, faster dissection, and a reduced overall operative blood loss.[4,8,9] Majority of studies had compared electrocautery and scalpel incision in terms of wound infection, postoperative pain, blood loss, duration of healing and postoperative wound complication in only selected groups of patients with the exclusion of patients with medical co-morbidities.[4,5,6,7,8,9,10,11] No study till date has focused on a heterogeneous population of general surgical cases in native Africans.

This study compared electrocautery and scalpel incisions in patients with varied general surgery conditions. The indices observed were the incision time, incisional blood loss, postoperative pain, wound healing and postoperative wound infection. The safety of diathermy in our environment was also considered.

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2. Materials and Methods

This prospective randomized clinical study was conducted in the Department of Surgery, JSS Hospital Mysuru between March 2011 and February 2016. An approval was obtained from the hospital ethics committee.

All patients admitted through the accident and emergency department and surgical out-patient department for surgery were eligible for the study. Consenting patients for surgery were further categorized as being clean or clean contaminated.

All consenting patients within the inclusion criteria were consecutively enrolled in the study. Block randomization was used for allocation of patients into two groups (A and B). The whole process of generation and implementation of randomization was done by a surgeon who could not be blinded to which modality was to be used for making the incision. The patient and the assessor of the pain score (intern) were both blinded to which participant had scalpel or diathermy skin incision at surgery. All consenting patients within the inclusion criteria were consecutively enrolled in the study. Block randomization was used for allocation of patients into two groups (A and B). The whole process of generation and implementation of randomization was done by a surgeon who could not be blinded to which modality was to be used for making the incision. The patient and the assessor of the pain score (intern) were both blinded to which participant had scalpel or diathermy skin incision at surgery. All the surgeons were of consultant and senior registrar grade.

The exclusion criteria were patients <15 years, contaminated and dirty procedures and patients who could not comprehend the pain scoring index for assessing postoperative pain either due to an altered sensorium or communication barrier.

All consenting patients within the inclusion criteria were consecutively enrolled in the study.

The patient and the assessor of the pain score (intern) were both blinded to which participant had scalpel or diathermy skin incision at surgery.

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A total of 193 patients was recruited into the study. In group A; 93 patients had diathermy skin incision while 100 patients in group B had conventional scalpel skin incision. Group A patients had a surgical incision made with force two valley lab diathermy machine in cutting mode, power of 5W and 515 kHz sinusoidal waveform while group B patients had surgical incision made with surgical blade. Prophylactic intravenous antibiotics were administered at induction of anesthesia. This was ceftriaxone alone or in combination with metronidazole when indicated. The prophylactic antibiotics were repeated for 72 h in clean-contaminated procedures. It was administered in the prophylactic setting for the clean procedures; hence it was not repeated in this cohort. The surgical incision in each case was made through skin, subcutaneous tissue, deep fascia, muscle ± aponeurosis and peritoneum or the proposed operation site. The length and depth of each incision were measured using a sterile flexible ruler and the incision time was defined as the start of the skin incision till the intended operation site was reached with complete hemostasis and incisional blood loss being the blood loss that occurred strictly during the period of skin incision and this was calculated as the differences between the dry and wet weight of the swabs (1 mg = 1 ml). No suction evacuation of blood was done while making the skin incision.

Postoperative analgesia was administered via the intravenous route using Tramadol hydrochloride for all patients on admission, and its oral form was used in day case surgery after an initial parenteral dose. The pain assessment

was done by surgical interns at fixed times on postoperative 6, 12, 24hours using the verbal, numerical rating scale to assess the level of pain. The day case respondents were called on the phone to assess their postoperative pain.

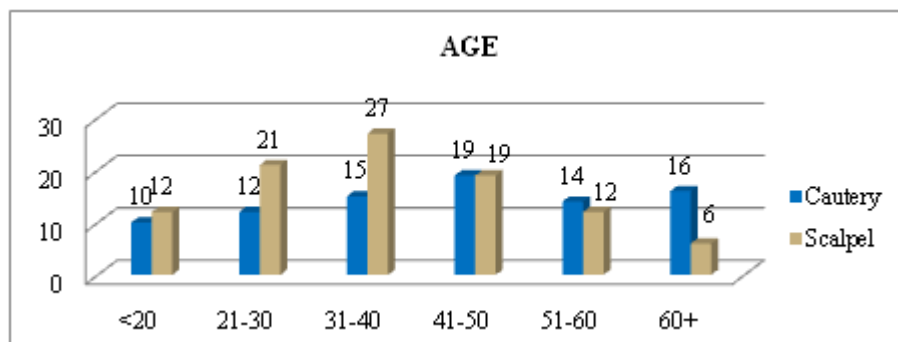
Postoperative wound assessment both for healing and surgical site infection were assessed concurrently on the first 5 postoperative days and then at appointed times depending on the site of surgery. Assessment of complications done with the terms of seroma formation, hematoma formation and purulent discharge. The peri-operative occurrence of any adverse reaction or event whilst using the electrocautery machine was noted at surgery.

Ethical approval was obtained for the study. Statistical data analysis was done using SPSS version 17 manufactured by IBM, Chicago.

Frequencies and proportions were used to summarize the variables while Chi-square and Student's *t*-test were used to test for association at 5% level of significance.

3. Results

Age - Total 193 patients were studied. The maximum of the patients belongs to age group of 31 -40 years (p - 0.71).The distribution was randomised.



Incision Size

The mean incision size taken in group A was 12.6 and scalpel was 10.61 but not significant.

| | GROUP | N | Mean | Std. Deviation | Std. Error Mean |
|---------------|---------|-----|---------|----------------|-----------------|
| INCISION SIZE | Cautery | 93 | 12.6022 | 6.65148 | 0.68973 |
| | Scalpel | 100 | 10.61 | 7.91737 | 0.79174 |

| | | t-test for Equality... | | | |
|---------------|-----------------|------------------------|-----|-------------------|-----------------|
| | | t | df | Sig (2-tailed)... | Mean Difference |
| Incision Size | Equal variances | 1.89 | 191 | 0.061 | 1.9922 |

BLOOD LOSS

Blood loss was estimated by the use of gauze. Scalpel used surgeries required 1 gauze for more than 70 percent of cases while 90 percent of cautery used cases the blood loss was nil so did not require any gauze.

| | No. of Gauze | GROUP | | Total | |
|------------|--------------|------------|---------|---------|--------|
| | | Cautery | Scalpel | | |
| BLOOD LOSS | 0 | Count | 84 | 5 | 89 |
| | | % of Group | 90.30% | 5.00% | 46.10% |
| | 1 | Count | 8 | 70 | 78 |
| | | % of Group | 8.60% | 70.00% | 40.40% |
| | 2 | Count | 1 | 20 | 21 |
| | | % of Group | 1.10% | 20.00% | 10.90% |
| 3 | Count | 0 | 5 | 5 | |
| | % of Group | 0.00% | 5.00% | 2.60% | |
| TOTAL | Count | 93 | 100 | 193 | |
| | % of Group | 100.00% | 100.00% | 100.00% | |

Post Operative Pain

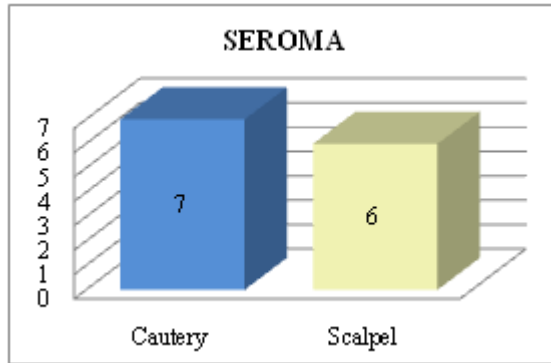
The post operative pain was more with scalpel operated surgeries but not significant (P> 0.05)

| PAIN | Group | Mean | Std. Deviation |
|-----------|---------|------|----------------|
| At 6 hrs | Cautery | 1.57 | 0.56 |
| | Scalpel | 1.65 | 0.54 |
| At 12 hrs | Cautery | 1.09 | 0.58 |
| | Scalpel | 1.5 | 0.6 |
| At 24 hrs | Cautery | 0.83 | 0.67 |
| | Scalpel | 1.36 | 0.64 |

Complications

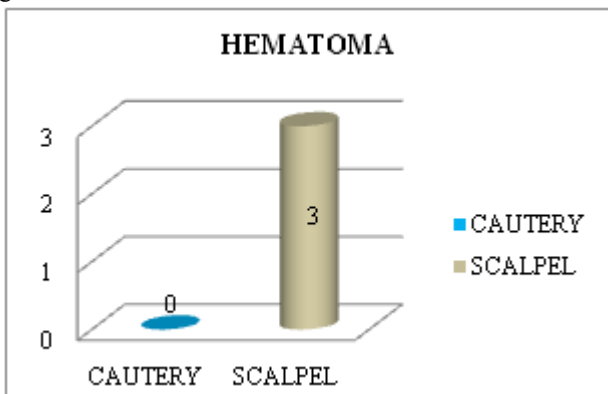
SEROMA –

Out of 193 cases 13 cases were observed to have seroma formation. 7 cases were of group A and 6 cases were of group B.



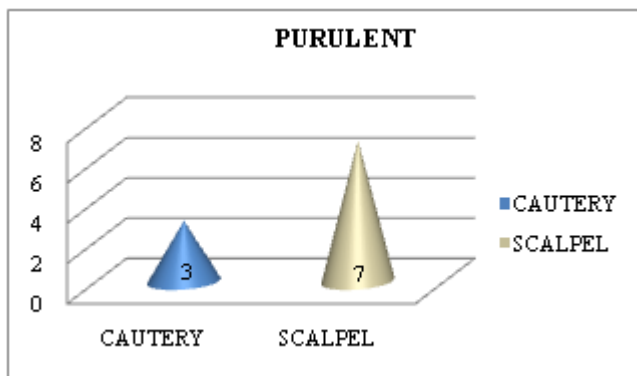
Hematoma–

Hematoma formation was observed in group B but its not significant.



Purulent discharge –

Purulent discharge was observed in 7 cases of group B while only 3 cases of group A. (p – 0.23) so not significant.



4. Discussion

Several studies have shown that diathermy is increasingly being used for making skin incisions, securing hemostasis, dissecting tissue planes and cutting.[4,6,7,12] It facilitates hemostasis, reduces overall intraoperative time and lastly produce a wound that heals similarly as one created by the scalpel.[4] Despite these advantages; its use by surgeons for skin incisions in centers in developing countries including ours is still sub-optimal. We can allude to the paucity of studies involving a heterogeneous group of patients in this part of the world as the cause along with the old belief that electrocautery causes electric burns when used to make skin incisions, thus increasing the amount of devitalized tissue within the wound.

Mastectomy for breast carcinoma (25%) accounted for the highest proportion of procedures performed in both groups. Hernioplasty for groin hernias and thyroidectomy for simple multinodular goiter followed thereafter for both groups respectively. This is in slight contrast to a previous study[3] which had more of open cholecystectomy for cholelithiasis (16.2%) followed by hernioplasty for groin hernia (14.7%). This can be explained by the sub-specialty of the surgical divisions and also regional variations in the epidemiology of the disease.

Slightly over a quarter (28.6%) of our patients had comorbidities, with hypertension ranking highest; comparable with other authors.[13,14,15] Our study along with various other studies showed a significantly shorter incision time in the diathermy group compared with the scalpel group. This is in contrast to the review by a previous study,[16] which suggested no added advantage with diathermy skin incision in terms of the incision time. The reduced incisional blood loss in the diathermy group is in concordance with the findings in a similar study.[10] This is due to the coagulative effect of diathermy on the micro-circulation of the area immediately adjoining the area of the incision.

In accordance with previous studies,[4] our results suggested a significantly reduced postoperative pain in the diathermy group. This is due to the thermal effect of diathermy on the sensory nerve fibers with the subsequent disruption of transmission of nerve impulses. Cell vaporization caused by the application of a pure sinusoidal current leads to immediate tissue and nerve necrosis without significantly affecting adjoining structures. Consequently, there is total or partial injury to the cutaneous nerves in the area of the surgical wound with a reduced postoperative pain profile in patients who had diathermy skin incisions.[17] We however did not compare the postoperative pain with the various sites of surgery because the varied anatomic sites, along with the various amounts of underlying tissue dissection and inherent class of surgery may all affect the pain assessment score. This is a one of the limitations of this study.

Although our wound infection rate compared favorably with an initial study,[6] it was higher when compared with 5% in a more recent study.[10] The conclusion was that it was not statistically significant. The overall outcome in this study in

terms of early and late wound complications is comparable with other similar studies.[12,17]

The mean duration for complete wound healing was similar for both groups. This is similar to initial studies.[3] There was no adverse effect noted during the course of our study attributable to the use of diathermy.

5. Conclusion

The method of electrosurgical incision can be easily learned, safe, highly effective technique associated with lesser complications. Comparatively less pain and less bleeding were noted with use of electrocautery and no delay in healing of wounds incised by diathermy was noted with good acceptable scar. Concluding that use of electrocautery is a suitable method of skin incision.

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