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Original Research Paper

General Surgery

CUTTING ELECTROCAUTERY VERSUS SCALPEL FOR SURGICAL INCISIONS: A COMPARATIVE STUDY

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ABSTRACT

Background & Objectives: Skin incisions are a critical component of surgical procedures. While the scalpel has traditionally been the preferred tool for its precision, cutting electrocautery is increasingly used for its ability to minimize bleeding and enhance operative efficiency. This study aims to evaluate and compare the effectiveness, safety, and postoperative outcomes of cutting electrocautery versus conventional scalpel for skin incisions in elective surgical procedures. **Methods:** This prospective, randomized comparative clinical trial included 90 patients undergoing elective surgery at Kanachur Institute of Medical Sciences, Mangalore. Participants were equally divided into Group A (scalpel, n=45) and Group B (electrocautery, n=45). Parameters assessed included incision time, postoperative pain using the Visual Analog Scale (VAS) on days 1, 2, and 5, local wound complications (seroma, hematoma, purulent discharge), and scar quality using the Patient and Observer Scar Assessment Scale (POSAS) at six weeks. **Results:** Both groups were comparable at baseline. Electrocautery demonstrated significantly shorter median incision time (58 vs. 64 seconds, p=0.03). Postoperative pain was equivalent on day 1 (VAS 5 vs. 5, p=0.976) but significantly lower with electrocautery on day 2 (VAS 2 vs. 3, p=0.03) and day 5 (VAS 1 vs. 3, p=0.033). Wound complications were markedly reduced in the electrocautery group: seroma (4.4% vs. 22.2%, p=0.027), hematoma (4.5% vs. 20%, p=0.04), and purulent discharge (6.66% vs. 31.1%, p=0.02). POSAS scores at six weeks also favoured electrocautery in both patient (18 vs. 21.5, p=0.027) and observer assessments (22 vs. 27, p=0.041). **Conclusion:** Cutting electrocautery is a safe, efficient, and effective alternative to the traditional scalpel for routine surgical skin incisions, offering advantages of shorter incision time, reduced mid-term postoperative pain, fewer wound complications, and superior scar outcomes.

KEYWORDS : Electrocautery, Scalpel, Skin Incision, Wound Healing

INTRODUCTION

Surgical procedures have evolved remarkably, yet the skin incision remains a consistent and fundamental step in nearly every operation. The choice of instrument for this step carries significant implications for intraoperative blood loss, postoperative pain, wound healing, and cosmetic outcomes. Two principal techniques are employed: the conventional scalpel and cutting electrocautery (Kearns et al., 2001; Shamim, 2009).

The scalpel has historically been regarded as the gold standard for skin incisions due to its precision and minimal thermal tissue damage. Conversely, cutting electrocautery — which uses high-frequency electrical current to simultaneously incise and coagulate tissue — has gained popularity for its ability to reduce intraoperative bleeding and improve operative field visibility (Dixon & Watkin, 1990; Ismail et al., 2017).

Despite these advantages, concerns persist about thermal tissue injury, delayed wound healing, and inferior cosmetic results with electrocautery (Pearlman & Stiegmann, 1991). Existing literature presents conflicting results, often limited by small sample sizes or procedure-specific designs. This study was undertaken to provide comprehensive, randomized comparative evidence across multiple elective surgical procedures, evaluating both objective clinical parameters and subjective patient-reported outcomes.

AIMS AND OBJECTIVES

The primary aim was to compare cutting electrocautery versus scalpel for skin incisions in elective surgeries with respect to:

1. To compare incision time between cutting electrocautery and the conventional scalpel for elective surgical skin incisions.
2. To assess postoperative pain using the Visual Analog Scale (VAS) on days 1, 2, and 5 between the two techniques.
3. To evaluate local wound complications (seroma, hematoma, purulent discharge) associated with each technique.
4. To compare scar cosmesis using the Patient and Observer Scar Assessment Scale (POSAS) at six weeks.
5. To determine the safety and viability of cutting electrocautery as an alternative to the conventional scalpel.

MATERIALS AND METHODS

Study Design and Setting

Prospective, randomized comparative clinical trial conducted at the Department of General Surgery, Kanachur Institute of Medical Sciences, Natekal, Mangalore, from April 2024 to September 2024. Ethics committee approval was obtained (Ref. No. KIMS/IEC/PG016/2024-EC/NEW/INST/2023/3522).

Participants

Ninety patients aged 18–70 years (ASA I–II) undergoing elective surgery requiring linear skin incisions ≥4 cm were enrolled after written informed consent. Exclusion criteria included uncontrolled diabetes, coagulation disorders, immunosuppression, emergency surgeries, and pacemaker implantation.

Interventions

Group A (n=45) received skin incisions using a No. 10 scalpel blade. Group B (n=45) received incisions using monopolar diathermy in cutting mode (30–35 watts) at 45° to the skin. Subcutaneous and fascial layers were managed identically in both groups.

Outcome Measures

Incision time was recorded in seconds. Postoperative pain was assessed using the Visual Analog Scale (VAS; 0–10) on days 1, 2, and 5. Local complications were recorded during the first postoperative week. Scar quality was assessed at six weeks using the Patient and Observer Scar Assessment Scale (POSAS; 1–60, lower = better).

Statistical Analysis

Data were analyzed using SPSS v27. Continuous variables were compared using the independent t-test or Mann-Whitney U test. Categorical variables were compared using Chi-square or Fisher's exact test. Within-group temporal pain changes were analyzed using the Friedman test. Statistical significance was set at $p<0.05$.

RESULTS

A total of 90 patients were enrolled — 45 per group. Baseline characteristics were comparable between groups with no statistically significant differences in age (44.9 vs. 48.4 years, $p=0.305$), gender distribution ($p=0.101$), or ASA classification ($p=0.158$).

Table 1. Comparison of Key Outcomes Between Study Groups

Parameter	Scalpel (Group A)	Electrocautery (Group B)	p-value
Incision Time (median, sec)	64	58	0.03*
VAS Day 1 (median)	5	5	0.976
VAS Day 2 (median)	3	2	0.03*
VAS Day 5 (median)	3	1	0.033*
Seroma	22.2%	4.4%	0.027*
Hematoma	20.0%	4.5%	0.04*
Purulent Discharge	31.1%	6.66%	0.02*
POSAS Patient Score (6 wks)	21.5	18	0.027*
POSAS Observer Score (6 wks)	27	22	0.041*

*Statistically significant ($p<0.05$).

Electrocautery resulted in significantly shorter incision times (median 58 vs. 64 seconds, $p=0.03$), attributed to its simultaneous cutting and coagulation properties. On postoperative day 1, pain was equivalent in both groups. However, electrocautery demonstrated significantly lower pain scores on days 2 and 5, reflecting faster resolution of post-incisional inflammation through thermal sealing of nerve endings and vessels.

Wound complication rates were markedly and significantly lower in the electrocautery group across all three parameters. POSAS scores at six weeks — both patient-reported and observer-assessed — were significantly better in the electrocautery group, indicating superior early scar quality.

DISCUSSION

This randomized comparative study provides comprehensive evidence that cutting electrocautery is superior to the conventional scalpel across multiple clinically significant parameters in elective surgery. The observed reduction in incision time with electrocautery is consistent with prior meta-analyses. Ismail et al. (2017), analyzing 41 studies and over 6,400 patients, confirmed shorter incision times (SMD = −0.63) and lower postoperative pain (SMD = −0.91) with electrocautery. Similarly, Yadav et al. (2021) demonstrated significantly less blood loss with electrocautery in midline abdominal surgery.

The significant reductions in seroma (4.4% vs. 22.2%), hematoma (4.5% vs. 20%), and purulent discharge (6.66% vs. 31.1%) observed in our study are noteworthy. These findings align with electrocautery's hemostatic mechanism — thermal vessel sealing reduces dead space and bacterial entry risk. While several earlier studies reported equivalence in complication rates (Prakash et al., 2015; Ansari et al., 2016), the optimized cutting-mode settings (30–35 watts) used in our study may explain the more pronounced benefit.

Regarding scar outcomes, our POSAS findings provide novel evidence favouring electrocautery at six weeks. Although Stupart et al. (2016) found no cosmetic difference at six months, the improved early scar scores in our study likely reflect reduced wound complications in the electrocautery group, which are known to adversely affect scar quality.

LIMITATIONS

This study was conducted at a single surgical centre, which may limit the generalisability of the findings. Scar assessment was limited to six weeks; long-term evaluation beyond this period, including the risk of delayed hypertrophic scarring, could not be assessed.

CONCLUSION

This study demonstrates that cutting electrocautery is a safe, efficient, and effective alternative to the traditional scalpel for routine surgical skin incisions. It offers significant advantages including shorter incision time, reduced mid-term postoperative pain, fewer wound complications, and superior early scar outcomes without increasing immediate pain or infection risk. Electrocautery should be considered the preferred incision modality in elective surgeries where hemostasis and operative efficiency are priorities. Future multicenter trials with extended follow-up are recommended to validate these findings in broader surgical contexts.

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