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Review

# Systematic review and meta-analysis of electrocautery versus scalpel for surgical skin incisions

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**KEYWORDS:**
Electrocautery;
Wound healing;
Surgical wound infection

**Abstract**

**BACKGROUND:** The creation of surgical skin incisions has historically been performed using a cold scalpel. The use of electrocautery for this purpose has been controversial with respect to patient safety and surgical efficacy. A systematic review and meta-analysis of randomized controlled trials (RCTs) was conducted to compare skin incisions made by electrocautery and a scalpel.

**DATA SOURCES:** A systematic electronic literature search was performed using 2 electronic databases (MEDLINE and PubMed), and the methodological quality of included publications was evaluated. Six RCTs were identified comparing electrocautery (n = 606) and a scalpel (n = 628) for skin incisions.

**CONCLUSIONS:** No significant difference in wound infection rates or scar cosmesis was identified between the treatment groups. Electrocautery significantly reduced the incision time and postoperative wound pain. A trend toward less incisional blood loss from skin incisions made with electrocautery was noted. Electrocautery is a safe and effective method for performing surgical skin incisions.
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On October 1, 1926, Dr. Harvey Cushing performed the first operation using William T. Bovie's electrosurgical device.[1] Since then, the use of electrocautery has become routine for many surgical specialties. Multiple human studies have been performed in the past few decades showing the safety and efficacy of electrocautery for dividing subcutaneous, muscle, and fascial layers.[2–6] However, the use of electrocautery for creating the initial skin incision remains controversial. Surgeons fear that the use of cautery in this application will create burns that are inferior cosmetically. Furthermore, there are some animal data to suggest increased problems with wound infections and wound healing.[7–12] Despite these findings, early case series have provided some evidence of safety with electrocautery used for skin incision.[13–18] The aim of this systematic review and meta-analysis was to pool the existing literature to determine if electrocautery is a safe and effective means of creating skin incisions when compared with a traditional scalpel.

## Methods

### Literature search strategy

On December 1, 2010, a systematic electronic literature search was performed on MEDLINE (1950–present) using the following medical subject headings search terms in various combinations: electrocautery, electrocoagulation, diathermy AND, wound infection, wound healing, skin,

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surgical wound infection. This electronic search was then modified for use in PubMed (1947–present). The titles and abstracts of studies identified by the search results were reviewed, and the full publication of potentially relevant studies was determined. Articles whose abstracts were of interest were obtained and read critically to assess if they met our inclusion criteria. Those publications that were selected to be included in the review then had their reference lists scrutinized for any other additional studies that met study inclusion criterion.

### Inclusion and exclusion criteria

Randomized controlled trials comparing electrocautery versus a scalpel for surgical skin incisions (epidermis and dermis) with the primary outcomes of surgical site infection or incision cosmesis were included. Surgical site infection was defined as per the following Centers for Disease Control definition of superficial incisional surgical site infections[19]: (1) purulent drainage with or without laboratory confirmation from the superficial incision, (2) positive wound culture, (3) signs or symptoms of infection, or (4) diagnosis by the surgeon or attending physician. Exclusion criteria were nonrandomized studies, animal research, and studies in which the skin incision was a mixture of electrocautery and a scalpel.

### Outcomes of interest and definitions

The primary outcomes of interest were postoperative wound infection and scar cosmesis. Secondary outcomes collected and analyzed included intraoperative blood loss during the skin incision, incision time, and postoperative incision pain.

### Data extraction and critical appraisal

Two independent reviewers (LNFA and CJB) separately evaluated the titles and abstracts retrieved during the electronic search for eligibility. Full-text articles were obtained for all publications that were potentially relevant to our review and assessed by both authors to evaluate whether they met inclusion criteria. Discrepancies between article selection were resolved through discussion and consensus. Study characteristics extracted from the studies included author(s), study location, publication date, surgery type, patient assignment, and outcomes measured. Individual study results relevant to our outcomes of interest were then entered into Review manager software (RevMan version 5.0.25; The Cochrane Collaboration, Copenhagen) for analysis.

### Risk of bias assessment

All trials included in the systematic review were read critically and appraised using a standardized table to assess study quality with respect to sources of bias. The items recorded were the following: randomization, concealment of allocation, blinding, and completeness of follow-up. Any concerns raised were discussed and noted within the text of the review.

### Statistical analysis

Revman 5 software was used for statistical analysis of the data extracted from the relevant publications. Dichotomous data were combined for a meta-analysis using a random-effects model, estimating risk ratio with a confidence interval of 95%. Continuous data were analyzed using a random-effects model, measuring mean difference with a confidence interval of 95%.

## Results

### Identification of studies

The systematic literature search identified 776 studies, 763 of which were excluded after screening citations and

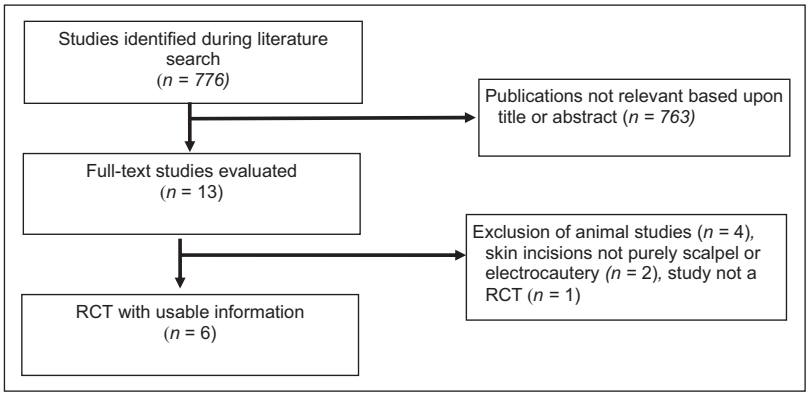


**Figure 1** A flowchart showing the process of identification of randomized controlled trials for inclusion in the systematic review and meta-analysis.

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