Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.JournalofSurgicalResearch.com

Cutting electrocautery *versus* scalpel for surgical incisions: a systematic review and meta-analysis

Ammar Ismail,[a,b,c,d,1] *Abdelrahman Ibrahim Abushouk, MBBCh*,[d,e,1] *Ahmed Elmaraezy*,[a,b,c,d,*,1] *Amr Menshawy*,[a,b,c,1] *Esraa Menshawy*,[a,b,c] *Mahmoud Ismail*,[a,b,c] *Esraa Samir*,[a,b] *Anas Khaled*,[a,f] *Hagar Zakarya*,[a,b] *Abdelrahman El-Tonoby*,[a,b,c] *and Esraa Ghanem*[a,b]

[a] *Al-Azhar Research Network, Cairo, Egypt*
[b] *Faculty of Medicine, Al-Azhar University, Cairo, Egypt*
[c] *Al-Azhar Medical Students' Association, Cairo, Egypt*
[d] *NovaMed Medical Research Association, Cairo, Egypt*
[e] *Faculty of Medicine, Ain Shams University, Cairo, Egypt*
[f] *Faculty of Medicine, Al-Azhar University, New Damietta, Egypt*

ARTICLE INFO

Article history:
Received 25 April 2017
Received in revised form
12 June 2017
Accepted 29 June 2017
Available online xxx

Keywords:
Electrocautery
Scalpel
Surgical incision
Meta-analysis

ABSTRACT

Background: Although cutting electrocautery can be superior to the scalpel in reducing blood loss and incisional time, several reports associated electrocautery with higher rates of wound infection, impaired healing, and worse cosmesis. We performed this systematic review and meta-analysis to compare cutting electrocautery *versus* scalpel for surgical incisions.

Materials and methods: We conducted a computerized literature search of five electronic databases and included all published original studies comparing cutting electrocautery and scalpel surgical incisions. Relevant data were extracted from eligible studies and pooled as odds ratios (ORs) or standardized mean difference (SMD) values in a meta-analysis model, using RevMan and Comprehensive Meta-analysis software.

Results: Forty-one studies (36 randomized trials, four observational, and one quasirandom study) were included in the pooled analysis (6422 participants). Compared with the scalpel incision, cutting electrocautery resulted in significantly less blood loss (SMD = −1.16, 95% CI [−1.60 to −0.72]), shorter incisional (SMD = −0.63, 95% CI [−0.96 to −0.29]) and operative times (SMD = −0.59, 95% CI [−1.12 to −0.05]), and lower pain scores (SMD = −0.91, 95% CI [−1.27 to −0.55]) with no significant differences in terms of wound infection rates (OR = 0.92, 95% CI [0.74-1.15]) or overall subjective scar score (SMD = −0.49, 95% CI [−1.72 to 0.75]).

Conclusions: Surgical incision using electrocautery can be quicker with less blood loss and postoperative pain scores than the scalpel incision. No statistically significant difference was found between both techniques in terms of postoperative wound complications, hospital stay duration, and wound cosmetic characteristics. Therefore, we recommend routine use of cutting electrocautery for surgical incisions.

* *Corresponding author*. Faculty of Medicine, Al-Azhar University, 11884, Egypt. Tel.: +201095233837; fax: +2020132706152.
E-mail address: ahmadalmraezy@azhar.edu.eg (A. Elmaraezy).
[1] These authors contributed equally.

0022-4804/$ – see front matter © 2017 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.jss.2017.06.093

Introduction

Surgical incision using a scalpel was the gold standard method for creating surgical wounds.[1] Despite the accuracy, minimal adjacent tissue injury, and the ease of use advantages of steel scalpel, considerable amounts of blood loss and collateral injuries to the assistant staff have been reported.[2] The complications, related to using the knife, urged scientists and inventors to find a better alternative. In the early 1900s, the eccentric inventor (Dr William Bovie) developed an electrocautery machine that was first used in the operating room by Dr Harvey Cushing on October 1, 1926.[3,4] The diathermy/electrocautery depends on an alternating current that causes cleavage/coagulation without harming neighboring tissues.[5] It can be used for dissecting fascia and muscle layers, as well as achieving hemostasis, and it has become an integral part of modern surgical practice.[6,7]

Several clinical studies were performed to evaluate the safety and efficacy of cutting electrocautery for surgical incisions in general,[8-10] plastic,[11,12] otorhinolaryngological,[13] orthopedic,[14,15] neurosurgical,[16] and gynecologic procedures.[17,18] The majority of these studies showed that using electrocautery to cut the skin reduces bleeding and makes a quicker incision, in comparison to scalpel incisions.[8,15-17] However, its use in this regard is not frequent owing to the concern that diathermy creates a thermal burn, resulting in scars that are cosmetically inferior to those of the conventional scalpel.[8] In 2008, the National Institute for Health and Clinical Excellence (NICE) published a guideline against the use of electrocautery for skin incision due to increasing concerns about surgical site infections.[19] However, data from large, subsequent clinical trials clearly contradicted this recommendation.[20-22]

The aim of the present systematic review and meta-analysis is to compare cutting electrocautery *versus* the scalpel for surgical incisions in terms of wound complication rate, incisional time, incision-related blood loss, and cosmetic outcomes.

Methods

During performing this systematic review and meta-analysis, we followed the standards of the Cochrane handbook of systematic reviews and meta-analyses,[23] as well as the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement guidelines (Supplementary file 1).[24] All steps have been prespecified in a published protocol on PROSPERO register of systematic reviews (CRD42016049648).

Literature search strategy

We searched the following electronic databases: PubMed, Cochrane central, Scopus, Embase, and Web of science during September 2016. The detailed search query is presented in Supplementary file 2. No language or publication period restrictions were used. Moreover, we manually scanned the bibliography of retrieved articles for relevant studies.

Eligibility criteria and study selection

We included all original studies that compared cutting diathermy and conventional scalpel techniques for surgical incisions and reported data on any of the following outcomes: incisional time, amount of blood loss, postoperative pain scores, and wound complication rates. We excluded single arm studies (cutting electrocautery only or scalpel only), conference abstracts, animal studies, and studies whose data were not reliable for extraction. Selection of studies was conducted in a two step-wise manner, title and abstract screening and full text screening. Each step was performed by three independent reviewers.

Data extraction

Each type of dataset was extracted independently by two authors at least. The extracted data included the following: baseline characteristics of enrolled patients, study design, and relevant outcomes including: (1) amount of blood loss (mL) (measured by weighing the swabs used between starting the incision and achieving hemostasis), (2) Operative time (min), incisional time (sec), incisional time per unit wound area (sec/cm^2), and hospital stay (d), (3) postoperative pain scores (measured using the visual analogue scale), (4) postoperative wound complication rates (all reported minor and major complications, in particular infection, seroma, hematoma, dehiscence, incisional hernia, and ecchymosis), (5) wound characters (length [cm], depth [cm], thickness [cm], and wound area [cm^2]), and (6) objective scar assessment scores (Vancouver Scar Scale [VSS] score[25] and Patient Observer Scar Assessment Scale [POSAS] overall score[26]), as well as subjective scar assessment scores (Patient Scar Assessment Scale [PSAS][27] and the subjective component of POSAS).

Risk of bias assessment

We used the Cochrane risk of bias (ROB) assessment tool, adequately described in chapter 8.5 of the Cochrane handbook of systematic reviews of interventions to assess the ROB in included randomized controlled trials (RCTs).[23] This tool can detect various types of bias, such as selection bias, performance bias, detection bias, attrition bias, and reporting bias. The authors classified RCTs in each domain as of low, high, or unclear ROB. The Newcastle Ottawa scale (NOS) was used to assess the ROB in included observational studies. Each observational study was assessed based on reporting three essential domains: (1) selection of the study subjects, (2) comparability of groups on demographic characteristics and important potential confounders, and (3) ascertainment of the prespecified outcome (exposure/treatment).[28] For quasirandom studies, we used the ACROBAT-NRSI tool to detect preintervention, during intervention, and postintervention bias.[29] Publication bias was assessed using Egger's regression test whenever 10 or more studies provided data of a particular end point.[30]