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Review

Ultrasonic versus electrosurgical device for laparoscopic cholecystectomy: A systematic review with meta-analysis and trial sequential analysis

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HIGHLIGHTS

- The present study was performed according to Cochrane Collaboration methodology and PRISMA guidelines.
- The study evaluated perioperative outcomes of two common devices during laparoscopic cholecystectomy.
- Trial sequential analyses were carried out to explore whether firm evidence favoring a specific device has been reached.

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ABSTRACT

Background: Ultrasonic and electrosurgical energy dissectors are main dissecting devices widely used for the laparoscopic cholecystectomy. Trial sequential analyses can establish whether firm evidence favoring a specific device has been reached from accumulated literature. To explore this, we performed a meta-analysis and trial sequential analyses.

Methods: PubMed, Embase, and the Cochrane Library were searched from inception to October 2016. The primary outcome was operative time. The secondary outcomes included adverse events during operation, postoperative complications, intra-abdominal collection, hospital stay, hospital costs, and sick leave or time to full recovery. Relative risks (RRs) were calculated for dichotomous outcomes and mean differences (MDs) for continuous outcomes. Finally, we calculated numbers needed to treat to examine benefits of the ultrasonic device.

Results: We identified 19 studies. Compared with the electrosurgical device, the ultrasonic device led to shorter operative time (MD, −14.86; 95% confidence interval (CI), −21.45 to −8.27; $P < 0.00001$), less blood loss (MD, −47.24; 95% CI, −79.57 to −14.90; $P = 0.004$), fewer gallbladder perforations (RR, 0.45; 95% CI, 0.35 to 0.57; $P < 0.00001$), shorter hospital stay (MD, −0.37; 95% CI, −0.61 to −0.14; $P = 0.002$), and fewer abdominal pains (MD, −0.95; 95% CI, −1.40 to −0.50; $P < 0.0001$). The trial sequential analysis demonstrated that the cumulative z-curve crossed the trial sequential monitoring and reached the required information size of the operative time. The numbers needed to treat to avoid one gallbladder perforation and postoperative nausea, respectively, were 7 and 15.

Conclusions: Compared with the electrosurgery device, the ultrasonic device could be superior with more clinical effectiveness. The trial sequential analysis demonstrated that further studies about the operative time were not needed.

1. Introduction

Laparoscopic cholecystectomy (LC) is the gold standard operation for benign gallbladder diseases [1]. There are two main dissecting devices used in the procedure, including the ultrasonic and electrosurgical energy dissectors. The electrosurgical device is widely used in LC, and the ultrasonic device has increasingly been

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Abbreviations

RR	relative risk
MD	mean difference
CI	confidence interval
LC	laparoscopic cholecystectomy
RCT	randomized controlled trial
TSA	trial sequential analysis
NNT	numbers needed to treat
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
MeSH	Medical Subject Headings
GRADE	Grading of Recommendations Assessment, Development, and Evaluation
RIS	required information size
OR	odds ratio
WMD	weighted mean difference

used in wider and deeper operative fields. The former can easily fragment soft tissues, such as adipose or hepatic tissues, by producing shearing forces, while the latter can cut harder tissues such as fibrous tissues by delivering heat energy.

It is controversial on the advantages and disadvantages of different devices [1,2]. The potential risks and benefits related to ultrasonic dissection compared with the electrosurgical dissection for cholecystitis or cholecystolithiasis are not fully understood.

A series of randomized controlled trials (RCTs) comparing the ultrasonic to the electrosurgical device for laparoscopic cholecystectomy have recently been published. Therefore, we carried out a meta-analysis of RCTs with adequate evidence and performed a trial sequential analysis (TSA) to objectively evaluate the reliability of statistical inferences. Furthermore, with the intention of examining the risks or benefits of different devices for some outcomes, we calculated the number of patients who must be treated in order to prevent one adverse event.

2. Materials and methods

The present study was conducted according to the recommendations of the Cochrane Handbook for Systematic Reviews of Interventions [3], and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [4]. The systematic review was registered at http://www.researchregistry.com. The review registry unique identifying number was reviewregistry171.

2.1. Literature search

PubMed, Embase, and the Cochrane Library were searched for articles related to different dissection techniques during LC from inception to October 2016. The electronic searches were performed using exploded medical subject heading (MeSH) keywords and

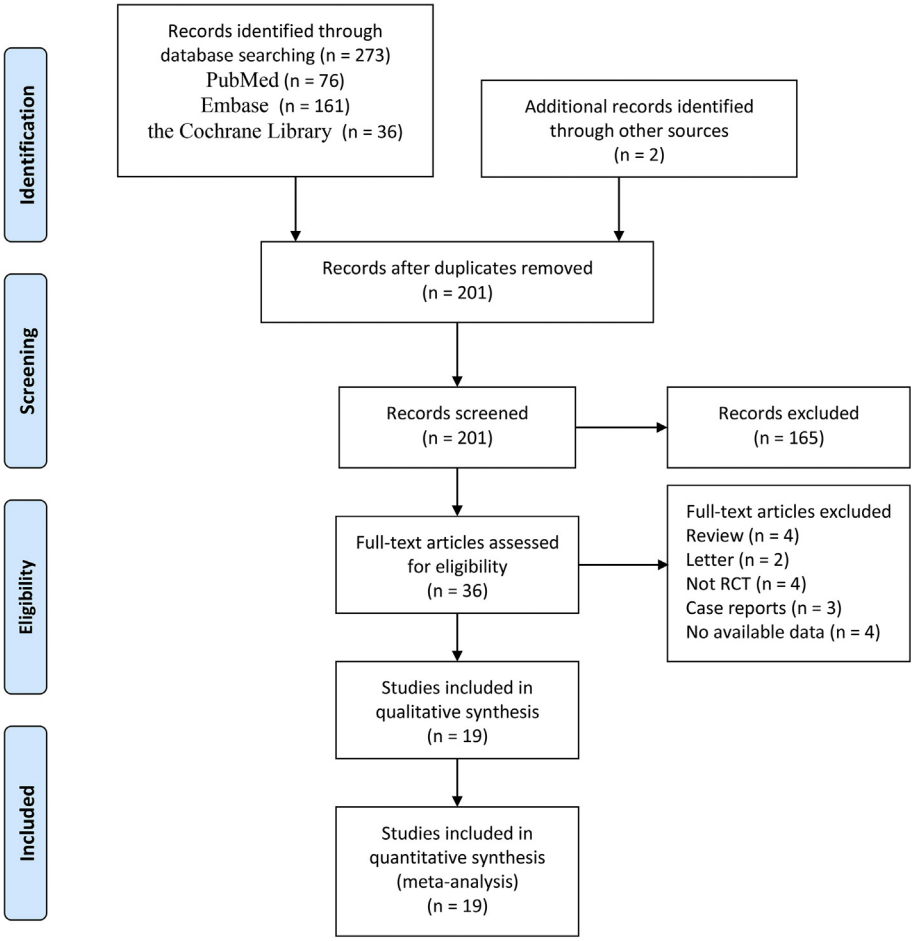

Fig. 1. Flow-chart of studies included in the meta-analysis. RCT = randomized controlled trial.