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ScienceDirect

EJSO 41 (2015) 527–533

EJSO the Journal of Cancer Surgery

www.ejso.com

# Ultrasonic dissection versus conventional electrocautery during gastrectomy for gastric cancer: A meta-analysis of randomized controlled trials

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Accepted 19 January 2015
Available online 4 February 2015

## Abstract

*Objective*: Use of ultrasonic surgical instrument is gaining popularity for dissection and coagulation in open surgery. However, there is still no consensus on the efficacy and safety of its use compared with conventional surgical technique in open gastrectomy for gastric cancer. The aim of this meta-analysis was to evaluate the role and surgical outcomes of ultrasonic dissection (UD) compared with conventional electrocautery (EC).

*Methods*: A systematic literature search was performed to identify all studies comparing UD and EC in gastric cancer surgery. Intraoperative and postoperative outcomes were compared using weighted mean differences (WMDs) and odds ratios (ORs).

*Results*: Five studies were included in this meta-analysis, comprising 489 patients. Meta-analysis results showed that compared with EC, UD was associated with significantly shorter operation time ($P = 0.03$), less intraoperative blood loss ($P = 0.002$), lower morbidity ($P = 0.02$), and reduced postoperative hospital stay ($P = 0.03$). However, there was no significant difference between the two surgical techniques with regards to postoperative abdominal drainage ($P = 0.17$), and total cost in hospital ($P = 0.59$).

*Conclusions*: Compared to EC, the use of UD during open gastrectomy can provide several improved outcomes for operation time, intraoperative blood loss, overall morbidity, and postoperative hospital stay. It appears that UD can be used instead of conventional EC in open gastric cancer surgery, although more larger trials with long follow-up should be performed.


*Keywords:* Gastric cancer; Gastrectomy; Lymphadenectomy; Ultrasonic dissection; Electrocautery; Meta-analysis

## Introduction

Gastric cancer is one of the most common malignancies with high mortality in the world.[1] Nowadays, gastrectomy with lymphadenectomy remains the most effective treatment for curable gastric cancer.[2,3] This surgical procedure requires safe tissue dissection with exhaustive hemostasis and minimal damage to the surrounding structures.[4] Traditionally, dissection and hemostasis during gastrectomy are achieved by standard electrocautery, clamp-and-tie techniques and the like. However these conventional surgical techniques, which have been widely used for decades, might be cumbersome, time-consuming and may pose a risk of thermal damage to adjacent tissues in the extensive and complex surgical procedure.[5,6] Thus, it is of great significance to search for a more effective and safer technique for surgical dissection and coagulation.

With advances in technology, ultrasonic surgical instrument, a relatively new alternative to conventional electrocautery (EC), is increasingly being used in a variety of surgical operations to improve dissection and coagulation

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http://dx.doi.org/10.1016/j.ejso.2015.01.025
0748-7983/

in recent years.[7–12] The technique of ultrasonic dissection (UD) combines cutting and coagulating tissue, relying on high-frequency mechanical vibration at 55.5 kHz.[13,14] UD works at much lower temperature than EC,[15] and thus minimizes local thermal injury, while still being able to safely transect and obstruct blood vessels ≤5 mm, as well as lymphatics.[16,17] Theoretically, it may offer potential advantages over EC in terms of reduced operative time, intraoperative blood loss and postoperative lymphorrhea, minimal lateral thermal tissue damage, as well as no transmission of electrical current to the body.[18–21] Although UD was an established technique in laparoscopic surgery, only recently have hand-operated UD instruments become available and advocated for open gastrectomy with lymph node dissection for gastric cancer. How does it compare to the conventional EC? Many clinical studies have provided data comparing UD to EC in this extensive surgical procedure.[4,6,22–26] However, there is still no consensus on the efficacy and safety of its use compared with EC. We thus felt a need to perform a meta-analysis to synthesize all existing evidences, aiming at increasing the statistical power to evaluate the role and surgical outcomes of UD as compared to EC during open gastrectomy for gastric cancer.

## Materials and methods

### *Search strategy*

A systematic literature search was performed in electronic databases (PubMed, EMBASE, Cochrane Library, Ovid, Web of Science and Chinese Biomedical Database) to identify all eligible studies published up to 2014 comparing UD versus EC during open gastrectomy for gastric cancer. The search strategy of PubMed was as follows: ["Stomach Neoplasms" (Mesh) OR "gastric cancer" (Textword) OR "gastric carcinoma" (Textword)] AND ["gastrectomy" (Mesh) OR "gastric resection" (Textword)] AND ["ultrasonic dissection" (Textword) OR "ultrasonic scalpel" (Textword) OR "ultrasonic dissector" (Textword) OR "harmonic scalpel" (Textword) OR "ultrasonically activated scalpel" (Textword)]. We also manually checked reference lists of relevant articles and reviews to identify potentially eligible studies. No language restriction was made. The most recent search was performed on June 10, 2014.

### *Eligibility criteria*

To be eligible, studies must meet all the following criteria: (1) only randomized controlled trials (RCTs) with full-text were included, and the RCTs had to involve human patients with at least 10 cases per treatment group; (2) the target population were patients with histopathology-confirmed gastric cancer; (3) the intervention involved gastrectomy with lymphadenectomy using UD versus EC; (4) one or more of the outcomes mentioned below were reported and available for the pooled analysis.

### *Quality assessment and data abstraction*

Two investigators independently extracted data and assessed the methodological quality of each eligible study. We reached a consensus for any disagreements by discussion and by referencing the original article. The Cochrane Collaboration's tool for assessing risk of bias was used to evaluate the quality of the included RCTs, based on the following criteria related to random sequence generation; allocation concealment; blinding of patients, personnel, outcome assessors; incomplete outcome data; selective reporting.[27]

We extracted relevant information regarding the characteristics of study, population, intervention, and outcomes from each eligible study by using a standardized data extraction form. The outcomes of interest involved intraoperative data (operation time in minutes, and blood loss in milliliters) and postoperative data (postoperative drainage in milliliters, postoperative complications and mortality, postoperative hospital stay in days, as well as total cost in US$).

### *Statistical analysis*

We pooled data across studies and expressed treatment effects as the weighted mean differences (WMDs) for continuous variables and odds ratios (ORs) for dichotomous variables, with their corresponding 95% confidence intervals (CI). The random-effects model was used for statistical analysis.[28] Heterogeneity among included studies was tested by the Chi-squared test,[29] with a $P$ value of $<0.10$ indicating a significant heterogeneity. A $P$ value of $<0.05$ was considered statistically significant. All meta-analyses for available outcomes were conducted by the Review Manager software (version 5.2.6; Cochrane Collaboration, Oxford, UK). Additionally, potential publication bias was assessed using a funnel plot.

## Results

The initial search yielded 181 potentially relevant studies. After screening, 5 RCTs[4,6,22,24,26] met the eligibility criteria and were finally included in the present meta-analysis. The detailed selection process is shown in Fig. 1.

### *Characteristics and methodological quality of studies included*

These studies were published between 2002 and 2013, including a total of 489 patients with gastric cancer that underwent open gastrectomy with curative intent, using UD [247 (50.5%)] or EC [242 (49.5%)]. The main study