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Review

Laparoscopic versus open repair for perforated peptic ulcer: A meta analysis of randomized controlled trials

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HIGHLIGHTS

- Laparoscopic surgery is comparable with open procedure in the setting of repair for perforated peptic ulcer.
- The advantages of laparoscopic surgery are lower surgical site infection rate, shorter nasogastric tube duration, and less postoperative pain.
- More higher quality RCTs are still needed to further confirm this conclusion.

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ABSTRACT

Introduction: The role of laparoscopic surgery in the repair for peptic ulcer disease is unclear. The present study aimed to compare the safety and efficacy of laparoscopic versus open repair for peptic ulcer disease.

Methods: Randomized controlled trials (RCTs) comparing laparoscopic versus open repair for peptic ulcer disease were identified from MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials, and references of identified articles and relevant reviews. Primary outcomes were postoperative complications, mortality, and reoperation. Secondary outcomes were operative time, postoperative pain, postoperative hospital stay, nasogastric tube duration, and time to resume diet. Statistical analysis was carried out by Review Manage software.

Results: Five RCTs investigating a total of 549 patients, of whom, 279 received laparoscopic repair and 270 received open repair, were included in the final analysis. There were no significant differences between these two procedures in some primary outcomes including overal postoperative complication rate, mortality, and reoperation rate. Subcategory analysis of postoperative complications showed that laparoscopic repair had also similar rates of repair site leakage, intra-abdominal abscess, postoperative ileus, pneumonia, and urinary tract infection as open surgery, except of the lower surgical site infection rate ($P < 0.05$). In addition, there were also no significant differences between these two procedures in some second outcomes including operative time, postoperative hospital stay, and time to resume diet, but laparoscopic repair had shorter nasogastric tube duration ($P < 0.05$) and less postoperative pain ($P < 0.05$) than open surgery.

Conclusions: Laparoscopic surgery is comparable with open surgery in the setting of repair for perforated peptic ulcer. The obvious advantages of laparoscopic surgery are the lower surgical site infection rate, shorter nasogastric tube duration and less postoperative pain. However, more higher quality studies should be undertaken to further assess the safety and efficacy of laparoscopic repair for peptic ulcer disease.

1. Introduction

With the development of recognition about the pathogenesis of peptic ulcer disease, and the widespread eradication of helicobacter

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pylori, the prophylactic use of proton-pump inhibitors and the rational use of nonsteroidal anti-inflammatory drugs, the disease incidence has drastically decreased in the past few decades [1]. However, the incidence of perforated peptic ulcer, one of the major complications of peptic ulcer disease, has not significantly decreased, and it is also a common disease in surgical emergency [2]. It is reported that peptic ulcer disease may have short-term morbidity in up to 50% of patients and mortality in up to 30% respectively, threatening seriously the health and life of human being [3]. Therefore, it is a long-standing interest to explore effective treatments for peptic ulcer disease in modern surgery.

In clinical practice, emergency surgery is usually required when patients suffer from peptic ulcer disease [4]. As we know, there are two kinds of surgical procedures available for patients to choose: open abdominal surgery and laparoscopic surgery. Open abdominal surgery has been a traditional treatment for peptic ulcer disease, and it is easy for young surgeons to master. Many patients who suffer from peptic ulcer disease have benefited from this procedure. However, in elective abdominal surgery, it has been shown that open abdominal surgery is associated with many shortages including more intraoperative blood loss and postoperative pain, more postoperative complications and longer hospital stay than laparoscopic surgery [5–7]. Therefore, to enhance recovery after surgery, more and more surgeons have tried to use laparoscopic surgery for peptic ulcer disease since its first introduction in 1989 [8–10].

Despite the development of laparoscopic surgery for peptic ulcer disease, no consensus conclusion favoring its application has been reached [1]. Some research showed that laparoscopic surgery has substantial advantages over open abdominal surgery for peptic ulcer disease, including less postoperative pain and postoperative complications and shorter hospital stay [11,12]. However, the other research showed that laparoscopic repair is not superior to open abdominal surgery for peptic ulcer disease, and may even have worse outcomes including longer operative time [13,14]. These inconsistent results make surgeons confounding whether laparoscopic surgery have better advantages than open abdominal surgery for perforated peptic ulcer.

In the present study, therefore, we further assessed the safety and efficacy of laparoscopic versus open repair for peptic ulcer disease by meta-analysis of randomized controlled trials (RCTs) to provide more clinical evidence regarding this controversial issue. The present meta-analysis was performed in accordance with the recommendations of the preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement [15].

2. Methods and methods

2.1. Literature search

The MEDLINE, EMBASE and Cochrane Central Register of Controlled Trials were systematically searched for randomized controlled trials (RCTs) comparing the outcomes of laparoscopic and open repair for perforated peptic ulcer between January 1990 and April 2016. Keywords used in the search were “laparoscopy/laparoscopic”, “open/conventional”, “peptic ulcer/duodenal ulcer/gastric ulcer”, “repair/surgery/closure”, and their combinations. To avoid overlooking other studies, the search was also maximized through manually screening the references of identified articles and relevant reviews. No language restriction was applied.

2.2. Inclusion and exclusion criteria

RCTs met the inclusion criteria if they compared the outcomes of laparoscopic and open repair for perforated peptic ulcer regardless of the sample size. All included studies were required to report at least one of the primary outcomes or secondary outcomes mentioned below. If the same authors or institution reported more than one studies with a similar patient population, only the largest and most detailed study was included. Laboratory or animal studies and studies that could not provide available outcome data for extraction were also excluded from our analysis.

2.3. Data extraction and outcomes of interest

Two review authors (Shanjun Tan and Chao Yu) independently extracted the data from the included studies using a previously designed data extraction form. Extracted data were then cross-checked between the two authors, and any discrepancy was resolved by consensus discussion. The following data were collected: the name of the first author, year of publication, country, study period, No. of patients, sex, age, and outcomes of interest. Primary outcomes were postoperative complications, mortality, and reoperation. Postoperative complications included repair site leakage, intra-abdominal abscess, surgical site infection, postoperative ileus, pneumonia, and urinary tract infection. Secondary outcomes were operative time, postoperative pain, postoperative hospital stay, nasogastric tube duration, and time to resume diet. Postoperative pain was defined as visual analog pain scores, or doses of analgesics required by patients.

2.4. Risk of bias assessment

Risk of bias assessment of the included studies was independently performed by two review authors (Shanjun Tan and Chao Yu) with the use of the Cochrane Collaboration's risk of bias tool [16]. The assessment contained seven elements: (1) random sequence generation, (2) allocation concealment, (3) blinding of participants and personnel, (4) blinding of outcome assessment, (5) incomplete outcome data, (6) selective reporting, and (7) other bias. Each element was graded as having a high risk of bias (seriously weakens confidence in the results), a low risk of bias (unlikely to seriously alter the results), or an unclear risk of bias (no sufficient information to judge). Any discrepancy was resolved by consensus discussion with the two authors.

2.5. Statistical analysis

Data management and statistical analysis were carried out by Review Manage software version 5.1.0 from the Cochrane Collaboration. For continuous outcome data, if the variable was presented in the same scale, weighted mean difference (WMD) was calculated; otherwise, standard mean difference (SMD) was used. If continuous variables were reported as medians and ranges, we imputed the means and standard deviations (SDs) as described by Hozo et al. [17]; if not ranges, but interquartile ranges were reported, we assumed them to be 1.35 SDs according to the Cochrane Collaboration's handbook [16]. For dichotomous outcome data, odds ratio (OR) was calculated. Pooled estimates were all presented with 95% confidence interval (CI). Chi^2 test was employed to assess heterogeneity [18,19]. When there was evidence of significant heterogeneity ($P < 0.1$), a random-effects model was used and sensitive analysis was further performed to identified studies contributing to the heterogeneity; otherwise, the fixed-effects model was employed [20]. Statistical significance was considered if the two-sided P value was <0.05 for outcome data comparison.