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Original research

Endoscopic minimal invasive cholecystolithotomy vs laparoscopic cholecystectomy in treatment of cholecystolithiasis in China: A meta-analysis

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HIGHLIGHTS

- The residual and recurrence of gallstones was consumedly reduced.
- Patients were recovered faster from EMIC.
- Less complications were reported in patients who treated with EMIC.
- EMIC is better for patients whose gallbladder function is normal.

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ABSTRACT

Introduction: Endoscopic minimal invasive cholecystolithotomy (EMIC) is recently popular in China which may offer advantages over laparoscopic cholecystectomy (LC). We try to find out the most favorable treatment for the patients underwent cholecystolithiasis. **Methods**: Databases PubMed, Elsevier, Wiley Online Library, The Cochrane library, CNKI, WanFang Data, and Chongqing VIP were searched for randomized controlled trials (RCTs) and on EMIC vs LC from 2009 to 2013. Odds ratio (OR), risk difference (RD) and weight mean difference (WMD) were calculated with 95% confidence intervals (CI). **Results**: 14 RCTs including 2030 patients were selected. No significant difference was present in operating time between EMIC and LC. EMIC shown significant less blood lost (WMD −23.45; 95% CI −30.34, −16.55; $Z = 6.66$; $P < 0.00001$) compared to LC. Shortened exhaust time (WMD −14.11; 95% CI −18.34, −9.88; $Z = 6.53$; $P < 0.00001$) and hospital stay (WMD −1.31; 95% CI −1.91, −0.71; $Z = 4.29$; $P < 0.00001$) were present in EMIC group. And EMIC shown decreased complication proportion (OR −0.14, 95% CI −0.09 to −0.21; $Z = 8.53$; $P < 0.00001$) in comparison with LC. There is no difference present in the recurrence of stones in two procedures but a significantly decreased recurrence rate of gallstones was present in EMIC compared to conventional cholecystolithotomy. **Conclusion**: Patients treated with EMIC shown faster recovery and less complication which were superior to LC.

1. Introduction

The technique of cholecystolithotomy was first described in 1985 by Akiyama [1] and Kerlan [2]. In 1988, Kellett [3] reported their experience with percutaneous cholecystolithotomy performed as a single-stage procedure, using a transperitoneal approach and a modified percutaneous nephrolithotomy technique. Nearly the same time, Mouret carried out the first cholecystectomy by means of electronic laparoscopy in March of 1987 [4]. In the following decades, LC was gradually became the vane in treatment of cholecystolithiasis, but percutaneous cholecystolithotomy only had a limited role in treatment of cholecystolithiasis because of its high recurrence rate of stones [5].

EMIC is a laparoscopic procedure that removed the calculi but preserved the gallbladder [6]. In comparison with percutaneous

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cholecystolithotomy, it is more mature in technology. Especially, the residual and recurrence of gallstones was consumedly reduced owing to the development of endoscopic and iconography. Meanwhile, with the deep recognition of gallbladder function that it is not only used to store bile, but also it has been proposed that the gallbladder can produce several hormones (e.g. insulin) [7]. So, more and more experts sanction to preserve the gallbladder. Moreover, gallbladder preservation can avoid some harmful effects due to cholecystectomy. 1), several investigations regarding an increased duodenogastric reflux was shown after cholecystectomy [8,9], and post-cholecystectomy syndrome usually takes the form of upper abdominal pain, dyspepsia [10], and the prevalence of diarrhea [11] has been reported to range from 0.9 to 35.6%; 2), Bile duct injuries are the most serious adverse events associated with laparoscopic cholecystectomy, with a rate usually ranging from 0.4% to 4% for most surgeons [12]; 3), several epidemiological studies demonstrated a potential link between cholecystectomy and colorectal cancer [13]. In addition, patients' desire to keep their gallbladder was also need to be considered.

EMIC recently is popular and successful in China, but it was not widely recognized in Europe and Americas. So, this meta-analysis is aimed to explore its feasibility and value in treatment of cholecystolithiasis and to illustrate the technique of EMIC.

2. Materials and methods

2.1. Literature research

We searched the following databases: PubMed, Elsevier, Wiley Online Library, The Cochrane library, CNKI, WanFang Data, and Chongqing VIP (1 Jan. 2009 to 31 Dec. 2013), using the terms 'gallbladder preserved', 'cholecystostomy', 'cholecystotomy', 'cholecyslithotomy', and 'laparoscopic cholecystectomy'. No attempt was made to retrieve unpublished studies. The 'related article' function was used to expand the search. The references from the included trials were searched for additional trials.

2.2. Study selection

All included RCTs [14] were comparing removal of calculi and preserved gallbladder to laparoscopic cholecystectomy. Trials were included irrespectively of blinding, number of patients randomized, and language of the article. Quasi-randomized studies were also included. The studies in Hong Kong, Macao and Taiwan were not included. The following classifications of the surgical procedures (based on intention-to-treat) were used: EMIC was defined as a laparoscopic cholecystolithotomy that calculi removal and gallbladder preserved via laparoscope and choledochoscope, and any percutaneous cholecystolithotomy, percutaneous cholecystotomy and percutaneous cholecystostomy were excluded. LC was defined as a laparoscopic procedure. Any kind of laparoscopic cholecystectomy with a creation of pneumoperitoneum, irrespective of the number of trocars used. Patients with one or more stones in the gallbladder were confirmed by ultrasonography or other imaging technique and symptoms attributable to them. Appendix 1 was applied for help to recognize the technical difference of EMIC and LC.

Two authors (Yong T and JiaQi Y) evaluated the titles and abstracts of the studies found with the online research. Those considered irrelevant were excluded and full texts of potentially suitable articles were retrieved. The same authors determined whether these articles satisfied the inclusion criteria.

2.3. Inclusion and exclusion criteria used in each trial

Studies were considered for inclusion if: they were RCTs, they compared EMIC with LC for benign gallbladder disease irrespective of type of surgical care (emergency or elective), and they reported at least one of the outcomes considered in this meta-analysis.

Studies were considered for exclusion if: they did not report at least one outcome of interest or it was impossible to calculate, they reported the outcomes using special instrument or procedure, such as minilaparoscopic instruments or naturalorifice transluminal endoscopic surgery techniques.

2.4. Data extraction

Data from included trials were extracted by Yong T. JiaQi Y checked the extracted data and Lin Y was asked to resolve any disagreements. An intention-to-treat analysis was performed. General descriptive data (like sex, age, sample size, single- or multi-centre study design, etc.) are listed in Table 1. The outcomes in the comparison of EMIC vs LC were defined as following: intra-operative outcomes including operating time and intra-operative blood lost. Post-operative outcomes including hospital stay, exhaust time, hospital expense, complications (bile leakage, bile duct injury, bleeding after operation, dyspepsia and diarrhea, and incision infection). Follow up data was also extracted according to availability.

2.5. Assessment of methodological quality of bias risk of included studies

We accessed the quality of studies using the framework suggested by the Cochrane Collaboration. The criteria for methodological quality were presented in Appendix 2. Then the trials were divided into low-bias risk trials (high methodological quality), moderate-bias risk (moderate methodological quality) and high-bias risk trials (low methodological quality). Trials that were assessed as adequate regarding three or more methodological criteria were considered low-bias risk trials, regarding two were considered moderate-bias risk trials and regarding only one or less were considered high-bias risk trials. Cochrane Collaboration's tool [14] was used to assess the risk of bias for the inclusion decision which carried out independently by three reviewers (Yong T, JiaQi Y and Lin Y). If two of them or three agreed, the study can be included to the meta-analysis.

2.6. Statistical analysis

Quantitative statistical analysis for dichotomous variables was carried out using OR as the summary statistic with the Mantel–Haenszel method. Specially, binary outcomes with zero events in both arms (e.g. recurrence rate) can merely be presented in risk differences (RD) [15]. OR and risk ratios (RR) are not estimable in trials with zero events in both arms. So RD was used instead for necessary. WMD was used as the summary statistic for quantitative statistical analysis of continuous variables. OR, RD and WMD [14] values are reported with 95% confidence intervals (CI). $P < 0.05$ was considered statistically significant. Where studies reported continuous data as medians with ranges, the mean and standard deviation were calculated using the methods described in the Cochrane handbook [14]. Funnel plots [16] were used for investigating publication bias.

Statistical heterogeneity was determined using the χ^2 test [17], with $P < 0.05$ indicating statistically significant heterogeneity. Clinical heterogeneity was tested by means of the I^2 value [18]; a value exceeding 50% was indicative of clinical heterogeneity. If heterogeneity was found, random-effects [19] analysis was performed; otherwise the results of fixed-effects [20] analysis are presented. If excessive heterogeneity occurred, data were re-checked first and then adjusted. Extreme outliers were excluded