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Original Article

Efficacy of radical and conservative surgery for hepatic cystic echinococcosis: a meta-analysis

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Abstract: Objective: To systematically evaluate the efficacy and safety of radical surgery (RS) and conservative surgery (CS) in the treatment of hepatic cystic echinococcosis (HCE). Methods: We searched PubMed, Embase, MEDLINE, SCI, CNKI, CBM, and WanFang databases, and the Cochrane Library (2013, Issue 3) for references published before December 2013. Both randomized and non-randomized controlled trials of radical and conservative surgery for HCE were collected. After the literature was screened in accordance with inclusion and exclusion criteria, data were extracted and the quality of methodologies of selected references was determined independently by two evaluators. A meta-analysis was performed on eligible studies with RevMan 5.1 statistical software. Results: Five non-randomized controlled trials (1267 patients) were included in this study. Patients in the RS group had fewer postoperative complications compared with the CS group [OR = 0.42, 95% CI (0.32, 0.56), $P < 0.00001$], whereas there was no significant difference in rates of postoperative bile leakage between the two groups [OR = 0.22, 95% CI (0.05, 1.12), $P = 0.07$]. Postoperative follow-up of patients revealed a significantly lower HCE recurrence rate in the RS versus CS group [OR = 0.17, 95% CI (0.08, 0.38), $P < 0.0001$]. Additionally, no statistical differences in the number of days of hospitalization [MD = -2.47, 95% CI (-6.42, 1.49), $P = 0.22$] and perioperative mortality [OR = 0.87, 95% CI (0.27, 2.79), $P = 0.82$] were identified between groups. Conclusion: RS, especially total pericystectomy, has obvious advantages over CS: fewer complications, lower postoperative recurrence, and a lower incidence of biliary fistula and infection, making RS the preferred surgical method. This conclusion requires further validation with high-quality RCTs with large sample sizes. Surgical approach should be based upon comprehensive assessment of individual circumstances in HCE patients.

Keywords: Hepatic cystic echinococcosis, radical surgery, conservative surgery, total pericystectomy, endocystectomy

Introduction

Echinococcus granulosus liver disease, also known as hepatic cystic echinococcosis (HCE) [1], has been described as "a water-filled sac" in the Talmud and is an ancient zoonotic parasitic disease prevalent in regions where animal husbandry is highly developed, including Asia, Africa, South America, the Middle East, Central Europe, Alaska in North America, and Hokkaido in Japan. The development of HCE can lead to serious complications such as localized infection, biliary tract infection caused by biliary fistula, and rupture of hydatid cysts into the abdominal or thoracic cavity. The increasing cost and burden to family and society has become a serious public health problem [2]. With increasing knowledge of HCE and the improvement in hepatobiliary surgical techniques, domestic and foreign scholars have proposed the concept of "radical surgery," or removing the complete hydatid cystic wall. This approach better addresses two major postoperative problems: biliary fistula and infection, and recurrence of HCE [3]. We performed a systematic review and meta-analysis of the efficacy of RS in the treatment of HCE, in order to provide the best evidence for clinical application.

Materials and methods

Inclusion and exclusion criteria

Research types: Randomized controlled clinical trials (RCTs, blinding, or allocation conceal-

Pubmed and MEDLINE
#1 Hepatic cystic echinococcosis
#2 Radical surgery
#3 Conservative surgery
#4 Total cystectomy
#5 Endocystectomy
#6 #1 AND #2 AND #3 AND #4 AND #5

Figure 1. Search strategy for PubMed and CNKI databases.

ment) were included. Non-randomized control trials (NRCTs) were included only if relevant RCTs could not be found. Publications in both the Chinese and English languages were included.

Research subjects: Diagnosis of HCE was confirmed by four hydatid serological tests, ultrasound, CT, and MRI, or postoperative liver pathology. There were no restrictions with regards to gender, age, race, and nationality of patients.

Surgical approach: This study included both radical and conservative surgery for HCE. While the former included total pericystectomy and liver resection, the latter referred to techniques such as endocystectomy, external drainage, the Mabit procedure (deroofing of the cyst roof and extraction of the parasite), the Posadas procedure (deroofing of the cystic cavity and closure by capitonnage without drainage), omentoplasty and drainage of the cystic cavity, partial pericystectomy (leaving a large piece of cyst wall deeply sited within the liver), cyst marsupialization with external drainage and cystojejunostomy, and subtotal pericystectomy.

Assessment of outcomes: (1) Rate of postoperative complication including biliary leakage and infection of the residual cavity, wound infection, and pulmonary complications (pneumonia and pleural effusion); (2) perioperative mortality rate; (3) postoperative recurrence rate; (4) total length of stay in hospital.

Exclusion criteria: (1) Liver diseases such as benign and malignant liver tumors, and bile duct stones in addition to HCE; (2) comparisons of radical and other surgeries were not explicitly performed; (3) robotic surgery was utilized; (4) an overlap existed between authors or institutes of publications (the latest study with complete data was chosen from duplicate publications); (5) papers without a control group, explicitly stated observation indicators, or too small sample size (£ 15 cases).

Search strategy

We identified publications by a systematic search of PubMed (February 1992-December 2013), Embase (1984-December 2013), MEDLINE (1946-December 2013), SCI (February 1992-December 2013), CNKI (1992-December 2013), CBM (2002-December 2013), WanFang Data (1996-December 2013), and the Cochrane Library (2013, Issue 3). English search terms included “hepatic cystic echinococcosis”, “radical surgery”, “conservative surgery”, “endocystectomy” and “total cystectomy”. The Chinese search terms are shown in **Figure 1**. References cited in these publications were further investigated, as well as conference records and related graduate papers. Search strategies are specified in **Figure 1**, using PubMed and CNKI as examples.

Literature search and data extraction

Literature was screened in accordance with strict inclusion and exclusion criteria, data were extracted, and the quality of selected references was evaluated independently by two evaluators. Selected references were cross-checked and disagreement was resolved by discussion or by a third investigator. Data extracted included patient demographic data, case characteristics, and outcome indicators in randomized or non-randomized controlled trials. Names of authors, journal titles, and years and countries of publications were concealed during the entire process to avoid subjective bias.

Assessing risk of bias

To assess risk of bias, the methodological quality of included studies was evaluated using RCT criteria from the Cochrane Handbook for Systematic Review of Interventions, Version 5.1. Details included: (1) random allocation, (2) allocation concealment, (3) blinding, (4) integrity of data, (5) whether selective-reporting bias existed, (6) whether other sources of bias existed. Each item was evaluated as “yes” (low bias), “no” (high bias), or “unclear” (lack of information or bias could not be determined).

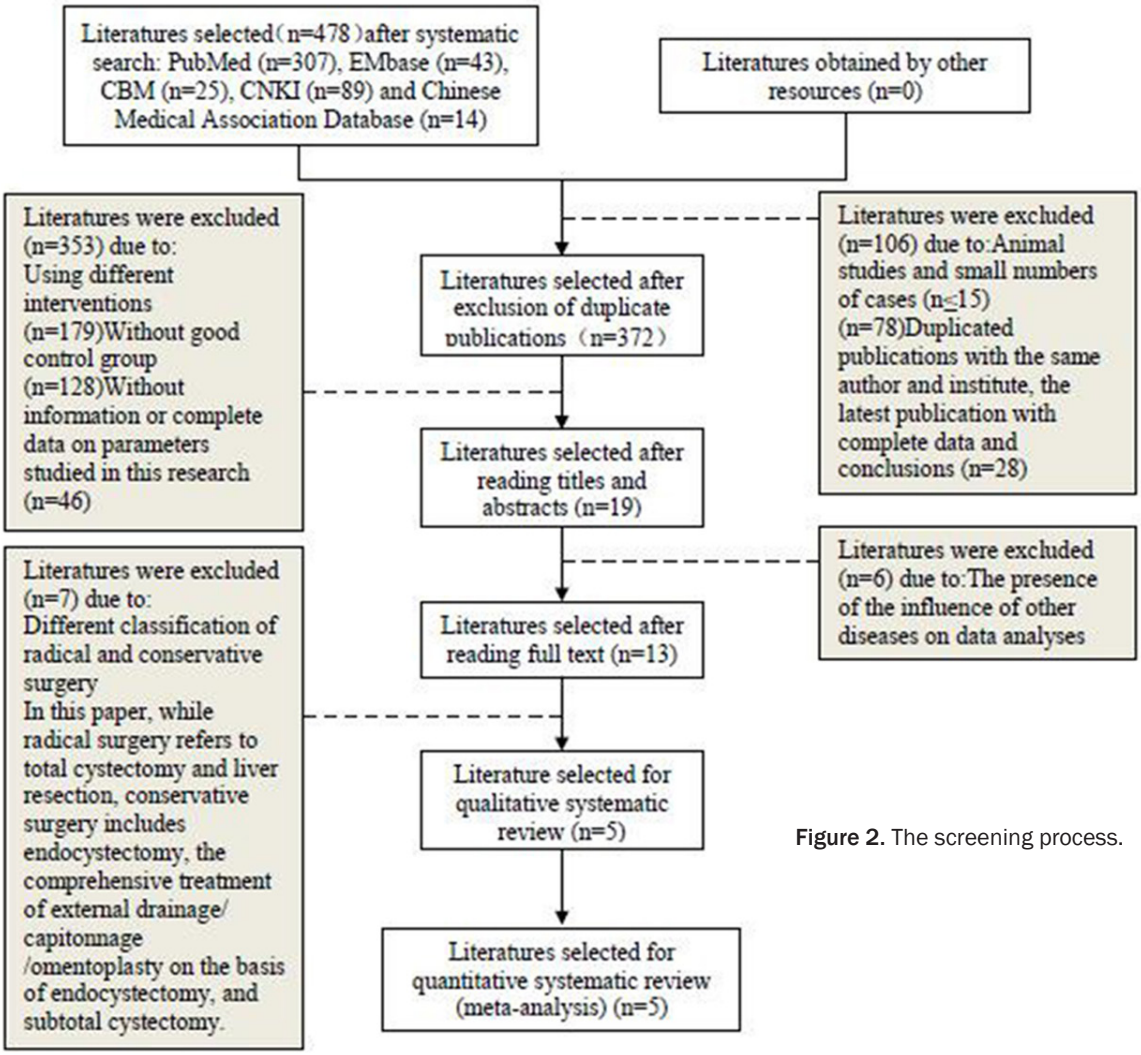


Figure 2. The screening process.

Statistical analysis

A meta-analysis was performed on eligible studies using RevMan 5.1 statistical software. Data were expressed as mean differences (MD) with 95% confidence intervals (CI), and numerical data were represented as odds ratios (OR) with 95% CIs. Heterogeneity among studies was analyzed by the chi-squared test. Studies with good homogeneity ($P > 0.1$, $I^2 < 50\%$) were subject to fixed effect models for meta-analyses. In the presence of heterogeneity ($P \leq 0.1$, $I^2 > 50\%$), sources of heterogeneity among various studies were analyzed. Random effect model meta-analyses were performed and results were interpreted with caution if no significant clinical heterogeneity existed among studies. Descriptive analysis was performed on included data whenever they were unable to be analyzed by meta-analysis. A funnel plot analysis was used to identify bias when a sufficient number of studies ($n \geq 10$) were included.

Results

General information and quality evaluation of included studies

A total of 478 publications were identified during the initial screening process (117 Chinese and 361 English). Duplicate publications, animal experiments, and those which did not meet inclusion criteria were excluded [4-8]. Nineteen publications were selected after reading the titles and abstracts, and five publications were further selected by reading the full text and strictly following inclusion and exclusion criteria. All were NRCTs, including four in English

Table 1. General information and results of quality evaluation

References	No. Author	Year	Country	Group	No. of patients (n)	M/F	Mean age (years)	Cyst size (cm)	Alben-dazole*
[4]	Wen et al.	2007	China	RS	142	1.36:1	32.7 (5-78)	/	Yes
				CS	299			/	
[5]	Aydin et al.	2008	Turkey	RS	92	45/47	51.3±13	10.5 (5-20)	Yes
				CS	129	53/76	51.9±15.4	8.9 (5-17)	
[6]	Motie et al.	2010	India	RS	64	61/74	46±4.2	10.23±3.4	Yes
				CS	71			13.6±5.2	
[7]	Akbulut et al.	2010	Turkey	RS	18	7/11	42.1±13.5	16.27±7.1	Yes
				CS	41	17/24	43.5±13.9	12.98±4.9	
[8]	Secchi et al.	2009	Argentina	RS	159	/	/	/	Yes
				CS	252	/	/	/	

Group RS: radical surgery; Group CS: conservative surgery. *All of the patients received Albendazole for 6 months after completion of surgery.

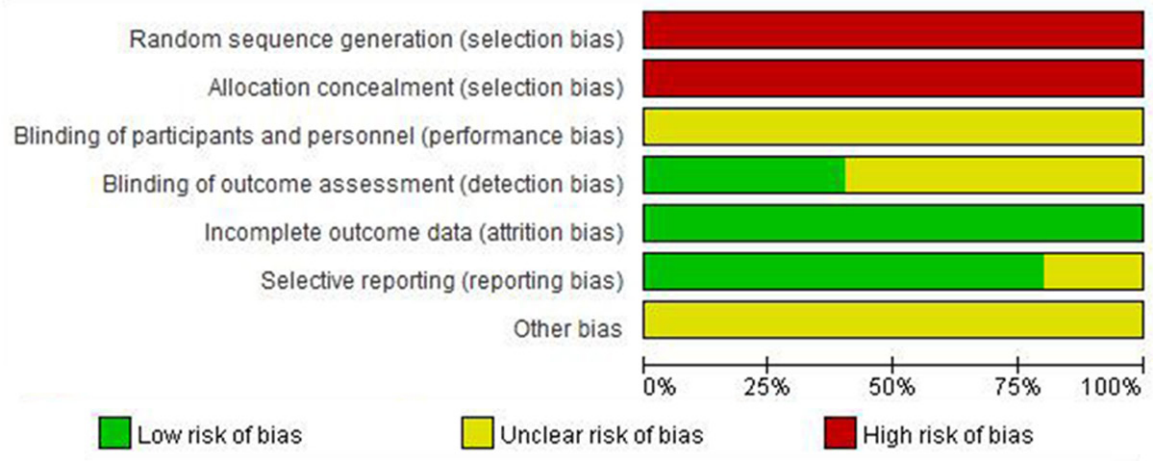


Figure 3. Risks of bias of included studies expressed as percentiles.

and one in Chinese. A total of 1267 patients were studied in the five papers, including 475 cases in the RS group and 792 cases in the CS group. The screening process of included studies is shown in **Figure 2**, and general information and quality evaluation are shown in **Table 1**.

No relevant RCTs were identified and five NRCTs [4-8] were eventually selected; in these, patients were not randomized and allocation was not concealed. Blinding was not reported in these studies; therefore, the existence of blinding could not be determined. All five studies reported complete results. Four studies [4, 6-8] clearly described selective reporting; selectivity of reporting was not mentioned in one study [5]. The existence of other biases could not be determined due to insufficient information (**Figures 3** and **4**).

Meta-analysis

Postoperative complications: Postoperative complications (n = 358) were reported in all five studies [4-8] and good homogeneity among studies (P = 0.12, I^2 = 45%) was observed. Results of the fixed effect model meta-analysis revealed that there was a statistically significant difference between groups [OR = 0.42, 95% CI (0.32, 0.56), P < 0.00001], suggesting that the RS group had fewer perioperative complications compared with the CS group (**Table 2**).

Postoperative biliary leakage in residual cavity: Postoperative biliary leakage (n = 121) was

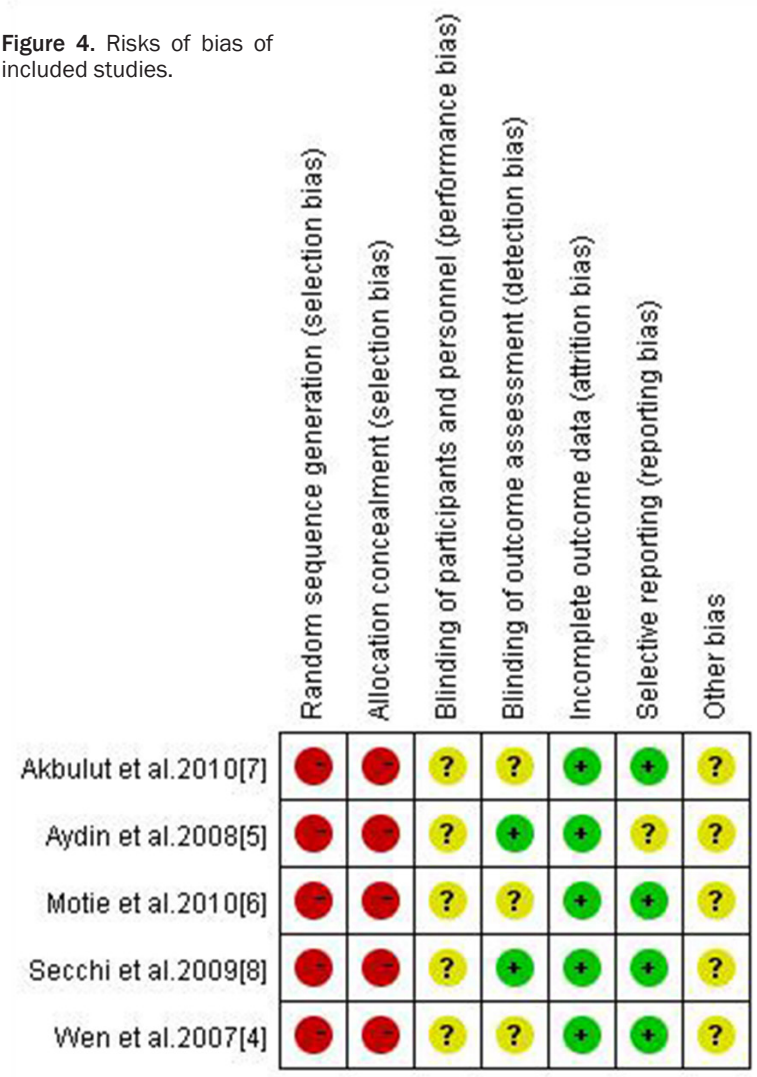


Figure 4. Risks of bias of included studies.

reported in 4 studies [4-7]. Significant heterogeneity was identified among studies (P = 0.007, I^2 = 75%) and a random effect model meta-analysis was performed. The results showed no significant difference between groups [OR = 0.22, 95% CI (0.05, 1.12), P = 0.07]. Biliary leakage in the study of Wen et al [4]. was significantly higher than in the other three [5-7]; sensitivity analysis was performed on these three studies (n = 415). A high level of homogeneity among these studies was shown (P = 0.42, I^2 = 0%), so a fixed effect model meta-analysis was performed. The results demonstrated that there was no significant difference between the groups [OR = 0.42, 95% CI (0.17, 1.06), P = 0.07] for postoperative biliary leakage between RS and CS approaches (**Tables 3** and **4**).

Perioperative mortality

All five studies [4-8] reported perioperative mortality rates (n = 11); good homogeneity among studies (P = 0.59, I^2 = 0%) was observed. A fixed effect mode meta-analysis revealed no significant difference between groups [OR = 0.87, 95% CI (0.27, 2.79), P = 0.82] (**Table 5**).

Recurrence

All five studies [4-8] reported recurrence (n = 58); good homogeneity between studies (P = 0.38, I^2 = 5%) was observed. A fixed effect mode meta-analysis was performed; a statistically significant difference existed between groups [OR = 0.17, 95% CI (0.08, 0.38), P < 0.0001], indicating that the RS group had a lower recurrence rate compared with the CS group (**Table 6**).

Length of hospital stay

Four studies [4-7] reported number of postoperative hospitalization days (n = 856); poor homogeneity among studies (P < 0.000001; I^2 = 99%) was observed. A random effect model meta-analysis was performed and showed no significant difference between groups [MD = -2.47, 95% CI (-6.42, 1.49), P = 0.22] with regards to length of postoperative hospital stay (**Table 7**).

Discussion

While there are currently no effective medical treatments for HCE, surgery is the most effective and commonly recognized cure for HCE. Endocystectomy has been classically used as conservative surgery for HCE for hundreds of years, since it was first reported by Lindeman in 1871. Its advantages include minimal trauma, and ease of technique. However, postoperative complications such as recurrence in the residual cavity and biliary fistula have caused serious

Table 2. Meta-analyses of postoperative complications in the RS and CS groups

Study or Subgroup	radical surgery Events	Total	conservative surgery Events	Total	Weight	Odds Ratio M-H, Fixed, 95% CI	Year
Wen et al.2007[4]	36	142	162	299	51.1%	0.29 [0.18, 0.45]	2007
Aydin et al.2008[5]	3	92	15	129	7.9%	0.26 [0.07, 0.91]	2008
Secchi et al.2009[8]	30	159	67	252	27.6%	0.64 [0.40, 1.04]	2009
Akbulut et al.2010[7]	3	18	10	41	3.3%	0.62 [0.15, 2.59]	2010
Motie et al.2010[6]	12	64	20	71	10.1%	0.59 [0.26, 1.33]	2010
Total (95% CI)		475		792	100.0%	**0.42 [0.32, 0.56]**	
Total events	84		274				

Heterogeneity: Chi² = 7.30, df = 4 (P = 0.12); I² = 45%
Test for overall effect: Z = 5.87 (P < 0.00001)

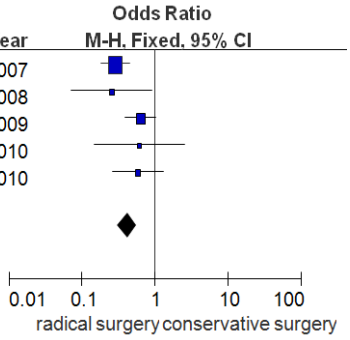


Table 3. Meta-analyses of postoperative biliary leakage in RS and CS groups, in four studies

Study or Subgroup	radical surgery Events	Total	conservative surgery Events	Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
Wen et al.2007[4]	3	142	97	299	29.8%	0.04 [0.01, 0.14]	2007
Aydin et al.2008[5]	0	92	4	129	16.2%	0.15 [0.01, 2.83]	2008
Akbulut et al.2010[7]	2	18	4	41	24.5%	1.16 [0.19, 6.97]	2010
Motie et al.2010[6]	4	64	11	71	29.5%	0.36 [0.11, 1.21]	2010
Total (95% CI)		316		540	100.0%	**0.22 [0.05, 1.12]**	
Total events	9		116				

Heterogeneity: Tau² = 1.89; Chi² = 12.03, df = 3 (P = 0.007); I² = 75%
Test for overall effect: Z = 1.83 (P = 0.07)

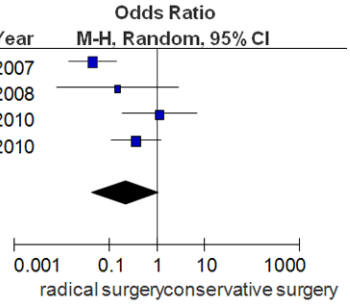


Table 4. Meta-analyses of postoperative biliary leakage of RS and CS groups, in three studies

Study or Subgroup	radical surgery Events	Total	conservative surgery Events	Total	Weight	Odds Ratio M-H, Fixed, 95% CI	Year
Wen et al.2007[4]	3	142	97	299	0.0%	0.04 [0.01, 0.14]	2007
Aydin et al.2008[5]	0	92	4	129	23.8%	0.15 [0.01, 2.83]	2008
Akbulut et al.2010[7]	2	18	4	41	13.8%	1.16 [0.19, 6.97]	2010
Motie et al.2010[6]	4	64	11	71	62.4%	0.36 [0.11, 1.21]	2010
Total (95% CI)		174		241	100.0%	**0.42 [0.17, 1.06]**	
Total events	6		19				

Heterogeneity: Chi² = 1.74, df = 2 (P = 0.42); I² = 0%
Test for overall effect: Z = 1.83 (P = 0.07)

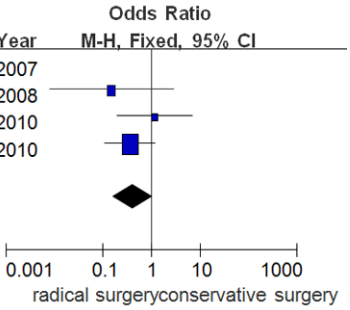
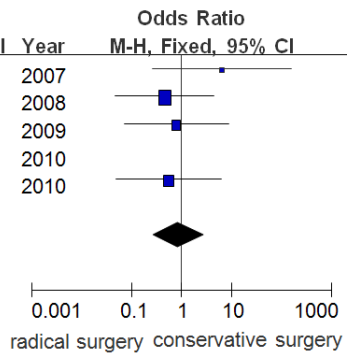


Table 5. Meta-analyses of perioperative mortality rate of the RS and CS groups

Study or Subgroup	radical surgery Events	Total	conservative surgery Events	Total	Weight	Odds Ratio M-H, Fixed, 95% CI	Year
Wen et al.2007[4]	1	142	0	299	5.2%	6.35 [0.26, 156.85]	2007
Aydin et al.2008[5]	1	92	3	129	39.9%	0.46 [0.05, 4.51]	2008
Secchi et al.2009[8]	1	159	2	252	24.8%	0.79 [0.07, 8.80]	2009
Akbulut et al.2010[7]	0	18	0	41		Not estimable	2010
Motie et al.2010[6]	1	64	2	71	30.1%	0.55 [0.05, 6.19]	2010
Total (95% CI)		475		792	100.0%	**0.87 [0.27, 2.79]**	
Total events	4		7				

Heterogeneity: Chi² = 1.92, df = 3 (P = 0.59); I² = 0%
Test for overall effect: Z = 0.23 (P = 0.82)



problems. McManus et al [9] reported recurrence rates between 2.6% and 25%, primarily due to *in situ* recurrence caused by incomplete removal of the internal capsule or close adhe-

Table 6. Meta-analyses of postoperative recurrence in the RS and CS groups

Study or Subgroup	radical surgery Events	Total	conservative surgery Events	Total	Weight	Odds Ratio M-H, Fixed, 95% CI	Year
Wen et al.2007[4]	0	142	2	299	3.8%	0.42 [0.02, 8.75]	2007
Aydin et al.2008[5]	3	92	31	129	58.6%	0.11 [0.03, 0.36]	2008
Secchi et al.2009[8]	2	159	4	252	7.2%	0.79 [0.14, 4.36]	2009
Akbulut et al.2010[7]	0	18	7	41	10.7%	0.12 [0.01, 2.30]	2010
Motie et al.2010[6]	1	64	9	71	19.7%	0.11 [0.01, 0.89]	2010
Total (95% CI)		475		792	100.0%	**0.17 [0.08, 0.38]**	
Total events	6		53				

Heterogeneity: Chi² = 4.22, df = 4 (P = 0.38); I² = 5%
Test for overall effect: Z = 4.36 (P < 0.0001)

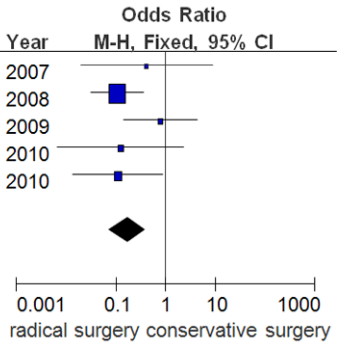
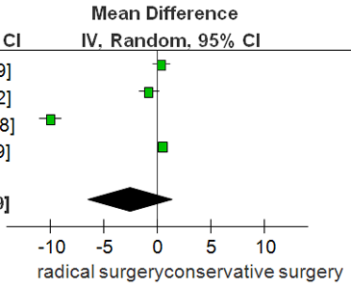


Table 7. Meta-analyses of the number of postoperative hospitalization days in the RS and CS groups

Study or Subgroup	radical surgery Mean	SD	Total	conservative surgery Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Akbulut et al.2010[7]	7.62	1.49	18	7.24	1.86	71	25.0%	0.38 [-0.43, 1.19]
Aydin et al.2008[5]	6.7	3	92	7.5	4	129	24.9%	-0.80 [-1.72, 0.12]
Motie et al.2010[6]	5	1.5	64	15	3.1	41	24.8%	-10.00 [-11.02, -8.98]
Wen et al.2007[4]	7.61	1.6	142	7.12	1.3	299	25.2%	0.49 [0.19, 0.79]
Total (95% CI)			316			540	100.0%	**-2.47 [-6.42, 1.49]**

Heterogeneity: Tau² = 16.11; Chi² = 379.22, df = 3 (P < 0.00001); I² = 99%
Test for overall effect: Z = 1.22 (P = 0.22)



sion of the internal capsule with surrounding tissues in the residual cavity, or secondary hydatid cysts caused by cyst rupture, fluid spillage, or spread and implantation of the head section or ascus in the abdominal cavity. Postoperative complications related to the residual cavity occur in 10.8%-65.8% of patients, primarily because the dense fibrous connective tissue layer of the cyst wall is avascular, with poor healing ability, resulting in fibrinoid necrosis. Furthermore, leakage of interlinked microbiliary ducts between the residual cyst wall and liver parenchyma may lead to cholestasis and infection in the residual cavity.

With the rapid development of hepatobiliary surgical techniques and continued in-depth study, optimizing surgical approach has been explored. Procedures such as internal capsule removal with external capsule suturing, internal capsule removal with omentopexy, internal capsule removal with Roux-en-Y anastomosis to the residual cavity, and partial excision of the external capsule have been developed, based upon traditional endocystectomy. However, these procedures have not addressed risks associated with cystic fluid spillage and the residual cyst wall. The "radical surgery" concept was proposed, with hepatic resection purported for the treatment of HCE in France, Spain, and Hungary in 1965. In order to maximize the size of the liver remnant, Napalkoff developed total pericystectomy, during which the entire cyst was removed. Peng et al. developed total cystectomy in 1999, an improvement to radical surgery, in which the cyst wall was removed [10]. This approach has greatly alleviated two postoperative complications, recurrence and biliary leakage and infection [3].

RS is a procedure developed within the past 10 years for complete removal of liver hydatid cysts. It remains unclarified whether this approach increases postoperative risks of ascus spread, recurrence, and mortality caused by cyst rupture and spillage. In contrast, CS is safe and efficacious; thus, concerns have been raised regarding RS in the treatment of HCE, despite its potential effectiveness.

The study did not include RCT studies; five NRCTs were selected after our systematic review. The results of the meta-analyses demonstrated that there were significantly fewer perioperative complications [OR = 0.42, 95% CI (0.32, 0.56), $P < 0.00001$] and a much lower postoperative recurrence rate in the RS group

compared with the CS group [OR = 0.17, 95% CI (0.08, 0.38), $P < 0.0001$], indicating that RS was far superior to CS. RS removes the cyst in its entirety without violating the integrity of the cyst wall, substantially avoiding complications from fluid spillage, residual cyst wall and cavity infection. Furthermore, postoperative biliary leakage was dramatically reduced, as long as the bile ducts connecting the cyst and parenchymal tissues were identified and carefully ligated. However, our meta-analyses revealed poor homogeneity ($P = 0.007$; $I^2 = 75\%$) with regards to biliary leakage. In the study by Wen et al [4]. biliary leakage was significantly higher than in the other studies. A total of 86 complications were reported in the paper, including 32 cases of hydatid rupture (18 cystic spills in the biliary tract and six cases in the abdominal cavity). Ninety-eight patients (18.9%) required a second operation and 69 patients (13.3%) required three or more surgeries. In an extreme case, the patient went through the procedure seven times. The risk of biliary leakage in these complex cases was significantly higher than in the other studies and a high level of clinical heterogeneity existed between this and the remaining three papers. Sensitivity analysis was performed on the three papers ($n = 415$) and good homogeneity among them was observed ($P = 0.42$, $I^2 = 0\%$). Results of a fixed effect model meta-analysis revealed no significant difference between rates of postoperative bile leakage between the RS and CS groups [OR = 0.22, 95% CI (0.05, 1.12), $P = 0.07$], which was inconsistent with the frequent incidence of biliary leakage after CS. The low rate of postoperative bile leakage in the CS group was probably attributed to experienced clinicians who routinely check for obvious bile leakage by angiography and perform suture ligation to prevent leakage. This procedure largely reduced the incidence of bile leak commonly seen in CS and greatly compensated for the drawbacks of surgery.

Although there was no statistically significant difference in length of hospital stay between the RS and CS groups [MD = -2.47, 95% CI (-6.42, 1.49), $P = 0.22$], poor homogeneity was found among studies ($P < 0.000001$, $I^2 = 99\%$). Duration of hospitalization might have been affected by location and size of hydatid cysts, complications, and the method of hepatic transection. This study matched groups with regards to baseline data, including cyst size, the use of anti-hydatid medicines, among other characteristics, in order to reduce clinical heterogeneity among studies. Subgroup analyses were not conducted because detailed information on location and complexity was not provided in the original data.

It is worth mentioning that total cystectomy is not equivalent to liver resection, despite the fact that both procedures are radical surgeries. We found that radical surgeries performed abroad were mainly liver resections, whereas total cystectomy has been used for the treatment of HCE in our country since 2002. HCE is a benign hepatic lesion; it remains unclear whether cyst excision with associated liver resection, a surgery similar to liver tumor resection, is appropriate for the treatment of HCE. Surgeons outside China have been more inclined to use endocystectomy, percutaneous drainage of echinococcal cysts (PAIR-puncture, aspiration, injection, reaspiration), and other conservative treatments to reduce trauma. With the rapid development of hepatobiliary surgery, the concept of surgical precision, and minimally invasive surgery [11], Wen [3] argued that total cystectomy has several advantages over liver resection, including less trauma and fewer complications. We advocate precise excision of the lesion in strict accordance with liver anatomy and pathological anatomy of the disease (the gap between the hydatid cyst wall and normal liver tissues). Laparoscopic techniques may even be employed if necessary.

However, these approaches require an experienced hepatobiliary surgeon, and cannot be used in primary hospitals, where the incidence of hydatid disease is extremely high [12, 13]. Therefore, having taken into consideration epidemiology and research progress, Wen developed a clinical pathway which indicates radical surgery as the first treatment option [14, 15], semi-radical surgery as the second, and improved conservative surgery as the last choice (**Figure 5**). According to this pathway, patients receive individualized treatment programs.

Although this study comprehensively evaluated the efficacy of RS in the treatment of HCE, there were still several limitations. First, we did not include RCTs, as it is difficult to design and perform RCTs on HCE due to moral and ethical

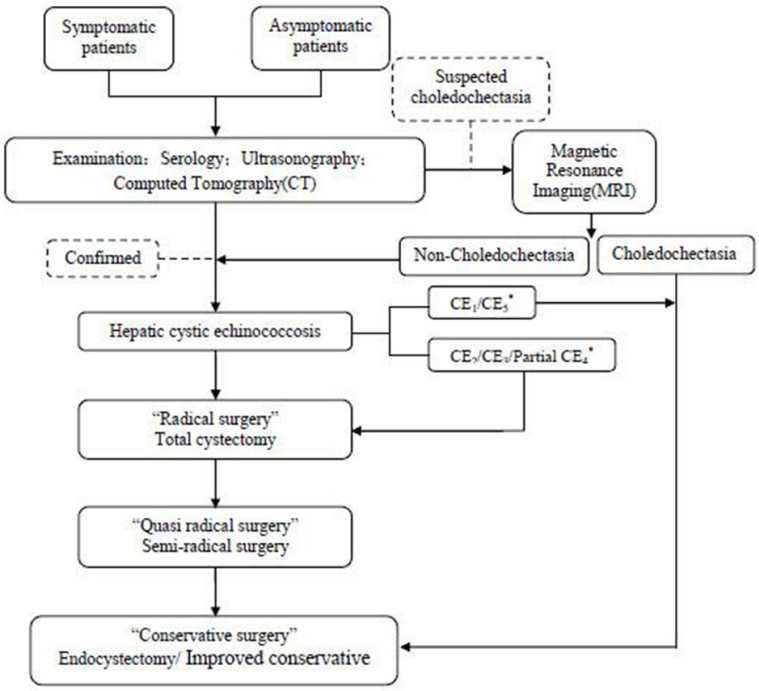


Figure 5. Clinical pathway diagram for the treatment of hepatic cystic echinococcosis (HCE). *CE1-5 represent the five types of HCE (CE1: unilocular simple cyst; CE2: multiseptated cyst; CE3: endocyst collapse; CE4: consolidation cyst; CE5: calcified cyst).

issues; all five selected papers are NRCTs. In addition, long-term prognosis could not be assessed due to a lack of long-term controlled studies. Furthermore, size, location, and classification of hydatid cysts are important surgical indicators. The lesions in the majority of the 475 patients of the RS group were exogenous, located in Couinaud segments II, III, IVa, V, VI, and VII. Cysts are always located right below the surface of the liver, and are not close to major blood vessels and the bile duct. However, since RS can lead to rupture of hydatid cysts in certain regions such as the caudate lobe and diaphragm, CS is paramount when there is a ruptured cyst or infection, or large, hidden hydatid cysts near major vasculature. Despite these limitations, this article still provides strong evidence comparing the efficacy of RS and CS in the treatment of HCE. Recommendations for clinical studies on HCE in the future should include the following. (1) Blinding is recommended, and the randomization method should be described in detail; design and implement RCTs rigorously if possible. (2) Choose indicators that are able to accurately reflect the content of the research; data should be reported in detail and in standardized format, and quality of studies should be strictly evaluated to reduce bias. (3) Research on the efficacy of surgery for HCE should include large numbers of cases in multiple centers, and results of a long-term follow-up study should be recorded in detail in order to evaluate its long-term efficacy.

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Disclosure of conflict of interest

None.

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