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Research Article

Effects Comparison between Endoscopic Papillary Large Balloon Dilatation and Endoscopic Sphincterotomy for Common Bile Duct Stone Removal

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Endoscopic sphincterotomy (EST) is a treatment of choice for stone extraction and is now most frequently used. The study was to compare the efficacy of endoscopic papillary large balloon dilatation (EPLBD) and endoscopic sphincterotomy (EST) for common bile duct stone removal. Trials comparing the effects between EPLBD and EST treatment were searched according to the study protocol. Overall stone removal rate, complete removal rate in 1st session, treatment duration, mechanical lithotripsy using rate, and overall complication rate were compared using risk ratio (RR) and mean difference (MD) and their 95% confidence interval (CI) via RevMan 5.2 software. For overall stone removal rate, two therapies showed similar effect, but EPLBD showed better overall stone removal rate for stone >10 mm in diameter. For complete stone removal rate in 1st session, no difference was found, even for those with stone >10 mm in diameter; EPLBD showed longer treatment duration, higher mechanical lithotripsy using rate obvious overall complications rate, and more serious bleeding, whereas there were no significant differences for perforation, hyperamylasemia, pancreatitis, and cholecystitis/cholangitis. EPLBD showed better efficacy in certain conditions compared to EST, however with shortcomings, such as more duration, higher mechanical lithotripsy using rate, more serious overall complications rate, and bleeding.

1. Introduction

Common bile duct stones are present in about 4–10 percent of patients who have undertaken cholecystectomy [1]. Reported incidence of common bile duct stone varies from 5% to 11% at the time of cholecystectomy [2, 3]. The vast majority of common bile duct stone mainly originates from gallbladder [4]. Its signs and symptoms are variable, ranging from being completely asymptomatic to complications, such as biliary colic, cholangitis, jaundice, or pancreatitis [5].

Endoscopic sphincterotomy (EST), first described in 1974, is a treatment of choice for stone extraction and is now most frequently used [6]. Although EST is relatively safe, it is reported to induce high level of overall complication rates, as well as short-term risks, including bleeding, perforation, and pancreatitis. Endoscopic papillary large balloon dilatation (EPLBD) had been introduced as an alternation for EST to manage the common bile duct stones, for its lower frequency in perforation and hemorrhage [7]. However, in another study comparing these two treatments, EST showed lower pancreatitis occurrence than EPLBD and 2 patients died of pancreatitis because of the EPLBD extraction [8]. It remained as a controversial issue whether EPLBD has a better effect than EST.

In this study, we conducted a meta-analysis to compare the data collected in trials published between 2004 and 2013. Overall stone removal rate, complete stone removal rate in 1st session, treatment duration, mechanical lithotripsy using rate, and overall/each complications rate were compared between the two therapies.

2. Methods

2.1. Information Sources and Searches. A search of the literature was conducted for studies that reported the EPLBD versus EST for common bile duct stone removal.

Table 1: Characteristics of the included 10 prospective studies.

Study	Design*	Country	Bile duct stones	Intervention (n)	Dilated balloon catheter
Lin et al., 2004 [9]	D, S, R	China	Multiple, mean = 8 mm	EPLBD (51) or EST (54)	10–12 mm
Heo et al., 2007 [6]	D, S, R	Korea	Multiple, mean = 16.0–15.0	EST plus EPLBD (100) or EST (100)	12–20 mm
Itoi et al., 2009 [10]	S	Japan	Large	Small EST plus EPLBD (53) or EST (48)	10–20 mm
García-Cano et al., 2009 [11]	D, S	*Spain*	Multiple, mean = 3 mm	EST plus EPLBD (31) or EST (60)	10–20 mm
Kim et al., 2009 [12]	D, S, R	South Korea	Large, ≥15 mm	Small EST plus EPLBD (27) or EST (28)	15, 16.5, or 18 mm
Kim et al., 2011 [13]	S	Korea	Large, ≥10 mm	Small EST plus EPLBD (72) or EST (77)	12–20 mm
Stefanidis et al., 2011 [14]	D, S, R	Greece	Large, >12 mm	Full EST plus EPLBD (45) or EST plus ML (45)	10–20 mm
Oh and Kim, 2012 [15]	S, R	Korea	Large, >10 mm	EPLBD (40) or EST (43)	10–20 mm
Teoh et al., 2013 [16]	D, S, R	China	Large, >13 mm	Limit EST plus EPLBD (73) or EST (78)	15 mm
Li et al., 2014 [17]	S, D	China	Multiple, mean = 12.7–13.2	Small EST plus EPBD (232) or EST (230)	15, 16.5, or 18 mm

*D: double blinded; S: single center; R: randomization.

The PubMed, Web of Science, Medline, Science Citation Index, EMBASE, China National Knowledge Infrastructure, Wanfang Database, and China Biomedical Database were searched to identify double blinded research (D, S, R), single center trials (S), and random clinical trials (RCTs published) in the field of common bile duct stone removal between 2004 and 2013. The keywords used in literature searches included the following: bile duct stones, endoscopic sphincterotomy, and endoscopic papillary balloon dilatation.

2.2. Eligibility Criteria and Outcome Measure. The inclusion criteria were the following: (i) the included studies were designed to compare the therapeutic effects of endoscopic sphincterotomy and endoscopic papillary large balloon dilatation or the combination of the two therapeutics and (ii) the publications could be written in any language. Reports of duplicated studies were excluded by examining the author list, parent institution, sample size, and results.

The primary outcome was overall stone removal rate, overall/complete stone removal rate in 1st session, treatment duration, mechanical lithotripsy using rate, and overall/each complications rate.

2.3. Assessment of Study Quality. Two authors (Shan Lei and Chen Li) independently assessed the quality of the included studies according to the descriptions provided by the authors of the included trials. The methodological quality of the trials was assessed based on adequate sequence generation, allocation concealment, blinding, management of incomplete outcome data, and early stopping for benefit [18].

2.4. Study Selection and Data Collection. Two authors (Shan Lei and Chen Li) independently screened titles and abstracts for potential eligibility and the full texts for final eligibility. We extracted the data from the included trials independently for quantitative analyses, and any disagreement was subsequently resolved by discussion. The quantitative data included the country, stone diameters, interventions, and dilated balloon catheter.

2.5. Synthesis of Results. In this meta-analysis, we used a random effect model because of the anticipated variability among trials with regard to patient populations [19, 20]. The measure of association used in this meta-analysis was the risk ratio (RR) or mean difference (MD) with a 95% confidence interval (CI). The summary RR with the 95% CI was calculated by the RevMan 5.2 software using the random or fixed effect model. A statistically significant result was assumed when the 95% CI did not include one.

Heterogeneity was explored using a Chi-square test; $P < 0.05$ represents that there is heterogeneity of effect size. In addition, the quantity of heterogeneity was measured using the I^2 statistic, which calculates the percentage of total variation across studies caused by heterogeneity rather than sampling errors. $I^2 = 25\%$ was considered as low heterogeneity and 50% as moderate, while 75% was considered as high.

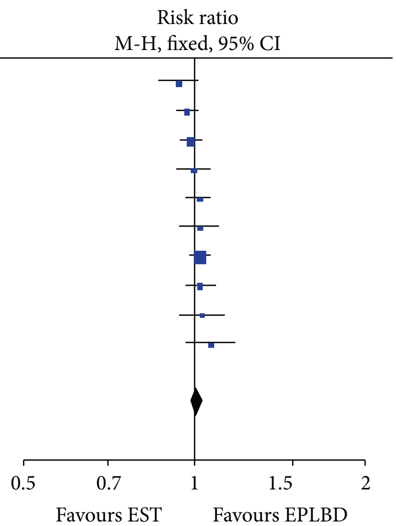
3. Results

3.1. Literature Search and Population. Fifteen trials were finally identified in the English literature. Two trials were removed after blind review because they did not compare the result of EST and EPLBD, 2 reviews were also excluded, and the data of 1 literature was also excluded for the information being incomplete. Characteristics of the final 10 prospective studies [6, 9–17] are shown in Table 1. Patient numbers with EST and EPLBD treatment were 763 and 769 (Table 1).

3.2. Comparison of the Overall Stone Removal Rate of EPLBD and EST Treatments. The rate ratios for overall stone removal

Study or subgroup	EPLBD Events	EPLBD Total	EST Events	EST Total	Weight	Risk ratio M-H, fixed, 95% CI
Lin et al., 2004	48	51	53	53	7.4%	0.94 [0.87, 1.02]
Teoh et al., 2013	71	73	78	78	10.7%	0.97 [0.93, 10.2]
Heo et al., 2007	97	100	98	100	13.8%	0.99 [0.95, 1.03]
Kim et al., 2009	27	27	28	28	4.0%	1.00 [0.93, 1.07]
Itoi et al., 2009	53	53	47	48	7.0%	1.02 [0.97, 1.08]
Oh and Kim, 2012	39	40	41	43	5.6%	1.02 [0.94, 1.11]
Li et al., 2014	222	232	215	230	30.5%	1.02 [0.98, 1.07]
Kim et al., 2011	70	72	73	77	10.0%	1.03 [0.96, 1.09]
García-Cano et al., 2009	29	30	57	61	5.3%	1.03 [0.94, 1.14]
Stefanidis et al., 2011	44	45	41	45	5.8%	1.07 [0.97, 1.19]
Total (95% CI)		**723**		**763**	**100.0%**	**1.01** [**0.99**, **1.03**]
Total events	637		674			

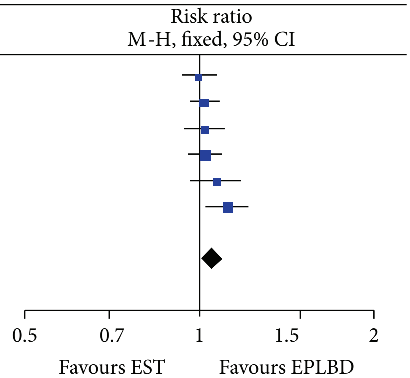
Heterogeneity: $\chi^2 = 9.09$, df = 9 ($P = 0.43$); $I^2 = 1\%$
Test for overall effect: $Z = 0.94$ ($P = 0.35$)



(a)

Study or subgroup	EPLBD Events	EPLBD Total	EST Events	EST Total	Weight	Risk ratio M-H, fixed, 95% CI
Kim et al., 2009	27	27	28	28	9.2%	1.00 [0.93, 1.07]
Itoi et al., 2009	53	53	47	48	16.3%	1.02 [0.97, 1.08]
Oh and Kim, 2012	39	40	41	43	12.9%	1.02 [0.94, 1.11]
Kim et al., 2011	70	72	73	77	23.1%	1.03 [0.96, 1.09]
Stefanidis et al., 2011	44	45	41	45	13.4%	1.07 [0.97, 1.19]
Li et al., 2014	88	90	75	86	25.1%	1.12 [1.03, 1.22]
Total (95% CI)		**327**		**327**	**100.0%**	**1.05** [**1.02**, **1.09**]
Total events	321		305			

Heterogeneity: $\chi^2 = 6.42$, df = 5 ($P = 0.27$); $I^2 = 22\%$
Test for overall effect: $Z = 2.97$ ($P = 0.003$)



(b)

FIGURE 1: Rate ratio for overall stone removal rate of EPLBD and EST treatment (a) and overall stone removal rate for stone >10 mm in diameter (b).

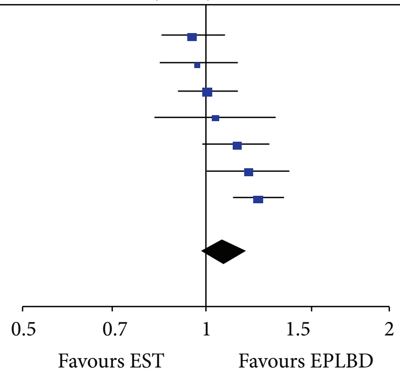
rate for patients taking EPLBD therapies were similar to that of those taking EST therapies (RR: 1.01, 95% CI: 0.99–1.03; $P = 0.35$) (Figure 1(a)), but, for the patient with stone >10 mm in diameter, the rate ratios for overall stone removal rate of EPLBD were higher than those of EST (RR: 1.05, 95% CI: 1.02–1.09, $P < 0.05$) (Figure 1(b)). The result showed that EPLBD had better efficacy than EST method for stones larger than 10 mm in terms of overall removal rate. The rate ratio for complete stone removal rate in 1st session of EPLBD was similar to that of EST (RR: 1.07, 95% CI: 0.98–1.16, $P = 0.11$) (Figure 2(a)), and the rate ratio for complete stone >10 mm in diameter removal rate in 1st session for EPLBD and EST was also similar (RR: 1.11, 95% CI: 0.99–1.24, $P = 0.08$) (Figure 2(b)). Thus, there was no significant difference between the two kinds of treatment in terms of complete stone removal rate in 1st session. In this meta-analysis for complete stone >10 mm in diameter removal rate in 1st session, there was apparent heterogeneity ($P = 0.01$, $I^2 = 64\%$), so random effect model was used. What is more, for the other outcomes, fixed effect model was used for there was no apparent heterogeneity.

3.3. Comparison for Treatment Duration and Mechanical Lithotripsy Using Rate for EPLBD and EST. There was significant heterogeneity in the assessment of treatment duration ($P < 0.00001$, $I^2 = 90\%$), so random effect model was used. It turned out that the two kinds of treatment were significantly different (MD = −5.05, 95% CI: −9.55∼ −0.54, $P = 0.03$; Figure 3(a)), and EPLBD showed longer treatment duration. Fixed effect model was used for mechanical lithotripsy assessment for no heterogeneity ($P = 0.13$, $I^2 = 37\%$), and the RR value was 0.47 with 95% CI being between 0.37 and 0.60 ($P < 0.00001$; Figure 3(b)). EPLBD treatment had higher mechanical lithotripsy using rate compared with EST treatment.

3.4. Comparison for Complications Rate for EPLBD and EST. No apparent heterogeneities were detected between the studies in terms of overall complications rate ($P = 0.22$, $I^2 = 24\%$) and each complications rate (bleeding: $P = 0.11$, $I^2 = 41\%$; perforation: $P = 0.63$, $I^2 = 0\%$; hyperamylasemia: $P = 0.22$, $I^2 = 24\%$; pancreatitis: $P = 0.98$, $I^2 = 0\%$; cholecystitis/cholangitis: $P = 0.64$, $I^2 = 0\%$); then fixed

Study or subgroup	EPLBD Events	EPLBD Total	EST Events	EST Total	Weight	Risk ratio M-H, fixed, 95% CI
Heo et al., 2007	83	100	87	100	16.1%	0.95 [0.85, 1.07]
Lin et al., 2004	44	51	47	53	13.7%	0.97 [0.84, 1.13]
Teoh et al., 2013	65	73	69	78	16.4%	1.01 [0.90, 1.13]
Kim et al., 2009	23	27	23	28	8.3%	1.04 [0.82, 1.31]
Itoi et al., 2009	51	53	41	48	15.1%	1.13 [0.99, 1.28]
Kim et al., 2011	63	72	57	77	12.7%	1.18 [1.01, 1.39]
Li et al., 2014	200	232	162	230	17.7%	1.22 [1.11, 1.35]
Total (95% CI)		**608**		**614**	**100.0%**	**1.07 [0.98, 1.16]**
Total events	529		486			

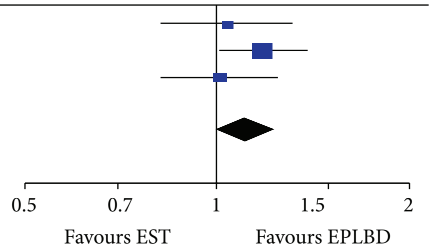
Heterogeneity: $\tau^2 = 0.01$; $\chi^2 = 16.45$, df $= 6$ ($P = 0.01$); $I^2 = 64\%$
Test for overall effect: $Z = 1.59$ ($P = 0.11$)



(a)

Study or subgroup	EPLBD Events	EPLBD Total	EST Events	EST Total	Weight	Risk ratio M-H, fixed, 95% CI
Kim et al., 2009	23	27	23	28	21.6%	1.04 [0.82, 1.31]
Kim et al., 2011	63	72	57	77	52.7%	1.18 [1.01, 1.39]
Teoh et al., 2013	28	33	26	31	25.7%	1.01 [0.82, 1.25]
Total (95% CI)		**132**		**136**	**100.0%**	**1.11 [0.99, 1.24]**
Total events	114		106			

Heterogeneity: $\chi^2 = 1.66$, df $= 2$ ($P = 0.44$); $I^2 = 0\%$
Test for overall effect: $Z = 1.78$ ($P = 0.08$)

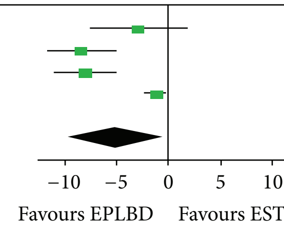


(b)

FIGURE 2: Rate ratio for complete stone removal rate in 1st session of EPLBD and EST treatment (a) and complete stone removal rate in 1st session for stone >10 mm in diameter (b).

Study or subgroup	EPLBD Mean	EPLBD SD	Total	EST Mean	EST SD	Total	Weight	Mean difference IV, random, 95% CI
Teoh et al., 2013	24.3	12.87	73	27.2	16.9	78	21.7%	−2.90 [−7.67, 1.87]
Li et al., 2014	38.6	15.5	232	47.1	20.2	230	24.9%	−8.50 [−11.79, −5.21]
Itoi et al., 2009	32	8	53	40	8	48	25.2%	−8.00 [−11.12, −4.88]
Lin et al., 2004	44	3	51	45	3	53	28.2%	−1.00 [−2.15, 0.15]
Total (95% CI)			**4.9**			**409**	**100.0%**	**−5.05 [−9.55, −0.54]**

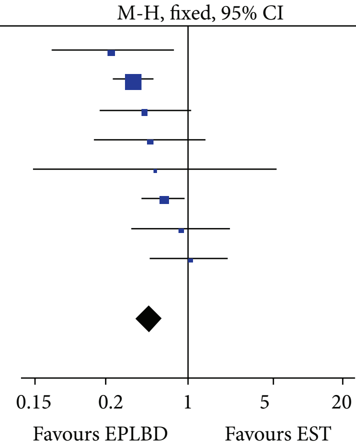
Heterogeneity: $\tau^2 = 18.42$; $\chi^2 = 31.24$, df $= 3$ ($P < 0.00001$); $I^2 = 90\%$
Test for overall effect: $Z = 2.19$ ($P = 0.03$)



(a)

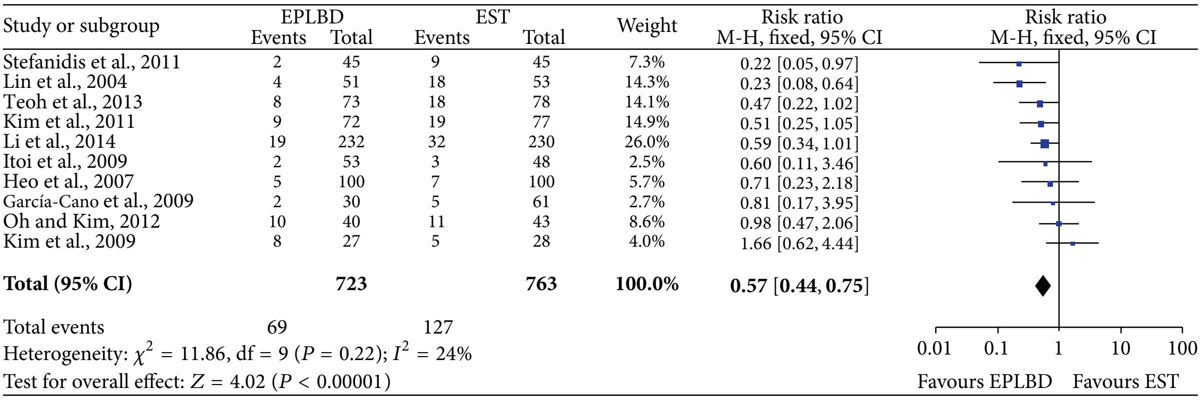
Study or subgroup	EPLBD Events	EPLBD Total	EST Events	EST Total	Weight	Risk ratio M-H, fixed, 95% CI
Itoi et al., 2009	3	53	12	48	7.4%	0.23 [0.07, 0.75]
Li et al., 2014	28	232	80	230	47.3%	0.35 [0.23, 0.51]
Kim et al., 2011	6	72	15	77	8.5%	0.43 [0.18, 1.04]
Oh and Kim, 2012	4	40	9	43	5.1%	0.48 [0.16, 1.43]
Lin et al., 2004	1	51	2	53	1.2%	0.52 [0.05, 5.56]
Teoh et al., 2013	21	73	36	78	20.5%	0.62 [0.40, 0.96]
Heo et al., 2007	7	100	8	100	4.7%	0.88 [0.33, 2.32]
Kim et al., 2009	9	27	9	28	5.2%	1.04 [0.49, 2.21]
Total (95% CI)		**648**		**657**	**100.0%**	**0.47 [0.37, 0.60]**
Total events	79		171			

Heterogeneity: $\chi^2 = 11.16$, df $= 7$ ($P = 0.13$); $I^2 = 37\%$
Test for overall effect: $Z = 6.23$ ($P < 0.00001$)

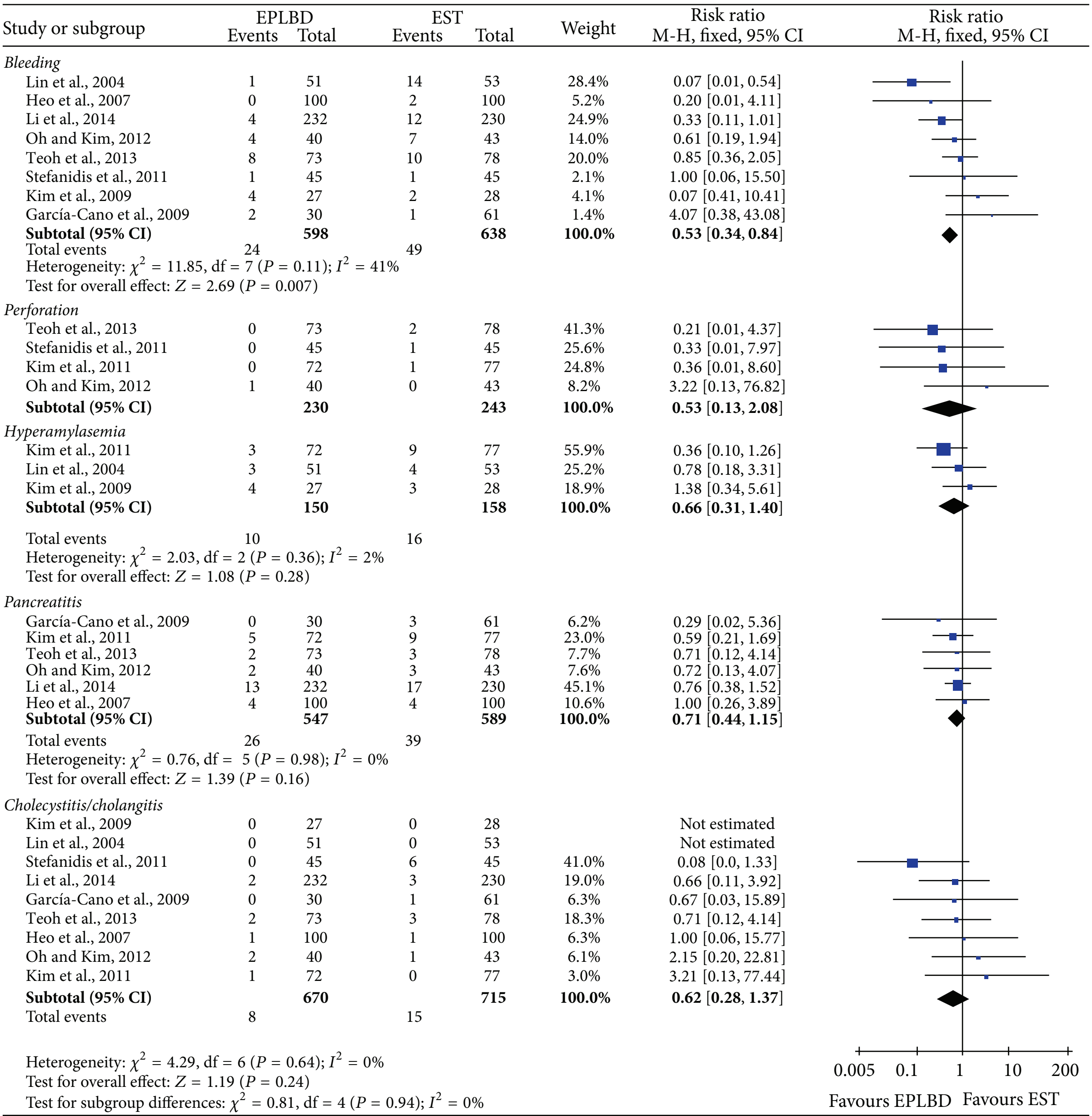


(b)

FIGURE 3: Comparison of treatment duration (a) and mechanical lithotripsy (b) using rate of EPLBD and EST treatment.



(a)



(b)

FIGURE 4: Comparison of overall complications rate (a) and each complications rate (b) of EPLBD and EST treatment.

effect model was used for the meta-analyses. EPLBD showed obvious overall complications rate (RR = 0.57, 95% CI = 0.44~0.75, $P < 0.0001$; Figure 4(a)) and more serious bleeding (RR = 0.53, 95% CI = 0.34~0.84, $P = 0.007$; Figure 4(b)) than EST, while there were no significant differences between these two treatments for perforation (RR = 0.36, 95% CI = 0.13~2.08, $P = 0.36$), hyperamylasemia (RR = 0.66, 95% CI = 0.31~1.40, $P = 0.28$), pancreatitis (RR = 0.71, 95% CI = 0.44~1.15, $P = 0.16$), and cholecystitis/cholangitis (RR = 0.62, 95% CI = 0.28~1.37, $P = 0.24$) (Figure 4(b)).

4. Discussion

EST used to be the most commonly used treatment for the removal of bile duct stones. Nevertheless, it is commonly reported that EST could induce substantial procedure associated risks, such as increased incidence of ascending cholangitis [6]. Endoscopic papillary balloon dilatation uses a small balloon catheter, while EPLBD uses a larger balloon (>12 mm) after the mid-incision EST to remove large common bile duct stones. EPLBD would theoretically combine the advantages of balloon dilation and sphincterotomy by increasing stone extraction efficacy while minimizing complications of them. We performed this meta-analysis to compare the effect of EST and EPLBD for common bile duct stones. Even no significant difference existed in the overall stone removal rate, but, for patients with stones >10 mm in diameter, EPLBD could give better overall stone removal rate; however, this treatment needs more duration and will induce higher mechanical lithotripsy using rate with more serious overall complications rate and bleeding, compared with EST. The result was consistent with the study of Fujita et al. [21]. Nevertheless, many studies have recently proposed that EPLBD will not cause complications if performed under strictly established guidelines [22]. Thus, it is of great importance to follow the guidelines during the treatment of EPLBD.

We reviewed previous meta-analysis and found that patients received EPLBD therapy which was associated with shorter length of hospitalization, whereas there was no significance for clearance rates and morbidity/mortality [4]. However, these conclusions may be unreliable, because only 2 included trials reported these outcomes. The current study is based on 10 prospective studies, which are potentially more robust than previous meta-analysis.

There are few limitations of our current study: (1) not all the included literatures studied all the assessment parameters, such as complete stone removal rate in 1st session and treatment duration; (2) the trials adapted different design, including D, S, R, and R; (3) we did not conduct sensitive analysis to test the reliability of the results.

In conclusion, the EPLBD treatment needs more treatment duration and mechanical lithotripsy using rate compared to EST, but, for patients with stones >10 mm in diameter, EPLBD could give better overall stone removal rate. What is more, EPLBD would produce obvious overall complications rate and bleeding, compared with EST.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

References

[1] E. S. J. Clayton, S. Connor, N. Alexakis, and E. Leandros, "Meta-analysis of endoscopy and surgery versus surgery alone for common bile duct stones with the gallbladder *in situ*," *British Journal of Surgery*, vol. 93, no. 10, pp. 1185–1191, 2006.

[2] R. A. Duensing, R. A. Williams, J. C. Collins, and S. E. Wilson, "Common bile duct stone characteristics: correlation with treatment choice during laparoscopic cholecystectomy," *Journal of Gastrointestinal Surgery*, vol. 4, no. 1, pp. 6–12, 2000.

[3] J. M. Hemli, R. S. Arnot, J. J. Ashworth, A. M. Curtin, R. A. Simon, and D. M. Townend, "Feasibility of laparoscopic common bile duct exploration in a rural centre," *ANZ Journal of Surgery*, vol. 74, no. 11, pp. 979–982, 2004.

[4] E. H. Phillips, J. Toouli, H. A. Pitt, and N. J. Soper, "Treatment of common bile duct stones discovered during cholecystectomy," *Journal of Gastrointestinal Surgery*, vol. 12, no. 4, pp. 624–628, 2008.

[5] G. R. Caddy and T. C. K. Tham, "Symptoms, diagnosis and endoscopic management of common bile duct stones," *Best Practice and Research: Clinical Gastroenterology*, vol. 20, no. 6, pp. 1085–1101, 2006.

[6] J. H. Heo, D. H. Kang, H. J. Jung et al., "Endoscopic sphincterotomy plus large-balloon dilation versus endoscopic sphincterotomy for removal of bile-duct stones," *Gastrointestinal Endoscopy*, vol. 66, no. 4, pp. 720–726, 2007.

[7] M. Staritz, K. Ewe, and K. H. M. zum Buschenfelde, "Endoscopic papillary dilation (EPD) for the treatment of common bile duct stones and papillary stenosis," *Endoscopy*, vol. 15, no. 1, pp. 197–198, 1983.

[8] T. H. Baron and G. C. Harewood, "Endoscopic balloon dilation of the biliary sphincter compared to endoscopic biliary sphincterotomy for removal of common bile duct stones during ERCP: a metaanalysis of randomized, controlled trials," *The American Journal of Gastroenterology*, vol. 99, no. 8, pp. 1455–1460, 2004.

[9] C.-K. Lin, K.-H. Lai, H.-H. Chan et al., "Endoscopic balloon dilatation is a safe method in the management of common bile duct stones," *Digestive and Liver Disease*, vol. 36, no. 1, pp. 68–72, 2004.

[10] T. Itoi, F. Itokawa, A. Sofuni et al., "Endoscopic sphincterotomy combined with large balloon dilation can reduce the procedure time and fluoroscopy time for removal of large bile duct stones," *The American Journal of Gastroenterology*, vol. 104, no. 3, pp. 560–565, 2009.

[11] J. García-Cano, L. T. Arana, C. J. Ayllón et al., "Biliary sphincterotomy dilation for the extraction of difficult common bile duct stones," *Revista Espanola de Enfermedades Digestivas*, vol. 101, no. 8, pp. 541–545, 2009.

[12] H. G. Kim, Y. K. Cheon, Y. D. Cho et al., "Small sphincterotomy combined with endoscopic papillary large balloon dilation versus sphincterotomy," *World Journal of Gastroenterology*, vol. 15, no. 34, pp. 4298–4304, 2009.

[13] T. H. Kim, H. J. Oh, J. Y. Lee, and Y. W. Sohn, "Can a small endoscopic sphincterotomy plus a large-balloon dilation reduce the use of mechanical lithotripsy in patients with large bile duct stones?" *Surgical Endoscopy*, vol. 25, no. 10, pp. 3330–3337, 2011.

[14] G. Stefanidis, N. Viazis, D. Pleskow et al., “Large balloon dilation vs. mechanical lithotripsy for the management of large bile duct stones: a prospective randomized study,” *American Journal of Gastroenterology*, vol. 106, no. 2, pp. 278–285, 2011.

[15] M. J. Oh and T. N. Kim, “Prospective comparative study of endoscopic papillary large balloon dilation and endoscopic sphincterotomy for removal of large bile duct stones in patients above 45 years of age,” *Scandinavian Journal of Gastroenterology*, vol. 47, no. 8-9, pp. 1071–1077, 2012.

[16] A. Y. B. Teoh, F. K. Y. Cheung, B. Hu et al., “Randomized trial of endoscopic sphincterotomy with balloon dilation versus endoscopic sphincterotomy alone for removal of bile duct stones,” *Gastroenterology*, vol. 144, no. 2, pp. 341.e1–345.e1, 2013.

[17] G. Li, Q. Pang, X. Zhang et al., “Dilation-assisted stone extraction: An alternative method for removal of common bile duct stones,” *Digestive Diseases and Sciences*, vol. 59, no. 4, pp. 857–864, 2014.

[18] K. F. Schulz and D. A. Grimes, “Allocation concealment in randomised trials: defending against deciphering,” *The Lancet*, vol. 359, no. 9306, pp. 614–618, 2002.

[19] R. DerSimonian and N. Laird, “Meta-analysis in clinical trials,” *Controlled Clinical Trials*, vol. 7, no. 3, pp. 177–188, 1986.

[20] R. DerSimonian and R. Kacker, “Random-effects model for meta-analysis of clinical trials: an update,” *Contemporary Clinical Trials*, vol. 28, no. 2, pp. 105–114, 2007.

[21] N. Fujita, H. Maguchi, Y. Komatsu et al., “Endoscopic sphincterotomy and endoscopic papillary balloon dilatation for bile duct stones: a prospective randomized controlled multicenter trial,” *Gastrointestinal Endoscopy*, vol. 57, no. 2, pp. 151–155, 2003.

[22] Y. H. Youn, H. C. Lim, J. H. Jahng et al., “The increase in balloon size to over 15 mm does not affect the development of pancreatitis after endoscopic papillary large balloon dilatation for bile duct stone removal,” *Digestive Diseases and Sciences*, vol. 56, no. 5, pp. 1572–1577, 2011.