Traitement mini-invasif de la lithiase de voie biliaire principale avec une vésicule biliaire en place : Quels niveaux de preuves? Revue systématique

Mini-invasive management of concomitant gallstones and common bile duct stones: where is the evidence (Review article)

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RÉSUMÉ

Introduction : Le traitement mini-invasif idéale des lithiases de la voie biliaire principales avec une vésicule biliaire en place est un sujet de controverse. Cette revue systématique vise à évaluer les différentes modalités thérapeutiques mini-invasives de cette pathologie au cours de la dernière décennie.

Méthodes : Une recherche bibliographique dans les bases des données Medline, Embase, Cochrane et Google Scholar a été réalisée pour les articles publiés entre Janvier 2009 et Décembre 2018. Les mots-clés utilisés sont «ERCP», «common bile duct exploration», «endoscopic sphincterotomy», «laparoscopic surgery», «laparoscopic cholecystectomy», «choledocholithiasis», «common bile duct stones» «meta-analysis» et «randomized clinical trials».

Résultats : Il y avait 14 études comparant les procédures mini-invasives. Il y avait neuf méta-analyses, trois revues systématiques et deux essais randomisés. Il n'y avait pas de différence entre les groupes cholécystectomie laparoscopique (LC) avec exploration laparoscopique de la voie biliaire principale (ELVBP) et LC avec cholangio-pancréatographie rétrograde endoscopique (CPRE) en termes de mortalité, morbidité, taux de réussite d'extraction des calculs et durée du séjour à l'hôpital. LC + ERCP est supérieur en termes de coût du traitement et de conversion. Concernant les LC avec une CPRE préopératoire versus les LC avec une CPRE postopératoire, sur la base des données de la littérature, aucune conclusion n'a pu être tirée. Concernant les LC avec ELVBP versus les LC avec CPRE préopératoire, Il n'y avait pas de différence en termes de mortalité, de morbidité et de conversion. Compte tenu de la discordance des résultats, en termes de taux d'extraction des calculs, de temps opératoire et de durée d'hospitalisation, aucune conclusion n'a pu être tirée. Concernant les LC avec ELVBP versus LC avec les CPRE postopératoires, Il n'y avait pas de différence en termes de mortalité, de morbidité, de taux de réussite de l'extraction de calculs, de durée des séjours à l'hôpital et de taux de conversion. Concernant les LC avec CPRE peropératoire versus LC avec CPRE préopératoire, il n'y avait pas de différence en termes de mortalité, de morbidité et de taux d'extraction des calculs. La LC + CPRE peropératoire était supérieure en termes de durée de séjour à l'hôpital et de taux de conversion. En ce qui concerne le traitement en une étape par rapport à deux étapes, il n'y avait pas de différence en termes de mortalité, de morbidité, de taux de réussite de l'extraction de calculs, de taux de conversion et de durée de séjour à l'hôpital.

Conclusions : Les procédures en une ou deux étapes sont réalisables et sûres avec une efficacité équivalente. Les praticiens doivent être conscients des difficultés de ces procédures et doivent utiliser judicieusement ces procédures en fonction du plateau technique disponible.

Mots-clés

Lithiase de la voie biliaire principale ; exploration laparoscopique de la voie biliaire principale ; ERCP ; cholécystectomie

SUMMARY

Background: The ideal mini-invasive management of common bile duct stones (CBDS) with concomitant gallbladder stones is debatable. This article aims to review the management of this condition during the last decade using the mini-invasive approach.

Methods: A database research in Medline, Embase, Cochrane and Google Scholar during the period between January 2009 to December 2018 was performed. The keywords used were «ERCP», «common bile duct exploration», «endoscopic sphincterotomy», «laparoscopic surgery», «laparoscopic cholecystectomy», «choledocholithiasis», «common bile duct stones» «meta-analysis» and «randomized clinical trials».

Results: There were 14 studies comparing mini-invasive procedures. There were nine meta-analysis, three reviews articles and two randomized clinical trials. We concluded to the absence of difference between the group laparoscopic cholecystectomy (LC) with a laparoscopic exploration of CBD (LECBD) and LC with endoscopic retrograde cholangiopancreatography (ERCP) in terms of mortality, morbidity, stones extraction success rate and duration of hospital stay. LC + ERCP is superior in terms of conversion and treatment cost. Concerning LC with a preoperative ERCP versus LC with postoperative ERCP, based on the literature data, no conclusions could be drawn. Concerning LC with LECBD versus LC with preoperative ERCP, we conclude to the absence of difference in terms of mortality, morbidity and conversion rate. Given the discordance of the results, in terms of successful extraction rate of stones, operating time and duration of hospital stay we cannot conclude to the superiority of one technique. Concerning LC with LECBD versus LC with postoperative ERCP, we conclude the absence of difference in terms of mortality, morbidity, the success rate of stones extraction, duration of hospital stays and conversion rate. Concerning LC with intraoperative ERCP versus LC with preoperative ERCP, we concluded to the absence of difference in terms of mortality, morbidity and rate of success stones extraction. The LC + intraoperative ERCP was superior in terms of hospital stay duration and conversion rate. Concerning one-stage versus two-stage treatment, we concluded to the absence of difference in terms of mortality, morbidity, the success rate of stone extraction, the conversion rate and the duration of hospital stay.

Conclusions: One-stage or two-stages procedures are feasible and safe with equivalent efficacy. Surgeons must be aware of the different difficulties of these procedures and should be judicious in their use of different techniques.

Key-words

Common bile duct stones; Laparoscopic common bile duct exploration; ERCP; cholecystectomy, mini-invasive procedure

INTRODUCTION

The common bile duct stones (CBDS) occurs mainly by migration from the gallbladder [1]. CBDS are associated in 10 to 15% to Gallbladder (GB) stones [1,2]. Even asymptomatic CBDS should be treated. Treatment is to evacuate of the biliary duct stones. Cholecystectomy is performed to prevent a recurrence. The treatment of CBDS, associated with cholecystectomy, may be entirely surgical, preferably using laparoscopic approach [3], or endoscopic, associating endoscopic retrograde cholangiopancreatography (ERCP) and sphincterotomy with the extraction of stones in the pre or post-operative delay. These different therapeutic modalities had presented the subject of several studies during this last decade and there is still no consensus on the ideal management of CBDS.

The purpose of this systematic review was to compare the different mini-invasive therapeutic modalities of CBDS in patients with GB by comparing the mini-invasive approach for the treatment of CBDS in one-stage (laparoscopic cholecystectomy (LC) with exploration of the CBD or intraoperative ERCP) and the two-stage endoscopic approach (LC with pre or postoperative ERCP).

METHODS

Study protocol

A literature search has been conducted in the databases of Medline, Embase, Cochrane Database and Google Scholar during the period between January 2009 to December 2018. The keywords used were “ERCP”, “common bile duct exploration”, “endoscopic sphincterotomy”, “Laparoscopic surgery”, “laparoscopic cholecystectomy”, “choledocholithiasis”, “common bile duct stones” “meta-analysis” and “Randomized clinical trials”. All the meta-analysis, systematic reviews, randomized clinical trials published between 2009 and 2018, in English or in French, reporting the comparison of the different mini-invasive therapeutic modalities of CBDS in patients with GB were considered. Endpoints considered were: Mortality, morbidity, success rate of stone extraction, operative time, conversion rate, duration of hospital stay, residual stones and cost of treatment based on different therapeutic modalities.

Studies selection

All studies meeting the inclusion criteria were methodologically evaluated by two authors (MAC and MWD) and in case of discrepancy, a discussion with consultation was made with IB. In order to evaluate the quality of the retained Meta-analysis and systematic review, we used the PRISMA “Prefered Reporting Items for Systematic reviews and Meta-analysis” [4]. We conducted a qualitative analysis, answering the questions asked, by the level of evidence and recommendation grade according to the Oxford for evidence-based medicine classification [5]. As concern RCTs, we have included only the studies not retained in the meta-analysis found in this literature search.

RESULTS

The electronic search allowed us to identify 34 studies. Four studies compared these minimally invasive techniques with other therapeutic procedures and 4 others were not available as a complete text. Two trials were published in a language other than English or French [6,7]. We excluded ten randomized controlled trials (RCT) that were included in the meta-analysis to avoid redundancy [8-17]. We finally selected 14 studies. The characteristics and the results of these studies were reported in table 1. There were nine meta-analysis [18-26], three reviews articles [27-29] and two randomized clinical trials [30,31] . After evaluating the methodology, no articles were excluded since they all had a PRISMA score> 13/27. The comparisons performed in the retained studies and their different conclusions were reported in table 2. (Figure 1)

Minimal invasive treatment in one step: “Laparoscopic Cholecystectomy (LC) with Laparoscopic Exploration of CBD (LECBD)” versus “LC with Intraoperative ERCP”

Three meta-analysis [18-20] and one review article [27] had compared these two techniques. The mortality was reported only by Dasari et al [15]. No cases of mortality were reported in the two groups. In terms of morbidity, no statistically significant difference between the two groups “LC + LECBD” and “LC + ERCP” was reported in the meta-analysis and the review article [18-20,27]. Regarding the rate of stones extraction success, all meta-analysis and the literature review concluded to the absence of a significant difference between these two techniques. It was ranging from 62% to 94.3% in the “LC + LECBD” group vs. 89% to 90.6% in the “LC + ERCP” group [18-20,27]. The two meta-analysis published in 2014 [19,20], involving respectively 708 and 453 patients, did not report

Table 1: Characteristics of the studies included in the systematic review

Authors	Country	Year of publication	Type of study	Number of patients	Design of study (RCT/CCT)	PRISMA
Gao et al [18]	China	2017	Meta-analysis	1663	11/0	25/27
Liu et al [19]	China	2017	Meta-analysis	1410	15/0	25/27
Nagaraja et al [20]	Austria	2014	Meta-analysis	1983	15/0	27/27
Zhu et al [21]	China	2015	Meta-analysis	1111	8/0	24/27
Prasson et al [22]	China	2015	Meta-analysis	1600	14/0	25/27
Gurusamy et al [23]	United Kingdom	2011	Meta-analysis	532	4/0	26/27
Lu et al [24]	China	2012	Meta-analysis	621	7/0	27/27
Alexakis et al [25]	New Zealand	2012	Meta-analysis	933	9/0	27/27
Wang et al [26]	China	2013	Meta-analysis	631	5/0	27/27
Dsari et al [27]	United Kingdom / Australia	2013	Review	1758	16/0	16/27
Li et al [28]	China	2011	Review	1396	12/0	13/27
Vatteretto et al [29]	Italy	2018	Review	517	5/0	18/27
Liu et al [30]	China	2017	RCT	89	-	-
Bansal et al [31]	India	2014	RCT	168	-	-

PRISMA: Preferred Reporting Items for Systematic reviews and Meta-analysis; RCT: Randomized controlled trial; CCT: Controlled clinical trial; M: Male; F: Female

a statistically significant difference between the two groups in terms of duration of the intervention. The most recent meta-analysis published by Gao et al in 2017 [18] including 1663 patients reported a statistically significant difference in favour of the " LC + LECBD " group (WMD = -11.55 min, 95% CI: -16.68, -6.42, p <0.01). The meta-analysis published in 2014 by Nagaraja et al [20], involving 453 patients, did not show a statistically significant difference between the two groups in terms of conversion rate which was 6% in the LC + LEVBP group vs. 9% in the LC + ERCP group. The meta-analysis performed by Gao et al [18] including 1663 patients reported a statistically significant difference in favour of the "LC + ERCP" group (RR = 1.59, 95% CI: 1.08, 2.35; 0.019). No studies reported a difference between the two groups in terms of duration of hospital stay [18-20]. A single meta-analysis had compared the cost of treatment between the two groups [19]. The reported difference between the groups was statistically significant in favor of the "LC + LECBD" group (WMD = -0.55, 95% CI, -0.097, -0.13, p <0.05).

Current literature data allow us to conclude with a Level I of evidence and Grade A of recommendation in the absence of difference between the groups "LC + LECBD" and "LC + ERCP" in terms of mortality, morbidity, stones extraction success rate and duration of hospital stay. The "LC + ERCP" is superior to the "LC + LECBD" in terms of conversion (level I evidence and grade A recommendation). LC + ELVBP is superior to LC + ERCP in terms of treatment cost (level I evidence and grade A recommendation).

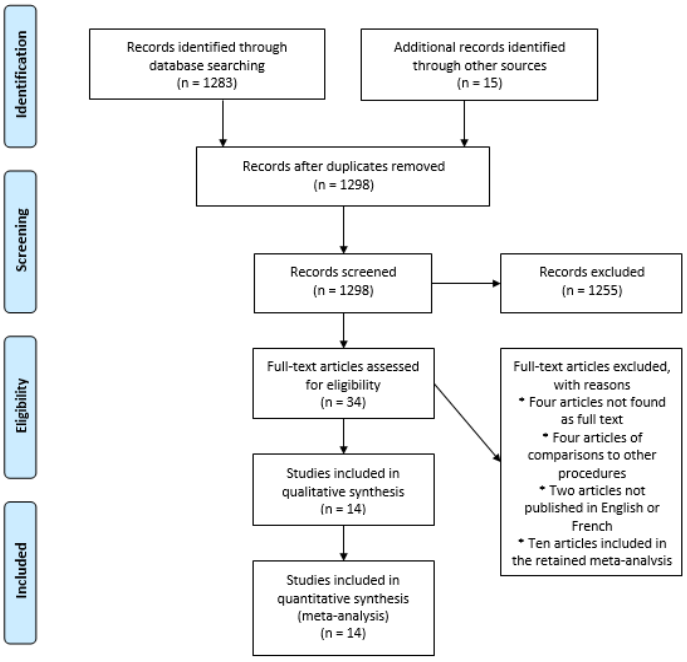

Figure 1: Flowchart of articles retained in the review

Two-stage treatment: LC with a preoperative ERCP versus LC with postoperative ERCP

The literature is poor in terms of publications comparing these two therapeutic strategies. This is probably due to

Table 2: Comparisons and results of the included studies

Authors	Comparisons	Conclusions
Gao et al [18]	LC + LECBD Vs LC + ERCP	Based on the current evidence, both LC + LECBD and LC + ERCP were highly effective in detecting and removing CBD stones and were equivalent in complications. However, our results might be biased by the limitations. Large-scale well-designed RCTs are needed to confirm our findings.
Liu et al [19]	LC + LECBD Vs LC + ERCP	To some degree, LECBD may be a better way of removing stones than ERCP.
Nagaraja et al [20]	Preop ERCP + LC Vs LC + ERCP LC + postop ERCP Vs LC + LECBD Preop ERCP + LC Vs LC + LECBD LC + ERCP Vs LC + LECBD	The evidence provided by this meta-analysis suggests that both of these approaches would appear comparable. To fully address which would be the better approach would require others RCTs.
Zhu et al [21]	LC + LECBD Vs preop ERCP + LC	Single stage (LC + LECBD) management approach treats both gallstones and CBDS in a single-stage and is cost-effective with shorter hospital stays, and it may achieve a higher CBDS clearance rate than the two-stage (ERCP + LC) approach when an experienced laparoscopic surgeon utilizes it. LECBD is a safe and effective treatment option for concomitant gallstones and CBDS in terms of long-term and short-term outcomes because it avoids the morbidity and mortality associated with ERCP and maintains the integrity of the sphincter of Oddi. With more refinement in equipment and technique, it is possible that LECBD may become the gold standard for stones treatment. Certainly, ERCP is irreplaceable because it can release biliary obstructions in acute suppurative obstructive cholangitis patients in a timely fashion, which causes the patients to tolerate the surgery
Prasson et al [22]	LC + LECBD Vs Two stage ERCP + LC	One- and two-stage management had similar efficacy and safety in terms of CBD stone clearance rate, mortality, morbidity, operating time, hospital stay, and retained stone rate. One-stage management may reduce additional procedure.
Gurusamy et al [23]	Preop ERCP + LC Vs LC + ERCP	In patients with gallbladder and CBD stones, intraoperative endoscopic sphincterotomy is as effective and safe as preoperative endoscopic sphincterotomy and results in a significantly shorter hospital stay.
Lu et al [24]	preop ERCP + LC Vs LC + LECBD Postop ERCP + LC Vs LC + LECBD	Single-stage management is equivalent to two-stage management but requires fewer procedures. However, patient's condition, operator's expertise and local resources should be taken into account in making treatment decisions.
Alexakis et al [25]	LC + (LECBD or ERCP) Vs LC + (preop ERCP or postop ERCP)	Outcomes after one-stage laparoscopic/endoscopic management of bile duct stones are no different to the outcomes after two-stage management.
Wang et al [26]	Preop ERCP + LC Vs LC + ERCP	With regard to the stone clearance and overall complication rates, preoperative endoscopic sphincterotomy is equal to intraoperative endoscopic sphincterotomy in patients with gallbladder and common bile duct stones. However, intraoperative endoscopic sphincterotomy is associated with a reduced incidence of ERCP-related pancreatitis and results in a shorter hospital stay.
Dsari et al [27]	LC + LECBD Vs LC + preop ERCP LC + LECBD Vs LC + ERCP	There is no significant difference in the mortality and morbidity between laparoscopic bile duct clearance and the endoscopic options. There is no significant reduction in the number of retained stones and failure rates in the laparoscopy groups compared with the pre-operative and intra-operative ERCP groups. There is no significant difference in the mortality, morbidity, retained stones, and failure rates between the single-stage laparoscopic bile duct clearance and two-stage endoscopic management. More randomized clinical trials without risks of systematic and random errors are necessary to confirm these findings.
Li et al [28]	Preop ERCP + LC Vs LC + LECBD LC + LECBD Vs LC + postop ERCP Preop ERCP + LC Vs LC + ERCP Preop ERCP + LC Vs LC + postop ERCP	Different management approaches of concomitant gallbladder stones and CBD stones were equivalent in efficacy. However, one-stage management had the advantage of providing a shorter hospital stay.
Vatteretto et al [29]	LC + ERCP Vs preop ERCP + LC	There was insufficient evidence to determine the effects of the laparoscopic-endoscopic rendezvous versus preoperative endoscopic sphincterotomy techniques in people undergoing laparoscopic cholecystectomy on mortality and morbidity. The laparoscopic-endoscopic rendezvous procedure may lead to longer operating times, but it may reduce the length of the hospital stay when compared with preoperative endoscopic sphincterotomy followed by laparoscopic cholecystectomy. However, no firm conclusions could be drawn because the quality of evidence was low or very low. If confirmed by future trials, these data might re-design the scenario of treatment of this condition, albeit requiring greater organizational effort. Future trials should also address issues such as quality of life and cost analysis.
Liu Z et al [30]	LC + ERCP Vs preop ERCP + LC	The one-step procedure of LC with ERCP 1EST is superior to the two-step procedure for treatment of patients with cholecysto-choledocholithiasis regarding to the reduced hospital stay and inhibited occurrence of pulmonary infections. Compared with two-step procedure, one-step procedure of LC with ERCP1 EST may be a superior option for cholecysto-choledocholithiasis patients treatment regarding to hospital stay and pulmonary infections.
Bansal VK et al [31]	LC + LECBD Vs LC + preop ERCP	Single- and two-stage management for uncomplicated concomitant gallbladder and CBD stones had similar success and complication rates, but the single stage strategy was better in terms of shorter hospital stay, need for fewer procedures, and cost effectiveness.

LC: laparoscopic cholecystectomy; LECBD: laparoscopic common bile duct exploration; ERCP: endoscopic retrograde cholangiopancreatography; CBD: common bile duct; RCT: Randomized clinical trials

the risk of CBS stones extraction failure after LC and most clinicians preferred the extraction of the detected CBD stones using a preoperative or intraoperative procedure. Chang et al in a randomized controlled trial including 59 patients with acute biliary pancreatitis, divided the patients considered to be at high risk of residual CBD stones (size stone ≥ 8 mm on admission US, total bilirubin serum ≥ 1.7 mg / dL, or serum amylase ≥ 150 U/L on the 4th day of hospitalization) in two groups: "preoperative ERCP + LC" and "LC + postoperative ERCP" [32]. Thirty patients were randomized to the preoperative ERCP arm (group I) and 29 patients to the postoperative ERCP arm (group II). In group II, postoperative ERCP was required for only 7/29 patients (24%). Therapeutic failure was 10% in both groups. Mean hospital stay was significantly longer in group I (11.7 days vs 9 days). The average total cost was statistically higher in Group I ($9426 Vs $7798, p=0.049). The authors concluded that in patients with mild to moderate pancreatitis without angiocholitis, a postoperative ERCP and extraction of CBD stones is associated with a shorter hospital stay, lower cost, no need for additional treatment modalities with a significantly lower failure rate compared to the preoperative ERCP group.

Based on the literature data, no conclusions could be drawn.

One-stage treatment versus two-stages treatment

LC with LECBD versus LC with preoperative ERCP

Three meta-analysis [20-22] and two reviews articles [27,28] had compared these two techniques. Considering the mortality endpoint, all meta-analysis [20-22] and reviews articles [27,28] concluded to the absence of statistically significant difference with varying mortality rates between 0.4% and 2.3%. No statistically significant difference between the two groups "LC + LECBD" and "LC + ERCP preop" was reported in terms of morbidity in the three meta-analysis [20-22] and in one review article [28]. The other review article [27] reported a higher morbidity rate in the "LC + LECBD" group (44/285 (15%) vs. 37/295 (13%); OR 1.28; 95% CI 0.80 - 2.05) without a statistically significant difference. Regarding the endpoint of successful stone extraction rate, two meta-analysis [20,22] and a review article [28] concluded that was no difference between the two techniques. Only one relatively recent meta-analysis [21], published in 2015, reported a higher stones extraction success rate in the "LC + LECBD" group (OR = 1.56, 95% CI: 1.05 to 2.33, P = 0.03). There was no statistically significant difference in two meta-analysis [20,22], with 1600 and 741 patients respectively, in terms of operating time. Only the meta-analysis of Zhu et al. [21] including 1130 patients reported a shorter operative time in the group of "LC + LECBD" (MWD = -16.78, 95% CI: -27.55 to-6.01, P=0.002). Two meta-analysis [20,21] and a review article [28] reported a statistically significant difference between the two groups in terms of hospital duration in favor of the "LC + LECBD" group while a single meta-analysis [22], published in 2016 and including 1600 patients, did not show any difference (MWD = 1.31 days, P=0.17). There was no statistically significant difference between the two groups in terms of conversion rate in three meta-analysis [20-22].

Current data allow us to conclude with a Level I of evidence and a Grade A of recommendation to the absence of difference between the groups "LC + LECBD" and "LC + ERCP preop" in terms of mortality, morbidity and conversion rate. Given the discordance of the results, in terms of successful extraction rate of stones, operating time and duration of hospital stay between the publications selected we cannot conclude to the superiority of one technique over the other.

LC with LECBD versus LC with postoperative ERCP

A meta-analysis [20] and two reviews articles compared these two techniques. The mortality was evaluated in the two literature reviews without a statistically significant difference. Concerning morbidity, the difference was not statistically significant in these three publications with a rate of 14% to 17.3% [20,27,28]. A meta-analysis and review article [20,28], including 166 patients each one, had compared the success rate of stone extraction. There was no statistically significant difference reported for this endpoint. The duration of the hospital stay was evaluated in a meta-analysis and a review article [20,28], the results were in favour of the arm "LC + LECBD" without being statistically significant. The conversion rate and operative time judgment criteria were compared in only a meta-analysis. No statistically significant difference was found between the two groups in terms of conversion rate (3.4 vs 15%, OR: 0.27, 95% CI: 0.01-9.45) and the operation time (126.5 vs. 124.4 min, P = 0.90).

Current literature data allow us to conclude with a Level I evidence and a Grade A recommendation to the absence of difference between the groups "LC + LECBD" and "LC + ERCP postop" in terms of mortality, morbidity, the success

rate of stones extraction, duration of hospital stay and conversion rate.

LC with intraoperative ERCP vs LC with preoperative ERCP

Two meta-analysis [20,23], two reviews articles [28,29] and two randomized clinical trials [30,31] had compared these two groups. Concerning the morbidity rate, the difference was not statistically significant in two meta-analysis [20,23] and a review article [29]. Regarding mortality, no difference between the two groups was found in the two meta-analysis [20,26], a review article [28] and two randomized clinical trials [30,31]. These results were consistent with those of a recent review article, published in 2018, including 257 patients, reporting a lower morbidity rate in the "LC + intraoperative ERCP" arm without reaching the significance level (RR 0.59, 95 % CI 0.29 to 1.20, participants = 434, the tests = 4, I^2 = 28%). Only the meta-analysis of Gurusamy et al [23] reported a statistically significant difference in favour of the group "LC + intraoperative ERCP " (RR 0.37, 0.18 to 0.78, P=0.009). Two meta-analysis [20,23], two reviews articles [28,29] and two randomized clinical trials [30,31] had compared these two groups in terms of the success rate of stones extraction. No statistically significant difference was reported.

Regarding the operative time, a meta-analysis [20] and a review article [29] concluded that the operative time was longer in the "LC + intraoperative ERCP" arm. This difference was not statistically significant. Only one randomized clinical trial [30] concluded that the operative time was longer in the "LC + preoperative ERCP" arm with no statistically significant difference. Similarly, the meta-analysis of Wang et al [26], including 631 patients, did not report a difference in term of operative time. Two meta-analysis [20,26] and a single randomized clinical trial [31] had compared the conversion rate between the two groups. No statistically significant difference was objectified. The length of hospital stay was compared between the two groups in two meta-analysis [20,23], two reviews articles [28,29] and two randomized clinical trials [30,31]. They all concluded that there is a statistically significant difference in favour of the "LC + intraoperative ERCP " arm with a shorter hospital stay. The cost of treatment was compared by a single randomized clinical trial [31]. It was higher in the "LC + preoperative ERCP " arm with no statistically significant difference (p=0.002).

Current literature data allow us to conclude with a Level I of evidence and a Grade A of recommendation to the absence of difference between the groups "LC + intrarop ERCP " and "LC + preop ERCP " in terms of mortality, morbidity and rate of success stones extraction.

The " LC + intraoperative ERCP" is better in terms of hospital stay duration and conversion rate (level I of evidence and grade A of recommendation).

One-stage versus two-stage treatment

Two meta-analysis [24,25] and a review article [27] compared treatment in one time versus two-stage treatment. Regarding the morbidity, the difference was not statistically significant in two meta-analysis [24,25] and a review article [27]. The mortality was evaluated in these three studies [24,25,27]. No statistically significant difference was objectified. Two meta-analysis [24,25] had compared these two groups in terms of stones extraction success rate. No statistically significant difference was found. Only one meta-analysis [24] has evaluated the operative time with no statistically significant difference (MWD = 12.14, 95% CI: -1.83 to 26.10, P = 0.09). Concerning the conversion rate, two meta-analysis [24,25] did not show any difference between the two groups. Lu et al [24] in a meta-analysis, including 707 patients, did not report a difference between the two groups in terms of duration of hospital stay (MD = 0.99, 95% CI: -1.59 to 3.57, P = 0.45).

Current data allows us to conclude with a Level I of evidence and a Grade A of recommendation to the absence of difference between single-stage treatment and two-stage treatment in terms of mortality, morbidity, the success rate of stone extraction, the conversion rate and the duration of hospital stay.

DISCUSSION

This systemic review provides some guidance as to the preferred approach. However, it remains difficult to identify the best mini-invasive approach for the management of CBDS with concomitant gallbladder stones. It is clear from the results of this study that these therapeutic armatures were safe and sure.

As concern single-stage treatment, the LC could be associated with an intraoperative LECBD or intraoperative ERCP. The evidence provided by this review suggests that both of these approaches would appear comparable. The differences were essentially in term of conversion rate and

coast. LECBD was correlated with a higher conversion rate. This is could be due to the reason that ERCP is more frequently used. In the other side, LECBD is more technically challenging It should be performed by trained surgeons, whereas most gastroenterologists trained in ERCP [19]. The second difference was the coast of treatment. This endpoint was evaluated by a single meta-analysis [19] containing only four trials from China. Hospital cost in the laparoscopic group was less than in the ERCP group. In addition, in case of small CBD stones, it seems to be more suitable to use LECBD via the trans-cystic duct approach. Choledochotomy is likely more successful for retrieving sizable stones or stones that are impacted and require lithotripsy. LECBD is also more suitable for those stones that need multiple ERCP sessions for removal [28]. However, choledochotomy is contraindicated in the setting of a small size CBD. This choledochotomy could be the reason of stricture after exploration.

As concern the two-stage treatment, the LC could be associated with preoperative ERCP or a postoperative ERCP. We found only one RCT in the literature [32] with a low number of participants. This is probably due to the risk of CBS stones extraction failure after LC. Many authors preferred the extraction of CBD stones preoperatively or intraoperatively. These procedures avoid unnecessary post-operative ERCP in case of spontaneous CBD stones clearance by trans papillary stones migration. This eventuality was reported in 76% of patients included in the RCTs of Chang et al. [32].

As concern the choice of a single-stage or two-stages mini-invasive treatment, current data allow us to conclude that was no difference between the LC with LECBD and preoperative ERCP followed by a LC in terms of mortality, morbidity and conversion rate. However, given the discordance of the results, in terms of successful extraction rate of stones, operating time and duration of hospital stay between the publications selected that was not possible to conclude to the superiority of one technique. Prasson et al [22], in a meta-analysis of 14 RCT, concluded that one- and two-stage management had similar efficacy and safety in terms of CBD stone clearance rate, mortality, morbidity, operating time, hospital stay, and retained stone rate. One-stage management may reduce additional procedure. Other studies found that the LC with intraoperative ERCP or LECBD had the advantage of providing a shorter hospital stay [28]. Zhu et al. [21] concluded that a single-stage (LC + LECBD) management approach treats both gallstones and CBDS is cost-effective with a shorter hospital stay, and it may even achieve a higher CBDS clearance rate than the two-stage (ERCP + LC) approach when an experienced laparoscopic surgeon utilizes it. LECBD is a safe and effective treatment option for concomitant gallstones and CBDS in terms of long-term and short-term outcomes because it avoids the morbidity and mortality associated with ERCP and maintains the integrity of the sphincter of Oddi. With more refinement in equipment and technique, it is possible that LECBD may become the gold standard for stones treatment. Certainly, ERCP is irreplaceable because it can release biliary obstructions in acute suppurative obstructive cholangitis patients in a timely fashion, which causes the patients to tolerate the surgery [21]. Finally, the appropriate therapy sequence depends on many conditions: morphology of the CBD stones, location in the CBD, number of CBD stones, operator experience, and the availability of expertise.

CONCLUSIONS

One-stage or two-stages procedures of managing gallstones and CBD stones were feasible and safe even in challenging cases [33]. They were equivalent in efficacy. The appropriate therapy depends on many criteria's: availability of appropriate technical support, patient's condition, operator experience and CBD diameter. Surgeons must be aware of the different difficulties to perform a successful and safe CBD stones extraction. They should be judicious in their use of different techniques.

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