



Laparoscopic common bile duct exploration, does real life practice mirror the evidence?

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Choledocholithiasis is identified in approximately 10–15% of the population with symptomatic cholelithiasis (1,2). Treatment is indicated, particularly when symptomatic, as the consequences may be serious. Ensuing complications from choledocholithiasis include pain, cholangitis, pancreatitis, hepatic abscess and in chronic obstruction, biliary cirrhosis and portal hypertension (1,3). The primary challenge in the management of choledocholithiasis associated with gallstones is to select the best strategy with respect to success, safety profile and cost effectiveness. In the minimally invasive era, the management of choledocholithiasis in those with an intact gallbladder has evolved from open procedures to primarily endoscopic and laparoscopic techniques. These techniques may either occur concurrently or separately respective to the cholecystectomy. Two-stage procedures include endoscopic retrograde cholangiopancreatography (ERCP) either preceding or following the laparoscopic cholecystectomy whereas single stage procedures may be either endoscopic such as intra-operative ERCP or laparoscopic, utilising transcystic exploration (TCE) or laparoscopic choledochotomy for laparoscopic common bile duct stone extraction (LCBDE) (4). Currently, the optimal approach to concomitant gallstones and CBD stones is still unclear, despite current data suggesting equivalent efficacy and safety amongst the various techniques available (4,5). However, single stage management has the advantages of requiring fewer procedures (5-8), shorter length of stay (6,9), and is considered to be more cost-effective (6,10), although some cost-modelling analyses

suggest two-stage procedures are more cost-effective than LCBDE (11,12). Importantly, LCBDE has the advantage of offering a single procedure, as well as preserving the biliary sphincter, avoiding risks associated with ERCP and sphincterotomy and it may also be associated with a lower risk of recurrent choledocholithiasis (13,14). The risk of recurrent choledocholithiasis in long-term follow-up after ERCP is reported to be up to 10% [Sugiyama and Atomi (15)]. It has been postulated that sphincterotomy causes bacterobilia leading to increased deconjugation of bile salts which reduces their solubility resulting in an increased risk of stone formation within the common bile duct (14).

Despite the apparent attractiveness of LCBDE, there remains significant variation amongst surgeons managing choledocholithiasis worldwide. Recently, Gilsdorf *et al.* (16) analysed the patterns of management in a large retrospective population-based study across multiple North American institutions in an integrated healthcare setting. The researchers analysed the outcomes, comparing LCBDE to ERCP (both pre- and post-operative) in 1,961 patients with a diagnosis of choledocholithiasis between 2008 and 2013. They found a lower mean total number of procedures, length of stay and hospital costs in the LCBDE group; findings similar to others (6-10). Clearance of all stones with the initial intervention was highest in the post-cholecystectomy ERCP group. Readmission, mortality and specific complication rates were all similar regardless of the treatment pathway. However, despite the reported benefits of single stage management with LCBDE, it was

performed in only a minority of cases (28%) and ERCP remained the preferred technique for attempts at CBD clearance. Furthermore, selection of single-stage versus two-stage management varied greatly between hospitals and was independent of the number of patients with choledocholithiasis treated by each hospital. Importantly, there are a number of limitations to the study by Gilsdorf *et al.* (16). First as the authors acknowledge, it is retrospective and therefore the treatments chosen are likely to have been subject to selection bias. Second, the authors failed to record the operative time for their respective procedures. It is possible that the longer operative time of LCBDE in a theatre compared to ERCP in endoscopy has associated hidden costs such as increased delay in the scheduling of other emergency cases. This was not considered in the cost comparison between the groups.

The authors conclude single-stage management is underused and may offer better value in a cost-contained environment. However, another interpretation of their data may be that the preference for ERCP may represent rational decision making in a “real-world” environment, where despite enthusiasm for LCBDE even in centres who performed a relatively high number of LCBDE, many patients with choledocholithiasis are still being managed with ERCP. Factors identified by the authors for abandoning LCBDE in their study included the availability of ERCP, lack of equipment and lack of comfort performing LCBDE. The preference for ERCP as demonstrated by Gilsdorf *et al.* (16) despite its apparent disadvantages, has been reported by other investigators. In a survey of American General Surgeons, the majority preferred preoperative ERCP for preoperatively suspected choledocholithiasis, conversely a minority would proceed to LCBDE for choledocholithiasis discovered intraoperatively (17). As a further example of the significant variation in therapeutic approaches, even within a single country, we have previously shown substantial state to state variation in the rate of LCBDE and ERCP in Australia (18). Interestingly even in states with high utilization of LCBDE, in particular Queensland, more than 50% of patients still required ERCP which closely matches the rate of ERCP in those hospitals, reported by Gilsdorf *et al.* (16) to be most committed to LCBDE.

There are a number of potential reasons to account for the discrepancy between the apparent benefits of LCBDE and its limited uptake in practice. Firstly, many of these studies comparing LCBDE and ERCP come from experienced laparoscopic centres and therefore the external

validity and application of these results to other centres requires caution. Furthermore, many studies examining LCBDE excluded patients from high risk population groups such as American Standards Association status 3–4, acute cholangitis, gallstone pancreatitis and anatomy precluding attempts at LCBDE. These group represents a significant proportion of patients with concomitant choledocholithiasis. Similarly, the evidence demonstrating equivalent ductal clearance rates is largely derived from the elective setting in which there may have been more capacity for extended operating times. In contrast, studies conducted in the emergency setting report more varied clearance rates ranging from 46–97% for LCBDE suggesting that ductal clearance may be more challenging in this environment (19–21). Finally, the type of LCBDE technique may have a significant impact on the likelihood of success (20,21), primarily employed transcystic techniques, whilst (19) utilised choledochotomy in a significant proportion of cases with much higher success rates reported. Whilst associated with higher clearance rates, laparoscopic choledochotomy is time-intensive and requires more advanced laparoscopic skills (22–24). Therefore, this technique may not be transferable outside of experienced laparoscopic centres, particularly in the emergency setting where operating time is often constrained by other competing interests. In summary, it would appear that many surgeons have made the assessment that the avoidance of ERCP and sphincterotomy does not merit the effort associated with LCBDE.

Clearly, single-stage management is the ideal option if it can be achieved efficiently and with a high degree of success. However, if cost containment, (rather than preserving the ampulla) is the major factor driving decision making, another approach to CBD stones may be the laparoscopic placement of a transcystic trans ampullary stent with the patient discharged the next day with a view to an outpatient ERCP for definitive clearance of the common bile duct. Indeed, endobiliary stents can be successfully deployed in a high proportion of cases without adding significantly to operative time. Furthermore the presence of laparoscopically placed endobiliary stent facilitates subsequent endoscopic biliary access (25). With recent advances in endoscopic management of difficult biliary stones such as large balloon dilatation, the vast majority of patients can have their bile duct cleared during a single ERCP. However, LCBDE and laparoscopic endobiliary stenting with post-operative ERCP have never been compared head to head with respect to operative time, length of stay and overall cost. This area

would be worthy of further study.

In the minimally invasive era, multiple therapeutic techniques are available to manage choledocholithiasis with the gallbladder *in-situ*. In the literature, multiple comparative studies comparing single-stage and two-stage techniques have demonstrated equivalence with respect to outcomes and ductal clearance rates with the reported advantages of LCBDE considered to be reduced length of stay and overall costs. Despite the evidence, the management of symptomatic common bile duct stones in the era of laparoscopic cholecystectomy remains controversial and practice varies widely with limited adoption of LCBDE by surgeons outside of experienced laparoscopic centres. The ongoing widespread reliance on ERCP, as reported by Gilsdorf *et al.* (16), may reflect the fact that many surgeons have decided that the time and effort required both to master the techniques of LCBDE and then to practice them assiduously enough to achieve a high level of ductal clearance are not worth the reduction in cost and length of stay and the theoretical benefits of preserving the sphincter of Oddi. If cost containment is considered a key consideration, it may be more effective to promote laparoscopic placement of an endobiliary stent, followed by outpatient ERCP rather than continuing to emphasise LCBDE which many surgeons clearly do not favour.

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