

Management of Common Bile Duct Stones in the Era of Laparoscopic Surgery

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1. INTRODUCTION

In the era of laparoscopic surgery, the best approach for common bile duct (CBD) stones remains a matter of debate. When CBD exploration was performed by laparotomy, prospective randomized trials did not show the superiority of preoperative endoscopic sphincterotomy (ES) over CBD surgery for stones.^{1,2} The advent of laparoscopic surgery led to a dramatic change in the approach of CBD stones treatment. Indeed, because of an obvious lack of expertise in laparoscopic surgery, surgeons elected to detect and treat preoperatively CBD stones by ES since they considered laparoscopic CBD exploration as an unduly, complex, and demanding procedure. It is worth mentioning that this approach requires several sessions of anesthesia and cumulates the risk of ES and laparoscopic cholecystectomy. In addition, it increases the cost.^{3,4} About 15 years after the introduction of laparoscopic cholecystectomy, one has to wonder whether or not this policy should be still applied. Indeed, in patients fit for surgery, laparoscopic CBD stones extraction seems to be superior to the association of ES and laparoscopic cholecystectomy.⁵ The reported incidence of CBD stones found during laparoscopic cholecystectomy ranges from 3 to 10%.^{6–8} It is unclear whether an asymptomatic choledocholithiasis requires treatment. Furthermore, it is well established that small stones may pass through the ampulla of Vater.⁹ Moreover, it is not clear what stone size precludes transpapillary migration into the duodenum nor which criteria will predict complications of pancreatitis or cholangitis if CBD stones are not treated. Therefore, it is generally recommended to treat CBD stones whenever detected. Theoretically, CBD stones can be treated with or without cholecystectomy. Moreover, if cholecystectomy is performed this could be done before, during or after CBD stones extraction. The purpose of this chapter is to try to clarify these different points.

2. CBD STONES EXTRACTION WITHOUT CHOLECYSTECTOMY

Treatment of CBD stones without cholecystectomy appears to be the most simple non surgical approach. But what happens when the gallbladder has been left in situ? In two randomized trials in which open CBD surgery was compared to ES, 20% of the patients managed expectantly after ES needed cholecystectomy during follow-up.^{10,11} These results have been confirmed by Boerma et al.¹² These authors showed in a prospective randomized

trial that after ES in patients fit for surgery, a wait-and-see policy concerning cholelithiasis was not valid. Indeed, with a median follow-up of 30 months, patients treated for CBD stones by ES without cholecystectomy had, in 50% of cases, biliary symptoms. Eighty percent of these patients had finally a cholecystectomy, suggesting that such a policy could not be recommended.

3. CBD STONES DETECTION

Identifying patients with CBD stones remains a diagnostic challenge. Indeed, CBD stones detection can be realized preoperatively or intraoperatively. In addition, in the preoperative period, screening can be systematic or selective. A systematic preoperative detection of CBD stones by ERCP has been assessed by Neuhaus et al.¹³ In a prospective study, they showed that 11% of the patients undergoing ERCP had CBD stones. Seventy percent of them had arguments in favor of CBD stones before ERCP on clinical and biological grounds, whereas 30% did not. According to the results of this study, there is no strong argument which allows to propose a systematic preoperative detection of CBD stones. Should this policy be selective? In a prospective study, Widdison et al.¹⁴ assessed the place of selective preoperative ERCP. In their work, ERCP was performed in patients with either abnormal liver function tests, CBD diameter superior 3–8 mm, a past history of jaundice or an episode of acute pancreatitis. CBD stones were present in less than 50% of the patients except in the group of patients suffering from jaundice, in which the rate was 87%. Therefore, according to the results of this study, it is not recommended to adopt a policy of selective preoperative detection of CBD stones. In the same way, Montariol et al.¹⁵ evaluated, in a prospective study, the value of a policy of selective detection of CBD stones in patients with symptomatic cholelithiasis, but without signs suggestive of the presence of CBD stones. To be included in their study, patients were selected on the basis of a predictive score of CBD stones. Patients with a score greater than 3.5, corresponding to a risk of CBD stones superior to 25%,¹⁶ had an endoscopic ultrasonography (EUS) and an intraoperative cholangiography (IOC), while those with a score inferior to 3.5 did not, since in this population, the risk of CBD stones is estimated to be less than 5%. This study showed that when both investigations were positive, there were 5% of false positive. At the opposite, when both investigations were negative, there were no false negative. Interestingly, when the results of EUS and IOC were discordant, 86% of false negative and 100% of false positive were always due to EUS. The results of this study allowed the authors to conclude that IOC was superior to preoperative EUS for the detection of CBD stones. Finally, the best strategy is to detect CBD stones intraoperatively using IOC¹⁷ or more recently by intraoperative ultrasonography.¹⁸ This approach was validated by Huguier et al.¹⁷ in a multivariate analysis. These authors set up a formula taking into account several parameters (age of the patient, CBD diameter, size of stones, presence of a previous history of biliary colic, and cholecystitis). They showed that when the score calculated using their formula was inferior to 3.5, the probability of CBD stones was 2%. This probability was 81% when the score was superior to 5.9 and 17% when the score was comprised between 3.5 and 5.9. More recently, the use of simple predictive criteria adapted to the age of the patient has been proposed.¹⁹ In the era of laparoscopic cholecystectomy, IOC should be performed in selected cases. When CBD stones are

detected, CBD exploration should be performed and clearance obtained. In case of failure of extraction, what should be done? In other words, should the procedure be converted to laparotomy or post ES performed? In a prospective randomized trial of Rhodes et al.,²⁰ patients were randomly allocated to laparoscopic cholecystectomy and CBD stones extraction or to laparoscopic cholecystectomy followed by postoperative ES. This study showed that the rate of CBD stones clearance was similar in both groups (laparoscopic CBD stones extraction: 100% vs. postoperative ES:93%). This study suggests that in case of failure of laparoscopic CBD stones extraction, postoperative ES is an acceptable option instead of conversion to open surgery.

4. INDICATIONS OF ES

Although, ES may lead to life threatening complications such as bleeding (2%), acute pancreatitis (2%), duodenal perforation (1%), and late papillotomy stenosis (15%),²¹ however, in medical practice there are still good indications of preoperative or postoperative ES. Namely when the patient had already undergone a cholecystectomy. Basically, preoperative ES should be proposed in patients with a past history of complex upper abdominal surgery: for instance a Bilioth II procedure; severe extra hepatic portal hypertension in which CBD exposure can be hazardous and the source of brisk bleeding. Finally, in the presence of acute cholecystitis. In such a situation, in some cases, inflammatory alterations of the hepatic pedicle may render impossible CBD exposure and therefore, represent a good indication of postoperative ES.

5. SURGICAL GUIDELINES

The laparoscopic treatment of CBD stones is safe.^{8,22–24} In essence, CBD stones can be removed via the cystic duct or through choledochotomy. Cystic duct extraction which is preferentially used by a large majority of surgeons^{25–27} is a very simple procedure. This approach is limited by the anatomic features of the cystic duct, especially when it joins downwards the CBD in the retro-duodenal area or on its left aspect. Furthermore, it carries several disadvantages. Indeed, bile duct injury can be created while dilating the cystic duct, in order to allow the introduction of the flexible endoscope or if the CBD stone is larger than the lumen of the cystic duct. Moreover, because of the angulation of the cystic duct at the junction with the CBD, in most cases, upper biliary endoscopy appears to be technically impossible and can lead to a higher rate of retained stones, although in some studies, the retained stone rate is inferior to 1%.^{25,28} The transcystic approach is indicated in case of small stones in a limited number with a large cystic duct with a modal implantation. It is worth mentioning that in the transcystic duct approach, stones smaller than 3 to 4 mm in size can often be flushed through the ampulla into the duodenum, which is facilitated by relaxation of the sphincter of Oddi using intravenous glucagon.²⁹ When this method fails, a Dormia basket can be passed through the cystic duct and into the CBD to extract stones. If attempts at transcystic Dormia basket extraction fail, a flexible endoscope should be inserted to remove the stones under direct vision. The flexible endoscope is passed through

a midaxillary port. The flexible endoscope is placed into the CBD through the cystic duct under direct vision. The lumen of the duct is then visualized by infusing saline through the operator channel. Under visual guidance, the tip of the Dormia basket is advanced beyond the stone and opened. As the Dormia basket is pulled backwards and rotated the stone is ensnared and extracted by retrieving synchronously the flexible endoscope and the Dormia catheter. The success rate of the transcystic approach varies from 69 to 92%,^{23,25,26} but concerns selected patients.

At the opposite, although choledochotomy is technically more complex, however, this approach allows thorough endoscopic exploration of the bile ducts. Choledochotomy should be done vertically, since it can be lengthened without any difficulty and is more easy to close than a horizontal opening. Complete clearance of the bile ducts under choledochoscopic guidance allows to close the CBD without any biliary drainage.^{20,26,30} CBD closure should be performed using continuous or interrupted resorbable stiches. This approach allows to shorten the postoperative hospital stay. CBD stricture following choledochotomy has never been reported.^{26,31,32} In practice, if transcystic approach fails or is not indicated, CBD is opened. Main indications for laparoscopic choledochotomy are stones which are multiple, large or located in the upper biliary tree above the cystic duct implantation. The length of CBD opening is adapted to allow the introduction of the 5 mm flexible endoscope and removal of the largest stone. Stones are removed under endoscopic visualization. The routine use of operative choledochoscopy has allowed to decrease the rate of retained stone.^{33,34} In the presence of an impacted stone, laser lithotripsy should be used, in order to avoid postoperative ES.²² The success rate of CBD stones extraction is up to 97%.²⁵

In case of failure of CBD stones extraction or if doubt persists for a possible retained stone, a thin drain (Escat drain) is placed into the CBD via the cystic duct in order to decompress the CBD. CBD opening is closed subsequently. A postoperative cystic tube cholangiography is performed and ES is realized if CBD stone is detected. The transcystic drain is then closed and removed more rapidly than a T tube drain.

6. PRESENT RECOMMENDATIONS AND CONCLUSION

In patients fit for surgery, in most cases, there is no place for preoperative investigations to ascertain the presence of stones in the CBD. IOC is indicated in selected patients. Selection of patients is based on simple preoperative criteria. Finally, postoperative ES should be performed in patients with retained stone or when laparoscopic CBD stones extraction has failed. According to the results of the literature,³⁵ the success rate for ES (median 92%) and duct clearance (median 91%), the complication rate (median 8%) mortality rate (median 1%), recurrence stone rate (2–16%) which increases according to the length of follow up, are not superior to those obtained by the laparoscopic CBD approach. All efforts must be paid to simplify the preoperative investigations and to adopt an operative protocol using the laparoscopic approach, taking into account the size of the cystic duct, its anatomy features, the size and the number of CBD stones.

Nowadays, the strategy adopted in laparoscopic surgery for CBD stones is similar to that used during the era of open surgery, suggesting that in teams involved in laparoscopic surgery, the so-called learning curve of CBD stones extraction belongs to the past.

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Liver and Pancreatic Diseases Management

Habib, N.; Canelo, R. (Eds.)

2006, VIII, 143 p., Hardcover

ISBN: 978-0-387-28548-1