

Current status of laparoendoscopic rendezvous in the treatment of cholelithiasis with concomitant choledocholithiasis

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Abstract

The current evidence in favor of the laparoendoscopic rendezvous is promising and demonstrates the main advantages of this technique in regard to shorter hospital stay and selective cannulation of the common

bile duct (CBD), avoiding thus the inadvertent cannulation of the pancreatic duct. In addition, in the rendezvous technique the contrast medium is not injected retrogradely as during the traditional endoscopic retrograde cholangiopancreatography (ERCP), when the medium accidentally could be injected under pressure into the pancreatic duct. The RV technique minimizes that risk. Both these main advantages of the RV technique over the classic ERCP, are related with a significant lower incidence of hyperamylasemia and post-ERCP pancreatitis, compared with the traditional two stage procedure. Choledocholithiasis is present in 10% to 15% of patients undergoing cholecystectomy. To date, the ideal management of CBD stones remains controversial. Prospective randomized trials have shown that laparoscopic management of the CBD stones, as a single stage procedure, is the most efficient and cost effective method of treatment. Laparoendoscopic rendezvous has been proposed as an alternative single stage approach. Several studies have shown the effective use of this technique in the treatment of CBD stones by improving patient compliance and clinical results including shorter hospital stay, higher success rate and less cost. The current evidence about the use of this technique presented in this review article is promising and demonstrates the main advantages of the procedure.

Key words: Common bile duct stones; Laparoendoscopic rendezvous; Endoscopic retrograde cholangiopancreatography; Cholecysto-choledocholithiasis; Laparoscopic cholecystectomy

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Core tip: This is a review article for the laparoendoscopic rendezvous technique - a promising single stage procedure in the treatment of patients with cholecysto-

choledocholithiasis. In this article we highlight the main advantages of the procedure compared to the traditional two stage approach [preoperative endoscopic retrograde cholangiopancreatography (ERCP) followed by laparoscopic cholecystectomy]. These advantages include the selective cannulation of the common bile duct and the avoidance of high pressure injection of the contrast medium into the pancreatic duct. Both factors are directly related with the pathogenesis of post-ERCP pancreatitis. The current evidence demonstrated in this paper is in favor of the laparoendoscopic rendezvous, however, this technique is still not widely accepted.

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INTRODUCTION

Choledocholithiasis is present in 10%-15% between patients undergoing cholecystectomy. The overall incidence of unsuspected common bile duct (CBD) stones is approximately 4%^[1,2]. Once discovered, CBD stones should be removed in order to prevent several complications, such as acute pancreatitis, jaundice and acute ascending cholangitis and hepatic abscess. The obvious aim in the treatment of patients with choledocholithiasis is to achieve ductal clearance with the less number of interventions and least morbidity^[3].

Over the past few decades, there have been significant improvements in both the diagnosis and treatment of patients with gallstone disease and CBD stones. Before the introduction of laparoscopic cholecystectomy, patients with cCBD stones underwent CBD exploration by open surgery. Although a high success rate of CBD clearance was achieved, the significant morbidity and mortality of a major abdominal surgery remained. Since then, many alternative treatment modalities have been developed. Especially, the introduction and evolution of endoscopic retrograde cholangiopancreatography with endoscopic sphincterotomy, which gradually became the gold standard for the treatment of biliary duct stones^[1,4].

Nowadays, laparoscopic cholecystectomy (LC) is the treatment of choice for patients with symptomatic cholelithiasis. The introduction of LC as a minimal invasive procedure, has also changed the therapeutic strategies for the management of choledocholithiasis. To preserve the minimal invasive concept of management, a number of options have been proposed, including two and single step management. Thus, the therapeutic approaches today vary, depending on availability experience and expertise and include open or laparoscopic CBD exploration, various combinations of LC

and endoscopic retrograde cholangiopancreatography (ERCP) and combined laparo-endoscopic procedures^[5].

Due to this wide variation of treatment options the ideal management of cholelithiasis and concomitant choledocholithiasis remains controversial. In the open surgery era, prospective studies compared the use of ERCP and endoscopic sphincterotomy (ES) before open cholecystectomy to open cholecystectomy with surgical exploration of the CBD. In these trials, a shorter hospital stay for patients underwent preoperative ES was reported, as well as, lower mortality and morbidity rates in patients over 60 years of age after ES^[6,7]. In the era of LC, the combination of preoperative ERCP and LC is considered the treatment of choice for concomitant cholecysto-choledocholithiasis and remains the most frequently applied strategy at most hospital centers^[8].

LAPAROSCOPIC CBD EXPLORATION

Since its introduction, ERCP has mainly been used preoperatively for the diagnosis of choledocholithiasis. However, a high incidence of negative ERCPs was recorded, raising the fear of major complications in patients who do not actually need the procedure. In addition to morbidity many patients were dissatisfied because of the need to have two procedures, an endoscopic for the clearance of CBD and a laparoscopic one for the removal of gallbladder. Thus, there was a desire from many surgeons to provide a single stage approach for the treatment of choledocholithiasis^[4,9]. The evolution of laparoscopic surgery stimulated the application of laparoscopic approach for the management of CBD stones. Skilled laparoscopic surgeons proposed LCBD exploration as an effective alternative for the treatment of choledocholithiasis.

Prospective randomized trials comparing LCBD exploration with two stage procedures, have shown that laparoscopic management of the CBD stones, as a single stage procedure, is associated with equivalent success rate and patient morbidity but shorter hospital stay and lower cost^[10,11].

Two, recently published meta-analyses, included studies comparing one stage vs two stage management of CBD stones. One stage procedures included LC and LCBDE or intraoperative ERCP, while two stage procedures included LC preceded or followed by ERCP. These meta-analyses showed that both clinical practices have similar clinical outcomes^[12,13]. Two studies in the meta-analysis published by Alexakis *et al*^[12] reported cost analysis. Both found a significantly higher costs for the two stage management.

Laparoscopic CBD exploration is a logical extension of LC. However it has not gained popularity amongst the surgical community. LCBDE, either through the transcystic route or through choledochotomy, is a technically demanding procedure and requires clinical experience in the open technique and advanced laparoscopic skills^[2,10]. Thus, it has remained a procedure for experienced and/or enthusiastic laparo-

scopic surgeons. Apparently, scientific data from centers of excellence cannot not always be extrapolated into everyday clinical practice.

LAPAROENDOSCOPIC RENDEZVOUS FOR THE TREATMENT OF CHOLEDOCHOLITHIASIS

Despite the evidence from prospective randomized trials suggesting the superiority of the so-called one-stage management of cholecysto-choledocholithiasis in regards to the hospital stay and cost effectiveness, two-stage techniques, mainly preoperative ERCP followed by LC, are currently being used by most clinicians in their daily practice^[10,11].

ERCP is associated with a failure rate to cannulate the ampula of Vater ranging from 4%-18% of cases while post ERCP pancreatitis is a major complication which can follow inadvertent pancreatic cannulation and contrast injection^[14-16]. The laparoendoscopic rendezvous (LERV) procedure, which is a single stage combined laparoscopic and endoscopic approach to CBD stone treatment, represents an effective alternative to the sequential treatment which, in addition, minimizes the risk of inadvertent pancreatic duct cannulation and subsequently the risk of pancreatitis. Several studies during the past decades have shown the effectiveness of this technique as a single stage procedure in the treatment of CBD stones by improving patient compliance and leading to shorter hospital stay, higher success rate and lower cost. However, organization and technical problems have not facilitated the diffusion of this method^[5,9,17,18].

The combined laparoendoscopic treatment was first described by Deslandres *et al.*^[19] in 1993. However, the method didn't encountered wide interest immediately. After the years, many authors used this approach in their practice. In 2009, La Greca *et al.*^[20] published the first review of original papers and case reports including a total number of some 800 patients, describing the results and comparing the LERV treatment with the other two main available treatment options. The overall effectiveness of the LERV technique was 92.3%. The duration of the endoscopic part of the procedure ranged from 8 to 82 min (mean 35 min), while the time of the whole LERV procedure was 40 to 360 min with a mean time of 104 min. The conversion rate to open surgery was 4.7%. The overall mortality and morbidity rates were 0.37% and 5.1% respectively. The mean hospital stay of patients treated with the LERV procedure was 3.9 d (range from 2 to 51 d)^[20].

The advantages of the LERV approach were outlined by most authors of the reviewed studies. The most important suggested advantages compared with the LCBD exploration, which represents the single stage management rival, were the reduced operation time and lower technical difficulties. On the other hand, the main clinical advantages in comparison with the

more popular two stage treatment (ERCP followed by LC) is the lower incidence of complications (especially pancreatitis), the higher success rate and the reduced hospital stay^[20].

LAPAROENDOSCOPIC RENDEZVOUS AND POST-ERCP PANCREATITIS

The incidence of the post-ERCP pancreatitis ranges between 1% to 14%^[21,22]. Multiple cannulation attempts have been described as an iatrogenic risk factor for post-ERCP pancreatitis. One of the most important technical factors in the concept of the LERV technique is that it facilitates the endoscopic procedure by the insertion of a guide-wire through the cystic duct and CBD into the duodenum ensuring thus elective CBD cannulation and avoiding the inadvertent cannulation of the pancreatic duct. This technical advantage provided by laparoendoscopic RV is of paramount importance, especially in cases with anatomical variations and difficult papilla cannulation^[1,8].

Another important mechanical factor related to the pathogenesis of post-ERCP pancreatitis is the volume and high pressure of contrast medium injected by the endoscopist inadvertently into the pancreatic duct, during canulation of the papilla of Vater. Using the LERV technique the contrast medium is injected by the surgeon through the cystic duct avoiding thus the direct injection into the pancreatic duct^[15,16].

In a recent study, LERV has been compared with standard ERCP at the same stage after the completion of LC. In this prospective randomized trial no case of post-ERCP pancreatitis was reported in either arm. However, during standard ERCP the risk of inadvertent pancreatic duct cannulation still exists, since selective cannulation of the bile duct is not ensured by the insertion of the guide-wire, as in the case of LERV^[23].

Two CRTs in which LERV compared with the traditional two stage procedure reported lower serum amylase levels in patients treated with the LERV technique^[8,24]. A statistically significant higher medium amylase value recorded by Tzovaras *et al.*^[24] in their study for the group of patients who underwent therapeutic ERCP followed by LC. La Greca *et al.*^[25] recorded a statistically significant reduction in serum amylase levels, in patients treated with rendezvous technique compared to ERCP/ES treatment. The authors concluded that the effectiveness and safety of the RV technique is mostly depended on the antegrade injection of the contrast medium by the surgeon through the cystic duct^[25].

A statistically significant lower incidence of acute post-ERCP pancreatitis was recorded in two controlled randomized trials comparing the laparoendoscopic technique with the traditional two stage treatment^[1,26]. All three meta-analyses, published to date confirmed the statistical significance of the lower post-ERCP pancreatitis rates in favor of the LERV technique^[27-29]. The assessment of the overall ERCP/ES related complications in two of three meta-analyses, also confirmed

a statistically significant difference favoring the RV approach. However, when these complications were separately assessed in a subgroup analysis, no differences were found in the incidences of bleeding, perforation, cholangitis, cholecystitis and gastric ulcer.

EFFECTIVENESS OF THE LAPAROENDOSCOPIC RENDEZVOUS TECHNIQUE

It has been demonstrated that the LERV technique is an attractive option for the treatment of patients with CBD stones. It offers an advantage in selective cannulation of the CBD especially in cases of difficult papilla cannulation and where ERCP has already failed to provide a reliable therapeutic solution.

Tzovaras *et al.*^[30] used the LERV technique for the treatment of 22 patients who had at least one failed attempt of ERCP because of the presence of anatomic variations, mainly papillary diverticula or deemed unable to cooperate for a classic ERCP. Selective CBD cannulation achieved in all but two in whom the guidewire could not advance through cystic duct, however, the procedure completed using the classic retrograde way of ERCP intraoperatively^[30].

In their controlled randomized study, Morino *et al.*^[8], proceeded with the rendezvous technique in 9 patients, initially randomized to the two stage approach, in whom ERCP failed to be performed. The treatment completed successfully in 8 patients using the laparo-endoscopic approach, indicating the use of the LERV technique as a safe and relatively easy way to cannulate selectively the CBD in patients in whom ERCP has failed^[8].

La Greca *et al.*^[20] reported a higher overall effectiveness of the LERV technique regarding the CBD clearance compared to either preoperative ERCP or laparoscopic CBD exploration^[20]. In controlled randomized trials comparing the LERV technique with the two stage treatment, the success rates of CBD stones clearance were similar for both treatment approaches^[1,8,24,26]. However, as reported by Wang *et al.*^[29] in their meta-analysis, the success rate of CBD cannulation was significant higher for the rendezvous technique than the sequential treatment (RR = 2.54, 95 %CI: 1.23-5.26; $P = 0.01$)^[29].

LAPAROENDOSCOPIC RENDEZVOUS TECHNIQUE AND TOTAL HOSPITAL STAY

Obviously, the laparoendoscopic rendezvous as a single stage procedure is related with shorter hospital stay, comparing with the traditional two stage treatment. Four RCTs recorded statistically significant reduced hospital stay for patients treated with the LERV technique, comparing with the two stage approach^[1,8,24,26]. Two meta-analyses confirmed the total hospital stay was

significantly shorter with the RV technique compared with the sequential treatment^[27,29]. This is mainly because a minimum of 24-48 h waiting period is required to ensure that no post-ERCP complication has occurred, before proceeding to LC in the two stage approach. It is difficult if not impossible this time interval to be reduced and this is a clear disadvantage of the two stage approach.

DISCUSSION

The LERV technique is a combined surgical and endoscopic procedure and it has been proposed as an alternative, single stage approach, for the treatment of patients with cholecysto-choledocholithiasis. This technique, did not reach wide acceptance immediately, because it requires the availability of surgical and endoscopic teams in the operating room. La Greca *et al.*^[20] presented the main disadvantage of the LERV technique to be logistics and organizational problems for an operation requiring the presence of two teams. Lella *et al.*^[1] considered this technique even more difficult to perform in the emergency setting. However, Tzovaras *et al.*^[24] concluded that the LERV could be effective and safe even in the urgent setting, including emergency cases in their study^[24]. Obviously, in the era of minimal invasive surgery, any possible logistic problems should be resolved making the LERV technique available in the treatment of cholecysto-choledocholithiasis and its complications improving clinical results and patient's discomfort.

In comparing the laparoendoscopic approach with the sequential treatment, it should be mentioned that this technique ensures elective CBD cannulation, avoiding thus the inadvertent cannulation of the pancreatic duct. In addition, in the LERV technique the contrast medium is not injected retrogradely as during the traditional ERCP, when the medium accidentally could be injected under pressure into the pancreatic duct. The LERV technique minimizes that risk. Both these main advantages of the LERV technique over the classic ERCP, are related with a significant lower incidence of hyperamylasemia and post-ERCP pancreatitis, compared with the traditional two stage procedure^[27-29].

The CBD clearance rate is an important outcome for the treatment of patients with CBD stones, leading in reduction of conversion rates to open surgery, which is associated with higher morbidity. The LERV technique is associated with at least equally high rates regarding overall CBD clearance compared to the traditional two stage approach, although it is associated with significantly higher success rate of CBD cannulation and lower number of procedures required for complete clearance. This technical advantage could be applied in clinical practice, especially in difficult papilla cannulation making it much easier for the endoscopist.

LERV is related with an additional operating time of approximately 30-45 min to be performed compared with the single laparoscopic cholecystectomy stage of

the sequential treatment. However, it saves more or less similar time in the endoscopic suite, where ERCP is performed as a separate procedure in a sedated but usually not anesthetized patient. Moreover, the extra time which represents the additional time needed for the performance of cholangiography and insertion/advancement of the guide wire into the duodenum would be balanced in case that intraoperative cholangiography is routinely used during LC^[24].

Despite the aforementioned advantages of LERV there is some concern about the distention due to insufflation of the stomach and small intestine during the endoscopic part of the procedure. The use of a special bowel desufflator to decrease bowel distention or a laparoscopic small bowel clamp placement across the first loop of jejunum, have been proposed to overcome this problem. It has been also suggested to perform as much as possible dissection of the gallbladder during the laparoscopic part before the beginning of the endoscopic part of the procedure^[8,24].

Laparoendoscopic rendezvous is an attractive alternative for the treatment of patients with cholecysto-choledocholithiasis. The current evidence in favor of the LERV is promising and demonstrates the main advantages in regard to shorter hospital stay and selective cannulation of the CBD. The concept of the RV technique contributes in avoiding the main mechanisms of iatrogenic pancreatic damage, leading in lower incidence of post-ERCP pancreatitis. LERV requires basic laparoscopic equipment and skills; The only additional laparoscopic skill is the ability to perform an intraoperative cholangiogram, however, at an extra cost of increased operating time^[24]. Despite the general improvement of skills in the last years, LERV is still considered as the least invasive approach for the treatment of cholecysto-choledocholithiasis^[31]. However, the availability of the LERV nowadays is limited in most hospital centers, where the choice of the best approach for the treatment of patients with CBD stones is based on the institutional availability and expertise of their surgical and endoscopy teams. It seems that the lack of cooperation between the two teams, still does not facilitate the diffusion of the LERV procedure.

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