

Transcystic versus transcholedochal laparoscopic common bile duct exploration: Choosing the right approach – A Case Series

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Case Report

ABSTRACT

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Laparoscopic common bile duct exploration (LCBDE) is a relevant therapeutic option in managing cholecysto-choledocholithiasis. The success of this procedure is highly dependent on selecting an appropriate method, either transcystic or transcholedochal. Intraoperative choledochoscopy proves its importance in evaluating the condition of the choledochal duct and sphincter of Oddi. In this case series, we report 2 cases of patients with complaints of right upper abdominal pain and jaundice. Both patients were diagnosed with multiple cholecysto-choledocholithiasis at Dr. Sardjito Hospital, Yogyakarta. The interventional measures applied to both patients were transcystic and transcholedochal exploration. In the first patient, the transcystic method was chosen because the cystic duct was widening up to 9 mm in diameter. While in the second patient, the transcholedochal method was taken because the diameter of the cystic duct was still within normal limits. The duration of surgery in transcystic surgery was shorter than in transcholedochal surgery, with a time ratio of 129 minutes versus 162 minutes. Postoperatively, both patients were discharged on the second day after the procedure, and both experienced recovery without any significant complications. Overall, LCBDE has been shown to be safe to perform. The one-stage surgical approach has been shown to reduce the risk of complications, cost, and duration of treatment required. The choice between the transcystic or transcholedochal method should be based on each patient's clinical condition.

Laparoskopi eksplorasi duktus koledokus adalah pilihan terapi yang relevan dalam penanganan kolesistokoledokolithiasis. Keberhasilan tindakan ini sangat tergantung pada pemilihan metode yang sesuai, baik transkistik maupun transkoledokal. Koledoskopi intraoperatif membuktikan pentingnya dalam mengevaluasi kondisi duktus koledokus dan sfingter Oddi. Dalam rangkaian kasus ini, kami melaporkan 2 kasus pasien dengan keluhan nyeri pada perut bagian kanan atas dan mengalami ikterus. Kedua pasien didiagnosis kolesistokoledokolithiasis multipel di RSUP Dr. Sardjito Yogyakarta. Tindakan intervensi yang diterapkan pada kedua pasien adalah eksplorasi transkistik dan transkoledokal. Pada pasien pertama, metode transkistik dipilih karena terdapat pelebaran pada duktus sistikus hingga mencapai diameter 9 mm. Sementara pada pasien kedua, metode transkoledokal diambil karena diameter duktus sistikus masih dalam batas normal. Durasi operasi pada tindakan transkistik lebih singkat dibandingkan dengan transkoledokal, dengan perbandingan waktu sekitar 129 menit versus 162 menit. Pascaoperasi, kedua pasien diperbolehkan pulang pada hari kedua setelah tindakan dilakukan, dan keduanya mengalami pemulihan tanpa adanya komplikasi yang signifikan. Secara keseluruhan, laparoskopi eksplorasi duktus koledokus telah terbukti aman dalam pelaksanaannya. Pendekatan operasi satu tahap terbukti mampu mengurangi risiko komplikasi, biaya, serta durasi perawatan yang dibutuhkan. Pemilihan antara metode transkistik atau transkoledokal sebaiknya didasarkan pada kondisi klinis masing-masing pasien.

INTRODUCTION

Choledocholithiasis can cause serious complications such as cholangitis, pancreatitis, obstructive jaundice, biliary colic, and liver abscess.^{1,2} The estimated incidence of cholecysto-choledocholithiasis, accompanied by cholecystitis in adults, ranges from 10% to 15%.³ Notably, choledocholithiasis can be categorised into two main types: primary stones, which originate within the common bile duct and are primarily composed of brown pigment or calcium bilirubin; and secondary stones, which form in the gallbladder and then migrate to the common bile duct, encompassing cholesterol and black pigment stones.⁴

The surgical approach to choledocholithiasis has witnessed swift advancements, particularly with the rise of laparoscopy as the preferred method for cholecystectomy. Consequently, the application of laparoscopy in managing choledocholithiasis has gained paramount importance.¹ The utilisation of laparoscopy for cholecysto-choledocholithiasis proves to be both secure and efficient, offering a viable option for elective as well as emergent surgical interventions. These advancements have notably improved the overall management of this condition.⁵

The treatment approach for cholecysto-choledocholithiasis has undergone a transformative shift, now encompassing a singular procedure, laparoscopic cholecystectomy, promptly succeeded by an examination of the common bile duct. Within the realm of laparoscopic exploration for cholecysto-choledocholithiasis, two distinct methods prevail: transcystic laparoscopic exploration and transcholedochal exploration.⁶ This unified approach to managing cholecysto-choledocholithiasis exhibits notably reduced morbidity and mortality rates in comparison to the previously favoured two-stage operation.⁷ Before the advent of the consolidated laparoscopic technique, a two-stage process was commonplace, involving initial endoscopic retrograde cholangiopancreatography (ERCP) and sphincterotomy, followed by a subsequent cholecystectomy in the second stage.⁸ This historical context underscores the considerable progress made in the field of cholecysto-choledocholithiasis management.

The choice of the transcystic laparoscopic surgical technique is particularly suited for cases

displaying cystic duct dilatation. Alternatively, in instances where cystic duct stenosis or a cystic duct of normal dimensions is evident, the transcholedochal laparoscopic approach is favoured.⁹ Within the laparoscopic surgical context, procedures such as intraoperative cholangiography and intraoperative choledochoscopy are routinely conducted to ascertain the presence of any residual stones within the common bile duct. Applying intraoperative cholangiography and intraoperative choledochoscopy to explore choledocholithiasis is safe and effective.^{10,11} Dormia basket is used to remove stones with the help of intraoperative cholangiography or intraoperative choledochoscopy.²

In this series of case reports, two patients with cholecysto-choledocholithiasis underwent laparoscopic cholecystectomy and exploratory choledocholithiasis with intraoperative choledochoscopy. The objective of documenting these 2 cases is to contribute to the deliberation regarding selecting an appropriate surgical technique for managing cholecysto-choledocholithiasis. This case report serves the purpose of initiating dialogue, particularly in hospitals that face constraints in accessing ERCP, a circumstance commonly encountered in regional hospitals across Indonesia. Given the predominant availability of laparoscopy, the primary intention is to highlight the viability of performing both the transcystic and transcholedochal laparoscopic techniques within a single surgical stage. This approach holds significant potential for streamlining treatment strategies and enhancing patient care, especially in settings where comprehensive facilities may be limited.

CASE DESCRIPTION

Case 1

A 44-year-old man presented with a primary complaint of pain in the upper right abdomen, accompanied by jaundice. The patient had been experiencing this pain for three months prior to admission to the Dr. Sardjito Hospital, Yogyakarta. The pain was described as radiating through to the back. Furthermore, the patient noticed yellow eyes, tea-coloured urination, and pale stools two weeks before admission. The patient also complains of frequent nausea and itching. Physical examination revealed icteric sclera and positive Murphy's sign. Laboratory assessments indicated a haemoglobin

level of 13.8 g/dL, leukocyte count of 10.4×10^3 /mL, total bilirubin level of 8.12 mg/dL, direct bilirubin level of 5.04 mg/dL, serum glutamic oxaloacetic transaminase (SGOT) level of 58 U/L, and serum glutamic pyruvic transaminase (SGPT) level of 84 U/L. The results of the abdominal magnetic resonance cholangiopancreatography (MRCP) examination showed widening of the right and left intrahepatic bile duct (IHBD), widening of the common bile duct (15 mm), cystic duct (9 mm) (Figure 1A), and multiple cholecystocholedocholithiasis (Figure 1B).

A laparoscopic cholecystectomy involving four ports was conducted (Figure 2A), followed by exploring choledocholithiasis via a transcystic approach employing a choledochoscope (Figure

2B). The indication of the transcystic approach in this patient was the dilatation of the cystic duct (9 mm) (Figure 1A). The stone was extracted with a Dormia basket (Figure 2C) and irrigated with normal saline through a nasogastric tube (NGT). Evaluation with a choledochoscope to the common bile duct proximal and distal to the sphincter of Oddi did not reveal any remaining stones (Figure 2D). Multiple instances of cholecystocholedocholithiasis were identified during this examination. Following the procedure, the patient was discharged in good health on the second day and maintained regular outpatient follow-ups. Notably, two weeks post-surgery, the patient's total and direct bilirubin levels were within the normal range.

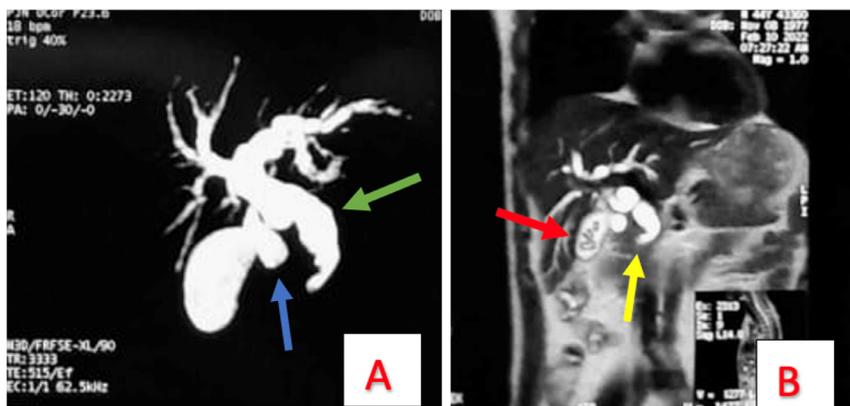


Figure 1. MRCP examination. (A) Bilateral IHBD dilatation, widening of the cystic duct (blue arrow), and common bile duct (green arrow); (B) Multiple cholelithiases (red arrows), choledocholithiasis (yellow arrows)

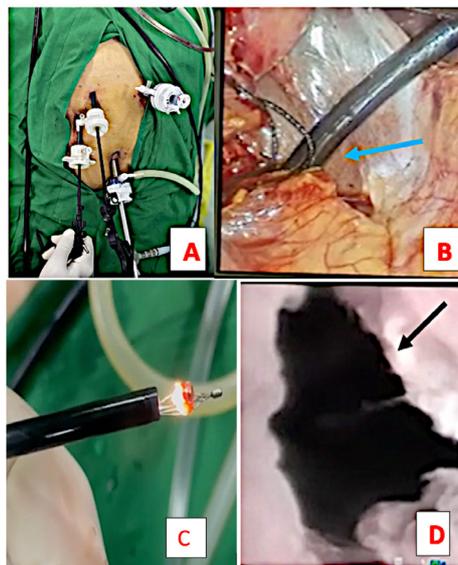


Figure 2. Laparoscopic cholecystectomy procedure. (A) Laparoscopic port; (B) Exploration with a choledochoscope through a cystic duct (blue arrow); (c) Stone extraction with Dormia basket (red arrow); (D) Evaluate with a choledochoscope to the sphincter of Oddi (black arrow)

Case 2

A 45-year-old man presented a primary complaint of intermittent pain in the upper right abdomen that radiated to his back. This discomfort persisted for three years. Over the past year, the pain had become more frequent in occurrence. The patient also experienced pruritus, yellowing of the eyes, tea-coloured urine, and pale stools. On physical examination, icteric sclera was observed and the Murphy sign test was positive. Laboratory investigations revealed a haemoglobin level of 15.1 g/dl, a leukocyte count of $5.8 \times 10^3/\text{mL}$, total bilirubin of 7.3 mg/dL, direct bilirubin of 4.41 mg/dL, SGOT level of 98.8 U/L, and SGPT level of 165 U/L. The results of the abdominal MRCP examination indicated no dilatation of the right and left IHBD. The diameters of both the common bile duct and the cystic duct were within the normal range. Furthermore, the MRCP revealed the presence of cholecysto-choledocholithiasis (Figure 3).

During the surgical procedure at Dr. Sardjito Hospital, Yogyakarta, laparoscopic cholecystectomy was performed, followed by exploring choledocholithiasis through a transcholedochal

approach employing a choledochoscope. The choice of the transcholedochal method was determined by the absence of cystic duct dilatation. The stone was successfully extracted using a Dormia basket and the area was irrigated with normal saline through a NGT. Evaluation using a choledochoscope, encompassing both the proximal and distal segments of the common bile duct positioned before and after the sphincter of Oddi, revealed no evidence of remaining stones. Multiple instances of cholecysto-choledocholithiasis were identified during this evaluation. Following the procedure, the patient was discharged satisfactorily on the second day and continued to receive outpatient care at the polyclinic. Subsequent evaluations indicated that the total and direct bilirubin levels had returned to normal levels.

DISCUSSION

The development of the laparoscopy application is very useful in managing cholecysto-choledocholithiasis. Preoperative diagnostics are very helpful in determining the surgical technique but also help the surgeon in the

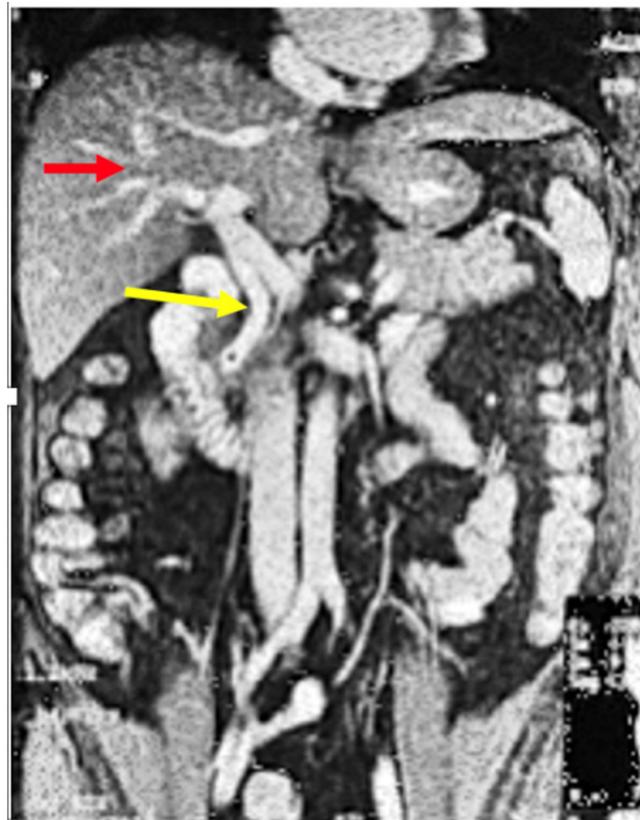


Figure 3. Abdominal MRCP examination; red arrow (no right/left IHBD dilatation); yellow arrow (normal diameter of the common bile duct and cystic duct)

operation.¹⁰ Clinical examination, laboratory studies (serum bilirubin, liver function test), and radiology are used to identify patients with cholecysto-choledocholithiasis.⁴ Radiology examinations are transabdominal ultrasound, computed tomography (CT) scan, and MRCP. Magnetic resonance cholangiopancreatography has been the gold standard for the detection of choledocholithiasis.⁴ Diagnostic for our two patients was confirmed with MRCP.^{4,10}

Many factors influence stone formation in the biliary tract and bladder. The majority of cases of choledocholithiasis are secondary stones. Some causative factors are saturation of bile fluid or cholesterol, chemical and physical changes of bile fluid, sedimentation of cholesterol, cholesterol malfunction, and infection. Cholesterol stones are the most common cause of stones in the biliary tract and gallbladder (60.4% cholelithiasis and 42.7% choledocholithiasis). Most choledocholithiasis was located at the distal common bile duct and duodenal ampulla.^{4,11,12,13} Choledocholithiasis frequently gives rise to symptoms such as abdominal pain, obstructive jaundice, cholangitis, and pancreatitis. In the cases of the two patients we documented, they complained of pain in the upper right abdomen alongside jaundice. These findings are in line with a prior study that reported similar patterns: 63.3% of cases exhibited right upper abdominal pain, 20% presented with jaundice, and 16.7% displayed a combination of symptoms, specifically right upper abdominal pain accompanied by jaundice.^{1,14}

The cystic duct and common bile duct dilatation in patients with cholecysto-choledocholithiasis was revealed on MRCP examination. In the first case, the diameter of the common bile duct was 15 mm and the diameter of the cystic duct was 9 mm. The study by Grubnik et al. reported that the mean common bile duct diameter in patients with choledocholithiasis is 10.2 mm.^{15,16} Transcystic approach was used because of the cystic duct dilatation. The transcystic approach also has advantages, as reported by Bove et al. such as keeping the common bile duct intact, preventing the risk of common bile duct stricture, reducing bile leakage, faster operating time, and reducing post-operative complications.⁸

The minimum diameter of the common bile duct for safe laparoscopic transcholedochal is controversial. Crawford et al. have asserted that

a diameter exceeding 8 mm is considered safe. In our second patient, the recorded diameter measured 8 mm. Transcholedochal approach was chosen because the cystic duct in our second patient was normal (3 mm). It is worth noting that choledochotomy incisions within the transductal context entail a risk of subsequent strictures. To mitigate this concern, Elghamry et al. utilised a longitudinal incision to prevent such strictures. Following a similar rationale, a longitudinal incision was also implemented in our patient. The transcholedochal approach notably serves as an effective strategy for addressing various scenarios, including impacted stones, larger stones, instances with multiple stones, cases where stone extraction via ERCP has failed (owing to factors such as failed cannulation, distal common bile duct stricture, and the presence of large, multiple, or impacted stones), as well as unsuccessful stone removal through the cystic duct.^{16,17,18,19}

The surgical procedure duration for the first patient employing the transcystic approach was notably shorter than that for the transcholedochal technique (129 minutes compared to 162 minutes). This observation aligns with findings from earlier investigations by Helmy et al. who reported an average operation duration spanning 90 to 220 minutes.¹

In both cases presented, we achieved successful LCBDE (through transcystic and transcholedochal approaches) without encountering any morbidity or mortality. The post-operative condition of the patients was satisfactory, with no reported complaints, allowing them to be discharged on the second day after the surgery, followed by scheduled outpatient monitoring. Existing studies have reported a success rate of 85-95% for laparoscopic common bile duct exploration, along with morbidity rates ranging from 4-16% and mortality rates of 0-2% (references 20-22). This becomes particularly relevant for hospitals with limited ERCP resources, especially in the context of regional hospitals in Indonesia, where only laparoscopy is available. Implementing both transcystic and transcholedochal techniques within a single surgical stage offers significant advantages. This consolidated approach not only reduces the surgical risks and associated complications, but also reduces costs and shortens the hospital stay period. While this study provides valuable insights by examining two cases, it is

important to acknowledge its limitations due to the small sample size. Therefore, further study with a larger cohort is warranted to yield more robust technical conclusions.

CONCLUSION

Laparoscopic procedures for cholecysto-choledocholithiasis can be effectively conducted within a single stage, ensuring safety. This approach mitigates surgical risks and contributes to cost reduction and shorter hospital stays. The choice between transcystic and transcholedochal surgical techniques depends on the patient's specific condition.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported. Both patients have given informed consent and agreed to publication.

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