



REVISTA DE
GASTROENTEROLOGÍA
DE MÉXICO

www.elsevier.es/rgmx



ORIGINAL ARTICLE

Intraoperative choledochoscopy usefulness in the treatment of difficult biliary stones[☆]



A. Cuendis-Velázquez^{a,*}, M.E. Rojano-Rodríguez^a, C.E. Morales-Chávez^a,
A. González Angulo-Rocha^b, E. Fernández-Castro^b, I. Aguirre-Olmedo^a,
M.F. Torres-Ruiz^a, J.C. Orellana-Parra^a, L.E. Cárdenas-Lailson^a

^a División de Cirugía General y Endoscópica, Hospital General Dr. Manuel Gea González, Mexico City, Mexico

^b Servicio de Endoscopia Gastrointestinal, Hospital General Dr. Manuel Gea González, Mexico City, Mexico

Received 23 January 2013; accepted 21 October 2013

Available online 2 June 2014

KEYWORDS

Cholangitis;
Choledocholithiasis;
Endoscopic Surgical
Procedure;
Choledochoduodenos-
tomy

Abstract

Background: Choledocholithiasis presents in 5–10% of the patients with biliary lithiasis. Numerous treatment algorithms have been considered for this disease, however, up to 10% of these therapeutic procedures may fail. Intraoperative choledochoscopy has become a useful tool in the treatment of patients with difficult-to-manage choledocholithiasis.

Objectives: To determine the usefulness of intraoperative choledochoscopy in the laparoendoscopic treatment of difficult stones that was carried out in our service.

Patients and methods: A cross-sectional study was conducted. The case records were reviewed of the patients that underwent intraoperative choledochoscopy during biliary tree exploration plus laparoscopic choledochoduodenal anastomosis within the time frame of March 1, 2011 and May 31, 2012, at the Hospital General Dr. Manuel Gea González. Transabdominal choledochoscopies were performed with active stone extraction when necessary, followed by peroral choledochoscopies through the recently formed bilioenteric anastomosis. The data were analyzed with descriptive statistics and measures of central tendency.

Results: The mean age was 71 years, 57% of the patients were women, and the ASA III score predominated. Active extraction of stones with 7 to 35 mm diameters was carried out in 4 of the cases and the absence of stones in the biliary tract was corroborated in all the patients. The mean surgery duration was 18 minutes (range: 4 to 45 min).

Conclusions: Choledochoscopy is a safe and effective minimally invasive procedure for the definitive treatment of difficult stones.

© 2013 Asociación Mexicana de Gastroenterología. Published by Masson Doyma México S.A. All rights reserved.

[☆] Please cite this article as: Cuendis-Velázquez A, Rojano-Rodríguez ME, Morales-Chávez CE, González Angulo-Rocha A, Fernández-Castro E, Aguirre-Olmedo I, et al. Utilidad de la coledoscopia transquirúrgica en el tratamiento de litos biliares difíciles. Revista de Gastroenterología de México. 2014;79:22–27.

* Corresponding author: Calzada de Tlalpan #4800 Col Sección XVI CP 14080 Delegación Tlalpan, Mexico City.
Phone: +4000 3000; +3329; fax: +4000 3000.

E-mail address: ftocuendis@hotmail.com (A. Cuendis-Velázquez).

PALABRAS CLAVE

Colangitis;
Coledocolitiasis;
Procedimiento
Endoscópico
Quirúrgico;
Coledocoduodeno-
anastomosis

Utilidad de la coledoscopia transquirúrgica en el tratamiento de litos biliares difíciles**Resumen**

Antecedentes: La coledocolitiasis se presenta en el 5 al 10% de los pacientes con colecistitis litiásica. Se han considerado múltiples algoritmos de tratamiento para esta afección; sin embargo, hasta el 10% de estos procedimientos terapéuticos pueden ser fallidos. La coledoscopia transoperatoria se ha convertido en una herramienta útil en el tratamiento de pacientes con coledocolitiasis de difícil manejo.

Objetivos: Determinar la utilidad de la coledoscopia transoperatoria en el tratamiento laparo-endoscópico de litos difíciles en nuestro servicio.

Pacientes y métodos: Se realizó un estudio transversal, en el que se revisaron los expedientes de los pacientes sometidos a coledoscopia transquirúrgica durante exploración de la vía biliar más coledocoduodeno-anastomosis laparoscópica, en el periodo comprendido entre el 1 de marzo del 2011 y el 31 de mayo del 2012 en el Hospital General Dr. Manuel Gea González. Se realizaron coledoscopias transabdominales, con extracción activa de litos en caso necesario, y posteriormente coledoscopias transorales a través de la anastomosis bilioentérica recién formada. Se analizaron los datos con estadística descriptiva y medidas de tendencia central.

Resultados: La edad promedio fue de 71 años, 57% mujeres, con predominio de puntuación ASA III. Se realizó la extracción activa de litos con diámetros de 7 a 35 mm en 4 de los casos y en el total se corroboró ausencia de litos en la vía biliar. La duración promedio del procedimiento fue de 18 min (rango 4 a 45 min).

Conclusiones: La coledoscopia es un procedimiento eficaz y seguro para el tratamiento definitivo de los litos difíciles, en el ámbito de los procedimientos de invasión mínima.

© 2013 Asociación Mexicana de Gastroenterología. Publicado por Masson Doyma México S.A. Todos los derechos reservados.

Introduction

Choledocholithiasis presents in 5 to 10% of patients with biliary lithiasis and up to 18% of patients with biliary pancreatitis. An estimated 21 to 34% of the stones spontaneously migrate from the biliary tract and up to 25 to 36% carry the risk for causing pancreatitis or cholangitis if they become obstructed. Numerous treatment algorithms have been considered, such as endoscopic retrograde cholangiopancreatography (ERCP) prior to cholecystectomy, intraoperative ERCP and postoperative ERCP. However, 5 to 10% of these procedures may fail due to access difficulty or stone extraction impossibility. Stones that are regarded as difficult are those that are larger than 15 mm, that cannot be trapped in a basket, stones that are located in the intrahepatic biliary tract, those associated with chronic biliary tract stricture, stones that are present in patients that have undergone surgeries modifying the continuity of the proximal digestive tract (Billroth II gastrectomy or gastric bypass), and those in patients with Mirizzi syndrome.¹ These conditions dramatically reduce the possibility of minimally invasive therapies. For instance, residual stones have been reported in 5 to 14% of the cases managed with laparoscopic biliary tract exploration.¹⁻³

Choledochoscopy was described for the first time in 1891 by Bakes, who designed a rigid instrument with a valve and a mirror that used a frontal light source for seeing inside the bile ducts. It was not until 1941 that McIver described a rigid optic choledochoscope equipped with an irrigation channel and an external light source. In 1965, the American Cystoscope Makers introduced the first flexible choledochoscope into the market.⁴

Today, intraoperative choledochoscopy has become a useful tool in the intraoperative treatment of patients with difficult-to-manage choledocholithiasis that undergo biliary tract exploration.⁵⁻⁷ It enables direct visualization of the stone and its active extraction with the help of balloons and baskets. In addition, it is indispensable for corroborating the absence of stones, once the procedure is over, thus ensuring 0% of residual stones.⁸⁻¹¹

The aim of this study was to determine the usefulness of intraoperative choledochoscopy in the laparoendoscopic treatment of difficult stones.

Methods

A cross-sectional study was conducted that reviewed the case records of patients that had undergone intraoperative choledochoscopy during biliary tract exploration plus laparoscopic choledochoduodenal anastomosis (LCDA) within the time frame of March 1, 2011 and May 31, 2012 at the *Hospital General Dr. Manuel Gea González*.

All the patients were admitted to the General and Endoscopic Surgery Division having had previous ERCP, with one or more of the following events: failed ERCP, choledocholithiasis recurrence, persistent cholestasis secondary to biliary tract dilation, and repeat cholangitis.

For these reasons, the surgical team decided to perform LCDA. [Table 1](#) shows a summary of the indications for this surgical procedure in these patients.

Antimicrobial administration was indicated in all the patients; it was therapeutic in 5 patients presenting with cholangitis and prophylactic in the remaining patients, given that the gastrointestinal tract is exposed in this surgery.

Table 1 Characteristics of the biliary tract and choledochoduodenal anastomosis indications in the patients.

Patient number	LCDA + intraoperative choledochoscopy indication				
	Prior episodes of cholangitis/ chole- docholithiasis	Bile duct caliber (mm)	Maximum stone diameter (mm)	Stone location	Others
Patient 1	2/5	20	20 ^a	Middle third of the choledochus	
Patient 2	1/1	35	35	Retroduodenal choledochus	
Patient 3	1/1	20, with stricture in the distal third	20	Distal third of the choledochus and right hepatic duct	
Patient 4	1/3	20	25	Left hepatic duct and confluence	
Patient 5	4/7	20	7 ^a	Middle third of the choledochus	Intradiverticular major duodenal papilla
Patient 6	1/1	20	15 ^a	Middle third of the choledochus	
Patient 7	1/1	25	22	Distal third of the choledochus and confluence	Villous adenoma in the duodenal ampulla

LCDA: Laparoscopic choledochoduodenal anastomosis; mm: millimeters

^a Successful stone extraction during the endoscopic retrograde cholangiopancreatography prior to the laparoscopic choledochoduodenal anastomosis.

Joint intraoperative management was carried out. After a laparoscopic surgical approach, intraoperative choledochoscopy was performed through an anterior longitudinal choledochotomy using an Olympus GIF-H180 gastroscope with a 9.9 mm diameter and a 2.8 mm working channel (fig. 1), introduced by way of a 12 mm laparoscopic working port.

Choledochoscopy was performed both distal and proximal to the choledochotomy, with active stone extraction through the use of a Dormia basket and endoscopic balloon (figs. 2 and 3), until the absence of stones and the complete permeability of the proximal and distal biliary tract were confirmed (figs. 4 and 5).

Once the surgical team finished the LCDA, peroral intraoperative choledochoscopy was performed through the recently formed anastomosis (fig. 6).

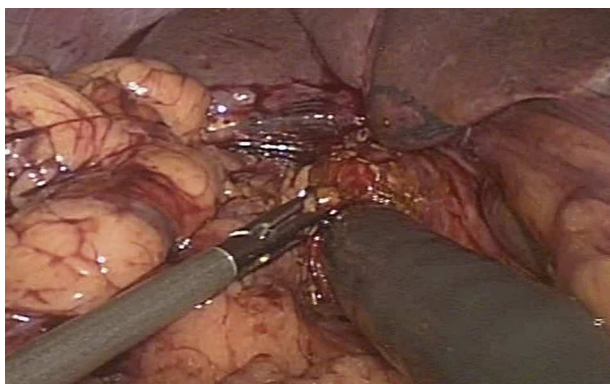


Figure 1 Laparoscopic view of the gastroscope entering the choledochotomy, through a surgical working port (trocar), by means of traction with a laparoscopic grasper.

A descriptive statistical analysis of the variables was done through measures of central tendency and dispersion according to the data distribution, using the SPSS version 17 statistical package.

Results

All the patients (n = 7) underwent peroral and transabdominal intraoperative choledochoscopy.

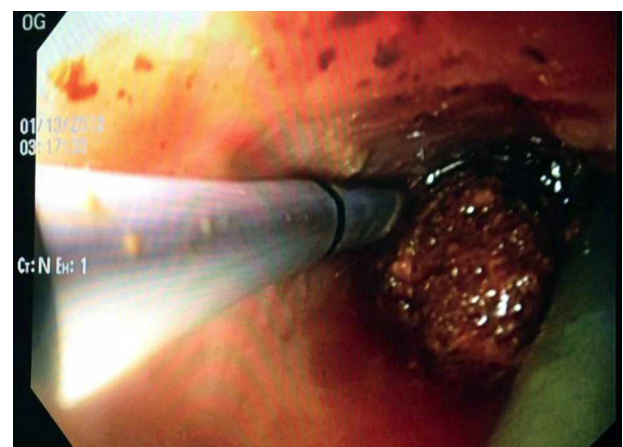


Figure 2 Intraoperative choledochoscopy. The image shows a stone located in the confluence of the biliary tract, as well as the blue endoprosthesis that was palliatively placed during the ERCP. The laparoscopic grasper with which the stone was extracted can also be seen. ERCP: endoscopic retrograde cholangiopancreatography.



Figure 3 View of an intraoperative choledochoscopy with active extraction of a large stone located in the confluence and the left hepatic duct, through an endoscopic balloon.

The mean age was 71 years (range 52-85 years), and there was a predominance of female patients (57.1%). In accordance with the Physical Status Classification established by the American Society of Anesthesiologists (ASA), one patient had an ASA II score, 5 had an ASA III score, and one had an ASA IV score. Patient comorbidities are described in Table 2.

During transabdominal choledochoscopy, active stone extraction was carried out through the use of a Dormia basket and endoscopic balloon in 4 patients, 3 of whom presented with intrahepatic lithiasis that was resolved with no complications. In the other 3 patients, the stones had been successfully removed during the preoperative ERCP. The absence of biliary tract stones was secured in 100% of the cases. The mean intraoperative endoscopy duration was 18 minutes (range 4 to 45 minutes).

In all the peroral intraoperative choledochoscopies both permeability and watertight closure of the choledochoduodenal anastomosis were secured.

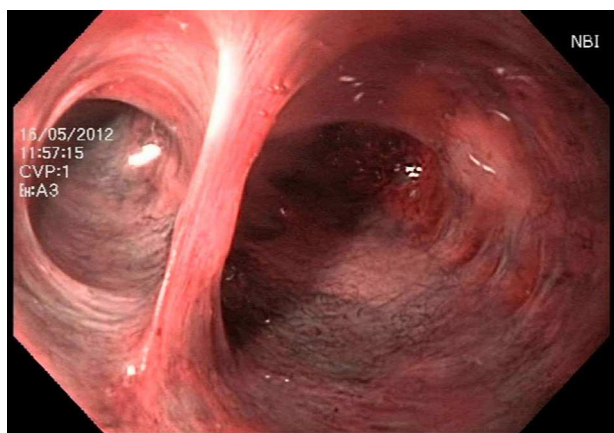


Figure 4 Endoscopic view of a transabdominal intraoperative choledochoscopy with NBI application, showing the stone-free biliary tract. NBI: narrow band image.

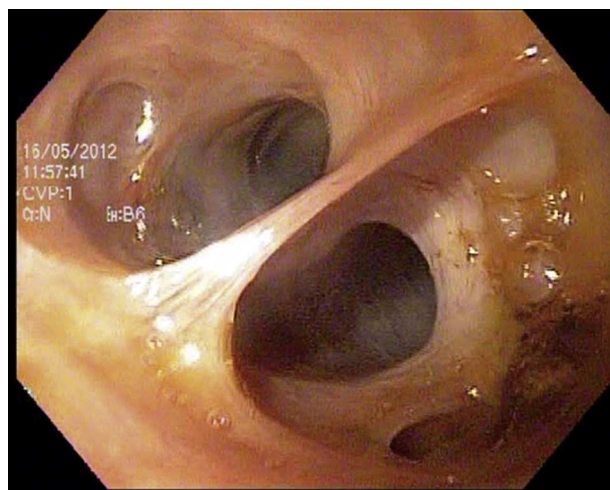


Figure 5 Endoscopic view of a peroral intraoperative choledochoscopy through the choledochoduodenal anastomosis, showing the stone-free intrahepatic biliary tract.

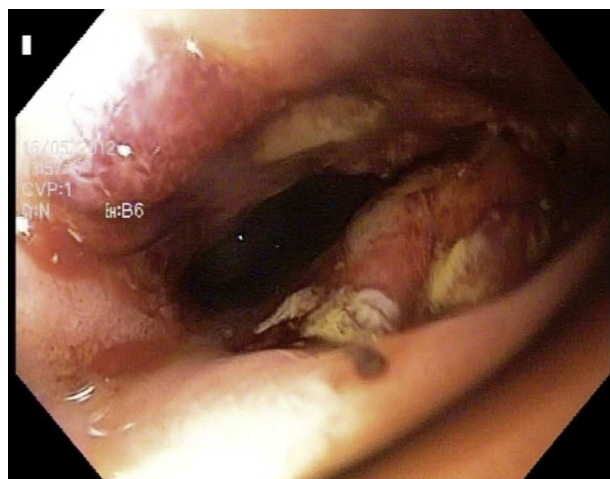


Figure 6 Immediate postoperative peroral choledochoscopy, showing the recently formed choledochoduodenal anastomosis; the biliary tract can be seen inside at the back.

No complication attributable to the laparoendoscopic procedure developed and the biochemical parameters normalized progressively (fig. 7). The mean follow-up period duration was 155 days (range 28 to 420 days).

Table 2 Comorbidities of the patients that underwent the laparoendoscopic procedure.

Comorbidities	% patients (n)
Diabetes mellitus type 2	57.4 (4)
High blood pressure	42.8(3)
Heart disease	14.2 (1)
Obesity	71.4 (5)
CVE sequelae	14.2 (1)
COPD	14.2 (1)
Others	28.5 (2)

CVE: Cerebrovascular event; COPD: Chronic obstructive pulmonary disease.

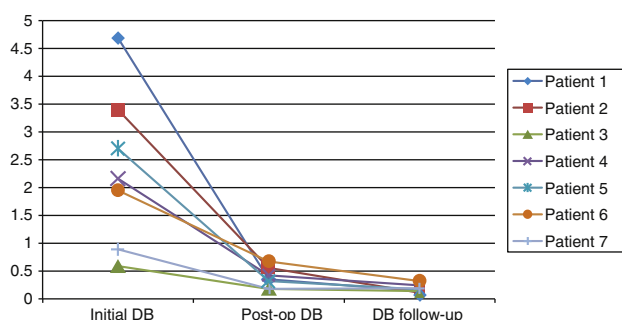


Figure 7 Descent progression of direct bilirubin in the patients; from their preoperative and immediate postoperative condition, as well as their outpatient follow-up status.

Initial DB: direct bilirubin prior to the endoscopic retrograde cholangiopancreatography, with stone extraction and endoprosthesis placement; Post-op DB: direct bilirubin after the laparoscopic choledochoduodenal anastomosis; DB follow-up: direct bilirubin in the outpatient follow-up.

Discussion

Choledochoscopy has traditionally been a desired tool by surgeons during biliary tract exploration because it turns a «blind» procedure into one of direct vision and enables the retained stone rate to be reduced to zero, while increasing diagnostic capacity.^{1,4,7,8,10,12–14} Choledochoscopy has been proposed as routine procedure in all cholecystectomies, assuming that choledocholithiasis would be found in 5 to 10% of the patients.^{9,10} Performed through the cystic duct, it is feasible in 85 to 90% of the cases and its therapeutic and technical success rates are similar. Nevertheless, this approach is limited to stones that are under 10 mm and located in the portion of the biliary tract that is distal to the cystic duct.^{11,13,15} Even though some techniques have been described for those that are proximal to the duct, none have been standardized.¹⁶

Several therapeutic algorithms have been suggested for the management of choledocholithiasis: preoperative, intraoperative, and postoperative ERCP. The first option has a therapeutic success rate of approximately 95%. The second alternative is considered to cost less and involve a shorter hospital stay, but not all centers can provide it. Postoperative ERCP implies a longer hospital stay, as well as the obvious consequences in relation to resources if there are complications associated with the endoscopic procedure or if the procedure fails.¹⁰ A previously published work by a surgical team demonstrated the advantages of LCDA for managing difficult stones.¹⁷

In the present case series, intraoperative choledochoscopy was employed to carry out active stone extraction and to corroborate the adequate cleansing of the biliary tract in a situation in which a simple laparoscopic exploration of the biliary tract would have been insufficient due to the location, size, and characteristics of the stones. As has been reported, choledochoscopy is the most effective method for treating cases presenting with difficult stones.^{7,14}

Peroral choledochoscopy by way of the anastomosis allows for the adequate diameter of the diversion and its

watertight closure to be corroborated, thus ensuring that there will be fewer complications such as leaks, fistulas, and early strictures as a consequence of the procedure.

No incident resulting from peroral choledochoscopy by way of an anastomosis was found in the literature review.

Conclusions

From our point of view, peroral and transabdominal intraoperative choledochoscopy are useful tools for the laparoscopic treatment of patients presenting with difficult-to-manage stones, given that they ensure adequate biliary tract clearance and enable the caliber and watertight closure of the anastomosis to be evaluated.

Multidisciplinary management is essential for offering decisive and definitive treatment for this complex pathology, with the benefit of a minimally invasive approach.

We recognize that the sample size of our study was a limitation, making it necessary to complement the information herein with future studies conducted on larger samples.

Financial disclosure

No financial support was received in relation to this article.

Conflict of interest

The authors declare that there is no conflict of interest.

References

1. American Society for Gastrointestinal Endoscopy. The role of endoscopy in the management of choledocholithiasis. *Gastrointest Endosc.* 2011;74:731–44.
2. Reymond MA, Chapuis N, Vala D, et al. Flexible choledochoscopy: Two years of experience. *Helv Chir Acta.* 1993;60:81–5.
3. Ming-Fang Qin, Hong-Bing Xu. Combined laparoscopic and endoscopic treatment for bile duct diseases. *Hepatobiliary Pancreat Dis Int.* 2004;3:284–7.
4. Rojas O, Vargas A, Sánchez F, et al. Coledocoscopia transoperatoria. Experiencia con 42 casos. *An Med Asoc Med Hosp ABC.* 1997;42:96–8.
5. Schwarz J, Simsa J, Pazdirek F. Our experience with peroperative choledochoscopy. *Rozhl Chir.* 2007;86:180–3.
6. Alecu L, Marin A, Corodeanu G, et al. Laparoscopic choledochoscopy. *Chirurgia.* 2003;98:175–82.
7. Rajan KV, Kate V, Ananthakrishnan N, et al. Role of operative flexible choledochoscopy in calculous biliary tract disease. *Trop Gastroenterol.* 2000;21:80–3.
8. Noble H, Norton S, Thompson M. Assuring complete laparoscopic clearance of the bile duct. *J Laparoendosc Adv Surg Tech.* 2011;21:319–22.
9. Csáky G, Bezilla J, Tóth D. Video-choledochoscopy in bile duct surgery. *Acta Chir Hung.* 1999;38:139–42.
10. Campagnacci R, Baldoni A, Baldarelli M, et al. Is laparoscopic fiberoptic choledochoscopy for common bile duct stones a fine option or a mandatory step? *Surg Endosc.* 2010;24:547–53.
11. Rojas-Ortega S, Arizpe-Bravo D, Marín López ER, et al. Transcystic common bile duct exploration in the management of patients with choledocholithiasis. *J Gastrointest Surg.* 2003;7:492–6.

12. Siddique I, Galati J, Ankoma-Sey V, et al. The role of choledochoscopy in the diagnosis and management of biliary tract diseases. *Gastrointest Endosc.* 1999;50:67–73.
13. Carroll BJ, Fallas MJ, Phillips EH. Laparoscopic transcystic choledochoscopy. *Surg Endosc.* 1994;8:310–4.
14. Grigoriu M, Palade R, Vasile D, et al. Indications and contribution of choledochoscopy in the diagnosis and treatment of biliary diseases. *Chirurgia.* 2003;98:167–73.
15. Lyass S, Phillips EH. Laparoscopic transcystic duct common bile duct exploration. *Surg Endosc.* 2006;20:441–5.
16. Prakash K, Ramesh H, Jacob G, et al. Multidisciplinary approach in the long-term management of intrahepatic stones: Indian experience. *Indian J Gastroenterol.* 2004;23:209–13.
17. Aguirre-O I, Cuendis-Velázquez A, Morales-Chávez CE, et al. Coledocoduodeno-anastomosis laparoscópica como opción terapéutica en coledocolitiasis compleja. *Cir Cir.* 2013;81:118–24.