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Choledochoscopy in the laparoscopic treatment of patients with choledocholithiasis: a single-centre study

Y. M. Susak, M. V. Maksimenko, L. Y. Markulan, V. V. Volkovetskii

Bogomolets National Medical University, Kyiv

✉ Vitalii Volkovetskii: vitalikvolkovetsky@gmail.com

Y. M. Susak, http://orcid.org/0000-0002-5102-485X
M. V. Maksimenko, http://orcid.org/0000-0003-2507-1238
L. Y. Markulan, http://orcid.org/0000-0003-2879-5012
V. V. Volkovetskii, http://orcid.org/0000-0003-3843-9783

Choledochoscopy is a minimally invasive procedure used for laparoscopic bile duct exploration and the removal of bile duct stones. However, there is insufficient information available about its advantages in diagnosing choledocholithiasis and its role in laparoscopic choledocholithoextraction.

Objective — to compare the diagnostic efficacy of imaging techniques and choledochoscopy in patients with choledocholithiasis and to evaluate the role of choledochoscopy in laparoscopic choledocholithoextraction.

Materials and methods. The study examined the results of 128 patients with calculous cholecystitis and choledocholithiasis who had laparoscopic choledocholithoextraction in combination with choledochoscopy. We assessed the sensitivity and specificity of ultrasound, CT, and MRI in the diagnosis of choledocholithiasis, as well as the efficacy of one-stage treatment of calculous cholecystitis and choledocholithiasis using choledochoscopy and laparoscopic choledocholithoextraction.

Results. Imaging techniques demonstrated limited sensitivity and specificity in determining the diameter and number of common bile duct stones. A total of 89 (69.5 %) patients achieved complete bile duct clearance after blind laparoscopic choledocholithoextraction: 86 (81.1 %) had choledochotomy, and 3 (13.6 %) underwent transcystic common bile duct exploration. The combination of choledochoscopy and laparoscopic choledocholithoextraction ensured the complete removal of bile duct stones in 97.6 % of patients.

Conclusions. The imaging techniques used for determining the number of common bile duct stones in choledocholithiasis had sensitivity and specificity rates of 41.4 % and 92.7 % for ultrasound, 72.7 % and 83.3 % for CT, and 86.7 % and 60.9 % for MRI, respectively. A total of 89 (69.5 %) patients achieved complete bile duct clearance after blind laparoscopic choledocholithoextraction: 86 (81.1 %) had choledochotomy, and 3 (13.6 %)underwent transcystic common bile duct exploration. Choledochoscopy was required for laparoscopic choledocholithoextraction in 18.9 % of choledochotomy patients and in 86.4 % of those who underwent transcystic common bile duct exploration. Choledochoscopy demonstrated an overall bile duct stone clearance rate of 97.6 %.

Keywords
choledocholithiasis, choledochoscopy, choledocholithoextraction, mechanical jaundice.

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Choledocholithiasis, or the presence of common bile duct stones, is the most frequent complication of gallstone disease, amounting to 5—33 % [4, 5, 16]. Today, there are two main approaches to the treatment of calculous cholecystitis with concomitant choledocholithiasis: two-stage treatment, including endoscopic retrograde cholangiopancreatography (ERCP) with papillosphincterotomy (EPST) and laparoscopic cholecystectomy (LCE), which is performed either in the first or second stage, and one-stage treatment, including laparoscopic choledocholithotomy with choledochoscopy, lithoextraction, and subsequent LCE [4, 5, 8, 9].

According to research, in 85—90 % of cases, calculous cholecystitis with concomitant choledocholithiasis can be successfully treated in two stages [6, 8, 12]. First and foremost, this is due to almost 50 years of ERCP development, as well as the

establishment and standardization of endoscopic procedures in the majority of medical institutions around the world [1, 8, 33]. Despite a number of obvious advantages, the one-stage approach is still not the most popular [8, 12, 19]. These advantages include reducing the length of hospital stays, preserving the sphincter apparatus of the major duodenal papilla, and lowering the overall cost of treatment [3, 7]. An important reason for the selection of a one-stage approach is found in the use of intraoperative choledochoscopy, which offers a higher level of precision in diagnosing choledocholithiasis compared to preoperative techniques while also facilitating complete lithoextraction. However, this particular aspect of the problem has received insufficient research attention.

Both approaches successfully achieve their goal of eliminating bile duct stones, but the choice of the treatment strategy remains a subject of debate.

Objective — to compare the diagnostic efficacy of imaging techniques and choledochoscopy in patients with choledocholithiasis and to evaluate the role of choledochoscopy in laparoscopic choledocholithoextraction.

Materials and methods

The study examined the results of 128 patients with calculous cholecystitis and choledocholithiasis who underwent treatment between 2019 and 2023 in the Department of Surgery No. 2 (a specialised department for the treatment of hepatopancreatobiliary diseases) at the Kyiv City Clinical Hospital of Emergency Medical Care, which is a clinical base of the Department of Surgery with the Course of Emergency and Vascular Surgery at Bogomolets National Medical University.

All patients had single-stage laparoscopic choledocholithoextraction with choledochoscopy and cholecystectomy. In 22 (17.2 %) patients, choledocholithoextraction and choledochoscopy were conducted through the cystic duct, while the remaining 106 (82.8 %) had choledocholithotomy, lithoextraction, and choledochoscopy.

The screening method for choledocholithiasis-complicated gallstone disease was an abdominal ultrasound. Imaging techniques were employed to address diagnostic difficulties in patients. Specifically, 23 (18.0 %) patients underwent contrast-enhanced computed tomography, and 38 (29.7 %) patients underwent magnetic resonance cholangiopancreatography.

The research parameters included the diameter of the common bile duct, the maximum diameter of bile duct stones based on the findings of imaging tests (ultrasound, CT, MRI) and intraoperative data (intraoperative measurement of the diameter of the choledochus was carried out using a tape measure (cm) immersed in the abdominal cavity, and the diameter of the removed bile duct stones was determined using a caliper), sensitivity and specificity of imaging tests and choledochoscopy in determining the number of bile duct stones, as well as a comparative assessment of the effectiveness of blind choledocholithoextraction, including bile duct stone clearance with lithoextraction during choledochoscopy, the frequency of postoperative complications according to the Clavien-Dindo classification [10], bed-day.

The main baseline characteristics of the patients are listed in Table 1.

Choledochoscopy was performed using Olympus CHF-V and Karl Storz fibrocholedochoscopes with a diameter of 5 mm and 3 mm, respectively. The operation was performed under general anaesthesia. A standard 4-port technique for laparoscopic cholecystectomy was used, and a separate port was placed in the projection of the common bile duct for choledochoscopy if choledocholithotomy was planned intraoperatively. The central part of the common bile duct was isolated, the cystic artery was ligated, a clip was applied to the proximal part of the d. cysticus, and the gallbladder was left and used for traction during manipulations on the common bile duct. A total of 106 (82.8 %) patients underwent choledocholithotomy with choledocholithoextraction and

Table 1. **Baseline characteristics of patients with gallstone disease and choledocholithiasis**

Indicator	Value
Male Female	46 (35,9 %) 82 (64,1 %)
Age, years	60,04 ± 1,31 (17—93 %)
Jaundice syndrome,	91 (71,1 %)
Total bilirubin, μmol/L	87,6 ± 5,6 (10,5—365,8)
Direct bilirubin, μmol/L	39,8 ± 2,8 (1,3—146,6)
Cholangitis (moderate and severe)	57 (44,5 %)
ASA I n (%)	40 (31,3 %)
ASA II	74 (57,8 %)
ASA III	14 (10,9 %)
Difficult cholelithiasis*	60 (46,9 %)

Note. Categorical variables are presented as the number of cases and percentage, while quantitative indicators are presented as M ± m (min–max)

* Difficult cholelithiasis was established according to the criteria described by Hyuk Oh C., Dong S. [17] and Yasuda I., Itoi T. [33].

choledochoscopy using a 5 mm Olympus CHF-V fibrocholedochoscope, and 22 (17.2 %) patients underwent transcystic choledocholithoextraction and choledochoscopy using a 3 mm Karl Storz fibrocholedochoscope.

An incision of 15 to 30 mm was usually made in the central part of the common bile duct, after which choledocholithoextraction was performed using a Dormia basket without visualisation (blind choledocholithoextraction) (Fig. 1).

The ducts were cleaned with a 0.9 % solution of sodium chloride heated to 37°C, which helped wash out small bile duct stones from the common bile duct to the outside. With the help of choledochoscopy, all accessible sections of the bile ducts were explored, including the ampulla of Vater (Fig. 2).

When bile duct stones were detected, we performed choledocholithoextraction. During the procedure, the Dormia baskets were used to remove them through the working channel of the fibrocholedochoscope (Fig. 3).

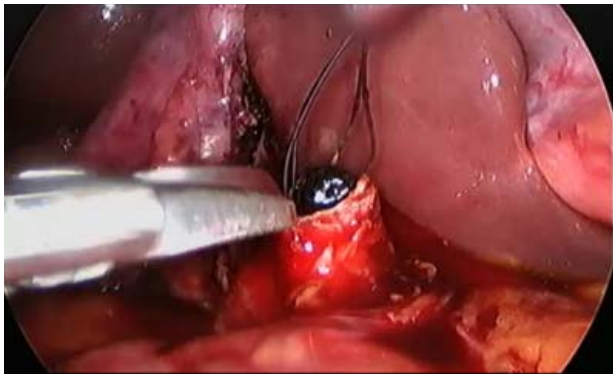

Figure 1. **Choledocholitotomy and mechanical choledocholithoextraction without visualisation**

After choledocholitoextraction, all bile duct sections were explored using choledochoscopy. In the absence of bile duct stones, the incision was closed with knotted sutures (absorbable monofilament 4/0). Bile duct drainage was carried out in the presence of purulent cholangitis and microcholedocholithiasis. The next stage involved a cholecystectomy.

The study employs descriptive statistics and presents the data as the arithmetic mean ± standard error (M ± m). The mean values of two variables were compared using the Mann-Whitney U-test. The sensitivity and specificity of diagnostic techniques for choledocholithiasis were assessed using ROC analysis. IBM SPSS Statistics 22.0 was used to complete the calculations.

Results

According to anamnestic data, the majority of patients were admitted to the hospital 24 hours after the onset of the disease (pain syndrome). Thus, the condition lasted up to 6 hours in 4 (3.1 %) patients, 7 to 24 hours in 16 (12.5 %), and more than 24 hours in 108 (84.4 %). Out of the total number of patients, 119 (93.0 %) were hospitalised for the first time due to a diagnosis of choledocholithiasis, while 9 (7.0 %) had repeated hospitalisation.

Following the diagnosis and preoperative preparation, all patients underwent surgery. Preoperative bed-day averaged 4.5 ± 0.2 days (from 1 day to 9 days) (Fig. 4).

The preoperative period was extended to manage the accompanying pathology and jaundice syndrome.

The operative intervention lasted an average of 115.0 ± 14.7 min.

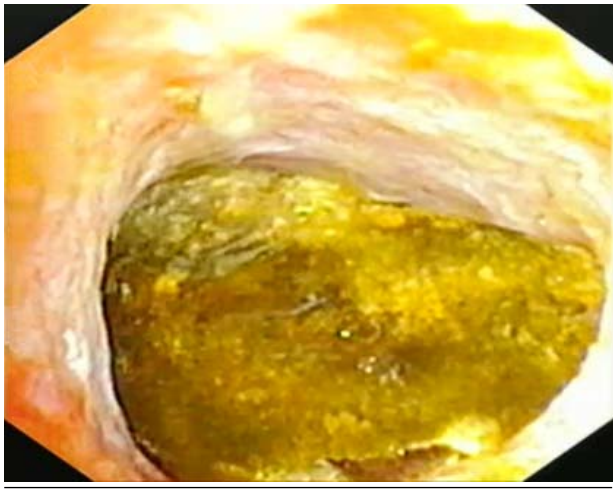

Figure 2. **A bile duct stone in the terminal section of the common bile duct (the ampulla of the major duodenal papilla)**

Figure 3. **The stone captured with the Dormia basket in the distal section of the common bile duct during choledocholithoextraction**

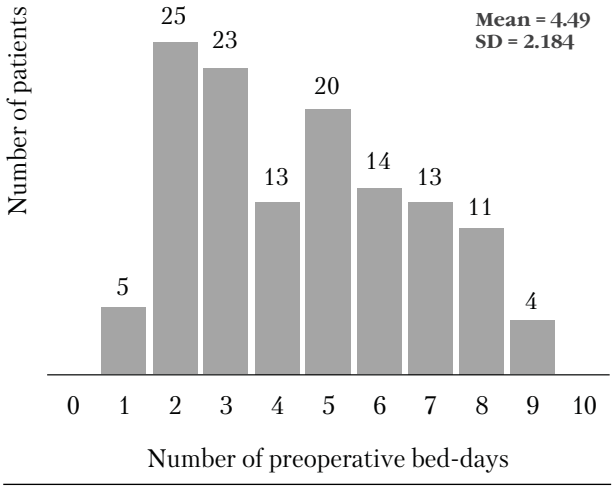

Figure 4. **Distribution of patients by preoperative bed-day**

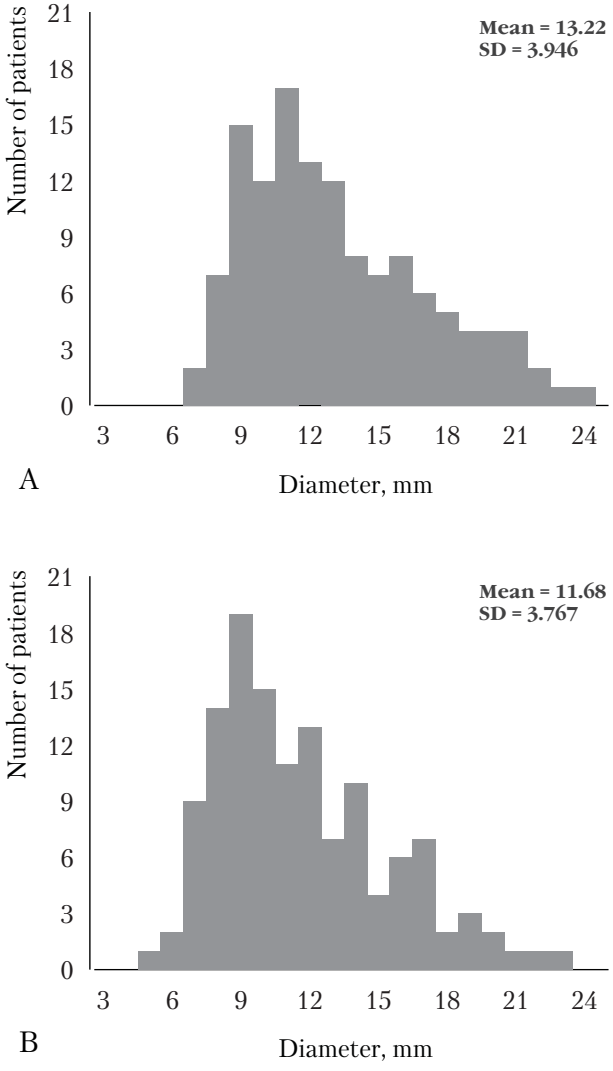

Figure 5. **Distribution of patients based on the diameter of the common bile duct, as determined by intraoperative (A) and ultrasound (B) data**

According to intraoperative data, the average diameter of the common bile duct (choledochus) was 13.22 ± 0.35 mm (from 7 mm to 24 mm). According to ultrasound data, the diameter averaged 11.68 ± 0.33 mm (from 5 mm to 23 mm), p = 0.003, which was smaller compared to intraoperative findings (Fig. 5).

The error of measuring the diameter of the common bile duct using ultrasound compared with intraoperative data was from 0 mm to 5 mm, on average 1.54 ± 0.86 mm.

In 53 (41.4 %) patients, the difference between ultrasound data and intraoperative measurement was 0 mm to1 mm.

Patients who underwent CT had an average common bile duct diameter of 11.86 ± 0.96 mm, which did not statistically differ from the intraoperative average diameter of 12.39 ± 1.0 mm (p = 0.712). In 21 (91.3 %) patients, the diameters of the common bile duct were found to be the same (a variation of 0 to1 mm). In two cases, the common bile duct diameters were 2 mm smaller than those measured intraoperatively.

Patients who additionally underwent MRI had an average common bile duct diameter of 12.74 ± 0.67 mm, which did not statistically differ from the intraoperative average diameter of 13.0 ± 0.65 mm (p = 0.774). In 36 (94.7 %) patients, the diameters of the common bile duct were found to be the same (a variation of 0 to1 mm). In other cases, the common bile duct diameters were 2 mm smaller than those measured intraoperatively.

According to intraoperative findings, 45 (35.2 %) patients had one common bile duct stone, 22 (17.1 %) had two, and 61 (47.7 %) had three or more (Fig. 6).

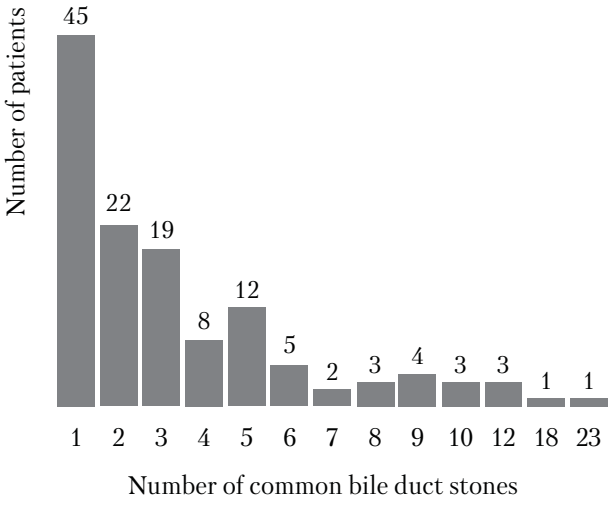

Figure 6. **The number of common bile duct stones according to choledochoscopy**

We compared the quantity of bile duct stones revealed intraoperatively and instrumentally. Ultrasound showed a considerably lower average number of bile duct stones (1.66 ± 0.13 versus 3.52 ± 0.31; p = 0.001). In 41 (32 %) patients, both approaches showed an identical number of bile duct stones. In the other 87 (68.0 %) cases, ultrasound reported a different number of bile duct stones than the actual number: 75 (58.6 %) had fewer (by 1—22) bile duct stones, while 12 (9.4 %) had more (by 1—4) bile duct stones. In general, ultrasound has a low diagnostic capacity for determining the exact number of bile duct stones: the area under the ROC curve is 0.675 (95 % CI: 0.583—0.767), sensitivity is 41.4 %, and specificity is 92.7 % (Fig. 7).

Patients who additionally underwent CT had an average number of bile duct stones of 1.91 ± 0.25, which did not statistically differ from the intraoperative average number of bile duct stones of 2.65 ± 0.46 (p = 0.166). In 12 (52.2 %) patients, the number of bile duct stones was found to be the same. In the other 9 (39.1 %) cases, CT diagnosed fewer (from 1 to 4) bile duct stones, and in 2 (8.7 %) patients, more (from 1 to 2) bile duct stones.

In multiple choledocholithiasis, CT had 72.7 % sensitivity, 83.3 % specificity, and an area under the ROC curve of 0.754 (95 % CI: 0.542—0.966) (Fig. 8).

Patients who additionally underwent MRI had an average number of bile duct stones of 3.08 ± 0.37, which did not statistically differ from the intraoperative average number of bile duct stones of 3.97 ± 0.47 (p = 0.142). In 22 (57.9 %) patients, the number of bile duct stones was found to be the same. In the other 13 (34.2 %) cases, MRI diagnosed fewer (from 1 to 5) bile duct stones, and in 1 (5.3 %) patient, more (by 1) bile duct stones.

In multiple choledocholithiasis, MRI had 86.7 % sensitivity, 60.9 % specificity, and an area under the ROC curve of 0.862 (95 % CI: 0.747—0.978) (Fig. 9).

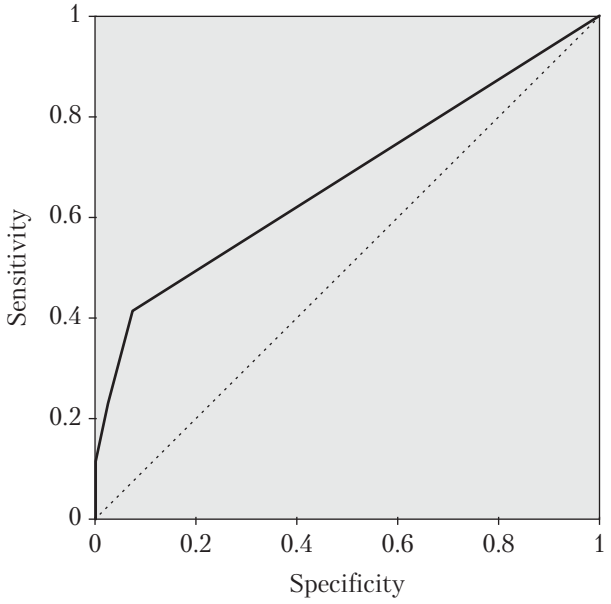

Figure 7. **ROC curve for determining the number of bile duct stones in choledocholithiasis according to ultrasound data**

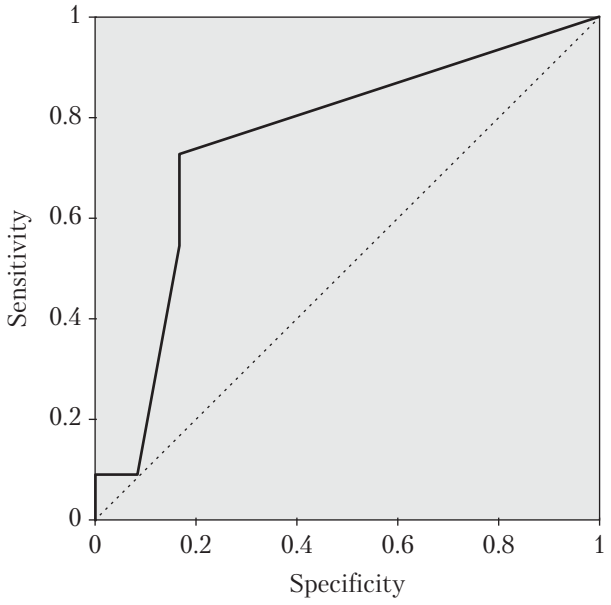

Figure 8. **ROC curve for determining the number of bile duct stones in choledocholithiasis according to CT data**

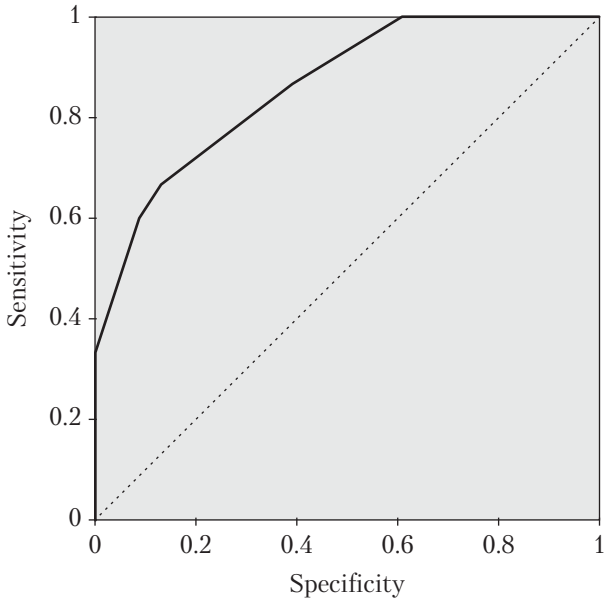

Figure 9. **ROC curve for determining the number of bile duct stones in choledocholithiasis according to MRI data**

Table 2. **Average values of the maximum sizes of bile duct stones, depending on the diagnostic method, mm**

Measurement method	n	Mean	SD	Min—Max	p*
Choledochoscopy	128	9,52	0,60	2—40	–
Ultrasound	128	8,05	0,95	2—120	0,192
CT	23	7,48	0,83	3—19	0,196
MRI	38	7,37	0,86	0—25	0,434

Note. * In relation to choledochoscopy.
Differences in the average values of the maximum size of bile duct stones for choledochoscopy, CT, and MRI data were determined in patients who underwent two corresponding diagnostic procedures concurrently.

The diagnostic procedures used to measure the maximum size of bile duct stones revealed no statistical differences (Table 2).

A total of 89 (69.5 %) patients achieved complete bile duct clearance after blind choledocholithoextraction, which was subsequently confirmed by choledochoscopy: 86 (81.1 %) had choledochotomy, and 3 (13.6 %) underwent transcystic common bile duct exploration. In other cases, bile duct stones were removed using a Dormia basket, which was passed into the common bile duct through the working channel of the choledochoscope. Further extraction of bile duct stones was carried out under visual control.

Choledochoscopy was required for laparoscopic choledocholithoextraction in 20 (18.9 %) choledochotomy cases and in 19 (86.4 %) cases of transcystic common bile duct exploration. Choledochoscopy demonstrated an overall bile duct stone clearance rate of 97.6 %.

In one case, the tight fixation of the bile duct stone in the area of the papilla of Vater prevented its removal during choledochotomy. In this case, we successfully applied the rendezvous method.

Although choledochoscopy allows us to correctly determine the completeness of stone removal, two patients returned to us within a year after the operation due to the presence of common bile duct stones. One patient had Caroli's disease whereas the other had a diverticulum of the common bile duct. Endoscopic papillosphincterotomy (EPST) was used in both cases to remove bile duct stones: three in a patient with Caroli's disease and two in a patient with a diverticulum of the common bile duct.

After choledocholithoextraction and choledochoscopy, external drainage of the common bile duct was performed in 15 (11.7 %) patients: 11 (10.4 %) had choledochotomy and 4 (18.2 %) underwent transcystic common bile duct exploration. Indications for external drainage in choledochotomy patients were cases of purulent cholangitis and/or biliary microcholedocholithiasis.

Postoperative complications were noted in 11 (8.6 %) patients: grade II complications in 6 (4.7 %) and grade III complications in 5 (3.9 %).

The average postoperative bed-day was 8.2 ± 0.3 days, and the total bed-day was 12.7 ± 0.4 days.

There were no fatalities.

Discussion

Gallstone disease and its complications, such as calculous cholecystitis and choledocholithiasis, remain an urgent problem in abdominal surgery [7, 27, 32]. According to modern research, the incidence of common bile duct stones in patients with symptomatic gallstone disease varies widely and reaches 5—33 %, depending on age [8, 13, 18]. The management of such patients requires the use of minimally invasive approaches, the reduction of surgical trauma, the reduction of bed-days and, accordingly, the cost of treatment [3, 23].

According to research, the frequency of complications arising from transpapillary interventions is 3.6—12 %. Among them, the most common are acute pancreatitis, perforation of the duodenum, bleeding, and cholangitis [8, 25, 33]. Complications after EPST were recorded in 9.4—11.1 % of cases [19, 27, 28].

Choledochoscopy combined with choledocholithoextraction and simultaneous cholecystectomy began to be used in the late 1990s. At first, access through the cystic duct was used, and later, choledocholithotomy was performed, which significantly expanded the possibilities of choledocholithoextraction [9, 15, 33].

Laparoscopic common bile duct exploration (LCBDE) is performed through the cystic duct and by choledochotomy, followed by primary sutures or drainage. In fact, applying primary sutures in comparison with drainage of the common bile duct is an obvious advantage for the patient [3, 19, 28]. The main disadvantages of drainage of the common bile duct are more prolonged hospitalisation, loss of bile, water-electrolyte disorders, additional discomfort for the patient, possible ascending infections of the biliary tract, etc. [3, 20, 26].

Considering these factors, the recommended procedures should be choledochoscopy and transcystic choledocholithoextraction, which is minimally traumatic as it does not require choledocholitotomy and allows for the avoidance of possible complications associated with drainage of the common bile

duct [19, 28]. However, this approach has many limitations: the size of the bile duct stone (< 6mm), the bile duct stone must be the same or smaller in diameter as the cystic duct, and the number of bile duct stones (< 5). Additionally, choledochoscopy and transcystic choledolithoextraction cannot be performed in the case of proximal choledocholithiasis, strictures of the common bile duct, acute angle between the cystic and common hepatic duct, or difficult choledocholithiasis [13]. Based on national and international data, fibrocholedochoscopes with a diameter of up to 3 mm are commonly used for performing choledochoscopy through the cystic duct. However, these devices have a smaller working channel, worse performance, and are prone to quick wear and fragility [3].

Taking into account the preoperative and intraoperative data, we used laparoscopic choledocholithotomy, lithoextraction, and choledochoscopy with a significantly higher frequency, namely in 106 (82.8 %) cases, compared to laparoscopic choledocholithoextraction and choledochoscopy through the cystic duct, which were used in 22 (17.2 %) patients. Some international studies have reported comparable access ratios, specifically 65 %/35 %) [3] and 76 %/24 % [15]. In cases where the primary choledochoscopy reveals the presence of a large common bile duct stone (≥ 15 mm), intrahepatic biliary stone, existing bile duct strictures (of any origin), a stone stuck in the terminal section of the common bile duct, or multiple choledocholithiasis (> 3 bile duct stones, size > 10 mm), it is recommended to conduct choledocholithotomy to explore the bile ducts [29].

The operative intervention lasted an average of 115.0 ± 14.7 min., which is consistent with other authors' results of 96 min [15] and 120 min [3].

A total of 89 (69.5 %) patients achieved complete bile duct clearance after blind choledocholithoextraction: 86 (81.1 %) had choledochotomy, and 3 (13.6 %) underwent transcystic common bile duct exploration.

Further extraction of bile duct stones was carried out under visual control. According to our findings, after choledochoscopy and choledocholithoextraction, an overall bile duct stone clearance rate was 97.6 %, which is consistent with the other authors' data of 93.6 % [26] and 95 % [3].

Some studies show the frequency of complications ranging from 7 % to 12.5 % [2, 3, 23, 25], which is consistent with our data: 8.6 % (according to P. Clavien and D. Dindo).

The main complication was leakage of bile from the sutures of the common bile duct, which in our study was registered in 3.7 % of cases, which is less than the indicators cited by other authors of 9.5 % [3]; 4.35 % [18]; and 7.2 % [23].

There were no strictures on the common bile duct and fatal consequences after a year of observation in our study, as in other authors' studies [19, 26, 29].

According to our data, the average length of stay in a hospital (bed-day) was quite significant and was 12.7 ± 0.4 days, while the world average is slightly lower at 10.7 [15], 12 [3], and 6 [26]. First of all, it can be explained by differences in patient discharge criteria.

Based on our experience, blind choledocholithoextraction is effective in removing just 69.5 % of stones. Therefore, information about the number of common bile duct stones and their characteristics plays an important role in preventing their incomplete removal. Unfortunately, imaging techniques such as ultrasound, CT, and MRI do not provide comprehensive information on this matter. Our findings show that, in relation to choledochoscopy, imaging tests used for determining the number of common bile duct stones in choledocholithiasis had sensitivity and specificity rates of 41.4 % and 92.7 % for ultrasound, 72.7 % and 83.3 % for CT, and 86.7 % and 60.9 % for MRI, respectively.

Considering the obtained data, the leading role in the diagnosis of choledocholithiasis belongs to choledochoscopy, due to which the risks of residual choledocholithiasis can be minimised.

Choledochoscopy provides visualisation of the extrahepatic bile ducts, the possibility of controlled removal of all bile duct stones, one-stage surgical treatment, preservation of the integrity of the papilla of Vater, and the absence of postoperative complications typical for transpapillary interventions.

Conclusions

The imaging techniques used for determining the number of common bile duct stones in choledocholithiasis had sensitivity and specificity rates of 41.4 % and 92.7 % for ultrasound, 72.7 % and 83.3 % for CT, and 86.7 % and 60.9 % for MRI, respectively.

A total of 89 (69.5 %) patients achieved complete bile duct clearance after blind laparoscopic choledocholithoextraction: 86 (81.1 %) had choledochotomy, and 3 (13.6 %) underwent transcystic common bile duct exploration.

Choledochoscopy was required for laparoscopic choledocholithoextraction in 18.9 % of choledochotomy patients and in 86.4 % of those who underwent transcystic common bile duct exploration. Choledochoscopy demonstrated an overall bile duct stone clearance rate of 97.6 %.

Our study is limited by its unicentricity.

Declaration of interests

The authors declare that they have no conflicts of interest.

Authors contributions

Conception and design: Y. M. Susak, M. V. Maksimenko; acquisition of data: L. Y. Markulan, V. V. Volkovetskii; drafting the article Y. M. Susak; critical revision of the article: L. Y. Markulan.

References

1. Насташенко ІЛ. Транспапілярні втручання з приводу гострого панкреатиту. Клінічна хірургія. 2015;(8):32-34.
2. Angsuwatcharakon P, Rerknimitr R, Cracking Difficult Biliary Stones. Clin Endosc. 2021;54(5):660-668. doi: 10.5946/ce.2020.256-IDEN.
3. Atstupens K, Plaudis H, Saukane H, Rudzats A. The role of choledochoscopy in transductal laparoscopic common bile duct exploration. General Surgery (Ukraine). 2021;(1):10-17. https://doi.org/10.30978/GS-2021-1-10.
4. Bang JY, Sutton B, Navaneethan U, Hawes R, Varadarajulu S. Efficacy of Single-Operator Cholangioscopy-Guided Lithotripsy Compared With Large Balloon Sphincteroplasty in Management of Difficult Bile Duct Stones in a Randomized Trial. Clin Gastroenterol Hepatol. 2020 Sep;18(10):2349-2356.e3. doi: 10.1016/j.cgh.2020.02.003. Epub 2020 Feb 10. PMID: 32057976.
5. Borysenko VB. Gallstone Disease Complicated by Choledocholithiasis: Modern Aspects of Diagnostics. JMBS. 2021;6(2):66-70. https://doi.org/10.26693/jmbs06.02.066.
6. Brewer Gutierrez OI, Bekkali NLH, Raijman I, Sturgess R, Sejpal DV, Aridi HD, Sherman S, Shah RJ, Kwon RS, Buxbaum JL, Zulli C, Wassef W, Adler DG, Kushnir V, Wang AY, Krishnan K, Kaul V, Tzimas D, DiMaio CJ, Ho S, Petersen B, Moon JH, Elmunzer BJ, Webster GJM, Chen YI, Dwyer LK, Inamdar S, Patrick VB, Attwell A, Hosmer A, Ko C, Maurano A, Sarkar A, Taylor LJ, Gregory MH, Strand DS, Raza A, Kothari S, Harris JP, Kumta NA, Manvar A, Topazian MD, Lee YN, Spiceland CM, Trindade AJ, Bukhari MA, Sanaei O, Ngamruengphong S, Khashab MA. Efficacy and Safety of Digital Single-Operator Cholangioscopy for Difficult Biliary Stones. Clin Gastroenterol Hepatol. 2018 Jun;16(6):918-926.e1. doi: 10.1016/j.cgh.2017.10.017. Epub 2017 Oct 24. PMID: 29074446.
7. Christopher F, Nicoll M, Pastorino M, Farooq U, Froehlich MJ. Choledocholithiasis. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing;2023Jan.2023Apr16. Bookshelf ID: NBK441961.
8. Cianci P, Restini E. Management of cholelithiasis with choledocholithiasis: Endoscopic and surgical approaches. World J Gastroenterol. 2021 July 28; 27(28): 4536-4554. doi: 10.3748/wjg.v27.i28.4536.
9. Classen M, Demling L, Endoscopic sphincterotomy of the papilla of Vater and extraction of stones from the choledochal duct (author's transl). Dtsch. Med. Wochenschr. 1974; 99:496-7.
10. Clavien PA, Barkun J, de Oliveira ML, Vauthey JN, Dindo D, Schulick RD, de Santiba?es E, Pekolj J, Slankamenac K, Bassi C, Graf R, Vonlanthen R, Padbury R, Cameron JL, Makuuchi M. The Clavien-Dindo classification of surgical complications: five-year experience. Ann Surg. 2009 Aug;250(2):187-96. doi: 10.1097/SLA.0b013e3181b13ca2. PMID: 19638912.
11. Costi R, Gnocchi A, Di Mario F, Sarli L. Diagnosis and management of choledocholithiasis in the golden age of imaging, endoscopy and laparoscopy. World J Gastroenterol. 2014 Oct 7;20(37):13382-401. doi: 10.3748/wjg.v20.i37.13382. PMID: 25309071; PMCID: PMC4188892.
12. Cuschieri A, Lezoche E, Morino M, Croce E, Lacy A, Toouli J, Faggioni A, Ribeiro VM, Jakimowicz J, Visa J, Hanna GBE.A. E.S. multicenter prospective randomized trial comparing two-stage vs single-stage management of patients with gallstone disease and ductal calculi. Surg Endosc. 1999 Oct;13(10):952-7. doi: 10.1007/s004649901145. PMID: 10526025.
13. Doshi B, Yasuda I, Ryozawa S, Lee GH. Current endoscopic strategies for managing large bile duct stones. Dig Endosc. 2018 Apr;30 Suppl 1:59-66. doi: 10.1111/den.13019. PMID: 29658655.
14. Gad EH, Zakaria H, Kamel Y, Alsebaey A, Zakareya T, Abbasy M, Mohamed A, Nada A, Abdelsamee MA, Housseni M. Surgical (Open and laparoscopic) management of large difficult CBD stones after different sessions of endoscopic failure: A retrospective cohort study. Ann Med Surg (Lond). 2019 May 31;43:52-63. doi: 10.1016/j.amsu.2019.05.007. PMID: 31198552; PMCID: PMC6556483.
15. Hongjun H, Yong J, Baoqiang W. Laparoscopic common bile duct exploration: choledochotomy versus transcystic approach? Surg Laparosc Endosc Percutan Tech. 2015 Jun;25(3):218-22. doi: 10.1097/SLE.0000000000000133. PMID: 25799258.
16. Hungness ES, Soper NJ. Management of common bile duct stones. J. Gastrointest. Surg. 2006;10(4):612-619. https://doi.org/10.1016/j.gassur.2005.08.015.
17. Hyuk Oh C, Dong S. Recent advances in the management of difficult bile-duct stones: a focus on single-operator cholangioscopy-guided lithotripsy. Korean J Intern Med. 2021;36:235-246. doi: 10.3904/kjim.2020.425.
18. Jinfeng Z, Yin Y, Chi Z, Junye G. Laparoscopic management after failed endoscopic stone removal in nondilated common bile duct. Int J Surg. 2016 May;29:49-52. https://doi.org/10.1016/j.ijsu.2016.03.037.
19. Karaliotas C, Sgourakis G, Lanitis S, et al. Laparoscopic transcystic or transcholedochal choledochoscopy during common bile duct exploration for stones? Differences and similarities. Hellenic Journal of Surgery.2015;87:394-406. https://doi.org/10.1007/s13126-015-0246-x.
20. Koc B, Karahan S, Adas G, Tutal F, Guven H, Ozsoy A. Comparison of laparoscopic common bile duct exploration and endoscopic retrograde cholangiopancreatography plus laparoscopic cholecystectomy for choledocholithiasis: a prospective randomized study. Am J Surg. 2013 Oct;206(4):457-63. doi: 10.1016/j.amjsurg.2013.02.004. Epub 2013 Jul 17. PMID: 23871320.
21. Lee SJ, Choi IS, Moon JI, Choi YW, Ryu KH. Comparison of one-stage laparoscopic common bile duct exploration plus cholecystectomy and two-stage endoscopic sphincterotomy plus laparoscopic cholecystectomy for concomitant gallbladder and common bile duct stones in patients over 80 years old. J Minim Invasive Surg. 2022 Mar 15;25(1):11-17. doi: 10.7602/jmis.2022.25.1.11. PMID: 35603338; PMCID: PMC8977497.
22. Nastashenko IL. Analysis of causes of unsatisfactory results of endoscopic transpapillary interventions Surgery. Eastern Europe. 2018;7(2):260-264.
23. Quaresima S, Balla A, Guerrieri M, Campagnacci R, Lezoche E, Paganini AM. A 23 year experience with laparoscopic common bile duct exploration. HPB (Oxford). 2017 Jan;19(1):29-35. doi: 10.1016/j.hpb.2016.10.011. Epub 2016 Nov 24. PMID: 27890483.
24. Reinders JS, Gouma DJ, Ubbink DT, van Ramshorst B, Boerma D. Transcystic or transductal stone extraction during single-stage treatment of choledochocystolithiasis: a systematic review. World J Surg. 2014 Sep;38(9):2403-11. doi: 10.1007/s00268-014-2537-8.
25. Susak YM, Maksimenko MV, Markulan LY, Honza RV, Tiuliukin IO, Volkovetskii VV. Results of laparoscopic choledocholithoextraction and choledochoscopy for difficult choledocholithiasis: a single centre experience. General Surgery (Ukraine). 2023:1;28-35. http://doi.org/10.30978/GS-2023-1-28.
26. Topal B, Aerts R, Penninckx F. Laparoscopic common bile duct stone clearance with flexible choledochoscopy. Surg Endosc. 2007 Dec;21(12):2317-21. doi: 10.1007/s00464-007-9577-1. Epub 2007 Oct 18. PMID: 17943379.
27. Tozatti J, Mello ALP, Frazon O. Predictor factors for choledocholithiasis. Arq Bras Cir Dig. 2015 Apr-Jun;28(2):109-12. doi: 10.1590/S0102-67202015000200006.
28. Trikudanathan G, Navaneethan U, Parsi MA. Endoscopic management of difficult common bile duct stones. World J Gastroenterol. 2013 Jan 14;19(2):165-73. doi: 10.3748/wjg.v19.i2.165. PMID: 23345939; PMCID: PMC3547556.
29. Troncone E, Mossa M, De Vico P, Monteleone G, Del Vecchio Blanco G. Difficult Biliary Stones: A Comprehensive Review of New and Old Lithotripsy Techniques. Medicina (Kaunas). 2022 Jan 13;58(1):120. doi: 10.3390/medicina58010120. PMID: 35056428; PMCID: PMC8779004.
30. Tunruttanakul S, Chareonsil B, Verasmith K, Patumanond J, Mingmalairak C. Evaluation of the American Society of Gastrointestinal Endoscopy 2019 and the European Society of Gastrointestinal Endoscopy guidelines' performances for choledocholithiasis prediction in clinically suspected patients: A retrospective cohort study. JGH Open. 2022 May 25;6(6):434-440. doi: 10.1002/jgh3.12773. PMID: 35774349; PMCID: PMC9218518.
31. Varban O, Assimos D, Passman C, et al. Laparoscopic common bile duct exploration and holmium laser lithotripsy: a novel approach to the management of common bile duct stones. Surg Endosc. 2020;24:1759-1764. https://doi.org/10.1007/s00464-009-0837-0.

32. Williams E, Beckingham I, El Sayed G, Gurusamy K, Sturgess R, Webster G, Young T. Updated guideline on the management of common bile duct stones (CBDS). Gut. 2017 May;66(5):765-782. doi: 10.1136/gutjnl-2016-312317. Epub 2017 Jan 25. PMID: 28122906.

33. Yasuda I, Itoi T. Recent advances in endoscopic management of difficult bile duct stones. Dig Endosc. 2013 Jul;25(4):376-85. doi: 10.1111/den.12118. Epub 2013 May 8. PMID: 23650878.

Холедохоскопія в лапароскопічному лікуванні хворих із холедохолітіазом: досвід одного центру

Я. М. Сусак, М. В. Максименко, Л. Ю. Маркулан, В. В. Волковецький

Національний медичний університет імені О. О. Богомольця, Київ

Лапароскопічна холедохоскопія (ЛХС) є одним із методів дослідження жовчних проток та дає змогу видалити конкременти. Інформації про її переваги для діагностики холедохолітіазу (ХЛ) та виконання лапароскопічної холедохолітоекстракції (ЛХЛЕ) недостатньо.

Мета — у хворих із ХЛ порівняти ефективність променевих методів діагностики і ЛХС та оцінити роль останньої в технології ЛХЛЕ.

Матеріали та методи. Проаналізовано результати лікування 128 хворих із калькульозним холециститом і ХЛ методом ЛХЛЕ з використанням ЛХС. Оцінювали чутливість і специфічність ультразвукового дослідження, комп'ютерної та магнітно-резонансної томографії щодо діагностики ХЛ, а також ефективність одноетапного лікування калькульозного холециститу і ХЛ із застосуванням ЛХС та ЛХЛЕ.

Результати. Установлено невисокі показники чутливості та специфічності променевих методів діагностики щодо діаметра загальної жовчної протоки та кількості конкрементів у ній. Очищено жовчні шляхи від конкрементів методом сліпого тролінгу в 69,5 % хворих: при холедохотомічному доступі — у 81,1 %, при доступі крізь міхурову протоку — у 13,6 %. Додаткове застосування ЛХС із ЛХЛЕ забезпечило повне видалення каменів у 97,6 % хворих.

Висновки. При холедохолітіазі чутливість і специфічність променевих методів діагностики кількості конкрементів у загальній жовчній протоці становить для ультразвукового дослідження 41,4 та 92,7 % відповідно, для комп'ютерної томографії — 72,7 і 83,3 %, для магнітно-резонансної томографії — 86,7 та 60,9 % відповідно. Холедохоскопія в складі лапароскопічної холедохолітоекстракції була потрібна 18,9 % хворим при застосуванні холедохотомічного доступу і 86,4 % — при доступі крізь міхурову протоку, забезпечила відсутність конкрементів у жовчних шляхах у 97,6 % пацієнтів.

Ключові слова: холедохолітіаз, холедохоскопія, холедохолітоекстракція, механічна жовтяниця.

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