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## V. V. Grubnik, A. I. Tkachenko, V. V. Ilyashenko, K. O. Vorotyntseva LAPAROSCOPIC CHOLEDOCHOTOMY FOR RETAINED STONES

The Odessa National Medical University, Odessa, Ukraine

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В. В. Грубник, А. И. Ткаченко, В. В. Ильяшенко, К. О. Воротынцева  
ЛАПАРОСКОПИЧЕСКАЯ ХОЛЕДОХОТОМИЯ ПРИ ВКЛИНЕННЫХ КАМНЯХ

Одесский национальный медицинский университет, Одесса, Украина

В то время как лапароскопическая холецистэктомия является методом выбора симптоматического лечения холедохолитиаза, проблема лечения камней общего желчного протока остается актуальной. Существует несколько мнений по поводу лечения пациентов с вклиненными камнями в общий желчный проток, однако при наличии у больных гнойного холангита, панкреатита необходимо выполнение эндоскопической сфинктеротомии. Достаточно часто для лечения холедохолитиаза используют двухэтапные операции, сочетание лапароскопической холецистэктомии с эндоскопической сфинктеротомией, однако данные операции имеют определенные осложнения. Для уменьшения количества послеоперационных осложнений необходимо развитие одноэтапных лапароскопических методов.

**Ключевые слова:** вклиненные камни, общий желчный проток, холедохолитиаз.

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The Odessa National Medical University, Odessa, Ukraine

**Introduction.** While laparoscopic cholecystectomy is considered the treatment of choice for symptomatic cholelithiasis, the management of common bile duct stones (CBDS) is still controversial. The treatment of choledocholithiasis since the development of laparoscopic cholecystectomy has often been ES combined with laparoscopic cholecystectomy in a two-stage procedure that adds the complications of both procedures.

The aim of this study was to evaluate effectiveness of laparoscopic choledochotomy compared to ERCP/ES for large retained stones.



**Materials and methods.** From September 1994 to June 2012 all patients who underwent a laparoscopic common bile duct stones extraction were included in a prospective study. They were managed in Odessa regional hospital. This series of 415 patients included 295 women and 120 men. The mean age was 64 years (range = 18–92). 321 patients were classified ASA I and ASA II and 94 were ASA III and ASA IV. Common bile duct stones were diagnosed or suspected preoperatively in 306 patients (73.8%) or identified at IOC in 109 patients (26.2%).

**Results.** A TCDE was attempted in 254 cases with success in 214 cases (51.5%). The main causes of failure were impacted stones and stones larger than 5 mm. The success rate was 97%. The overall success rate of laparoscopic treatment of CBDS was 96.2%. The mean operative time was 124 min (range = 40–360). It was 96 min in TCDE and 137 min in choledochotomy. The complication rate was 6.7%, including 3.9% of local complications and 2.8% of general complications and the mortality rate was 1%.

**Conclusion.** The laparoscopic management of CBDS has the advantage over ES followed by LC because it is a onestage procedure. The laparoscopic treatment of CBDS is particularly indicated in ASA I and ASA II patients because it is a safe procedure in terms of short-term outcome and late sequelae.

**Key words:** retained stones, common bile duct, choledocholithiasis.

## Introduction

While laparoscopic cholecystectomy is considered the treatment of choice for symptomatic cholecystolithiasis, the management of common bile duct stones (CBDS) is still controversial [13]. There is no consensus about CBDS treatment except for residual stones, complicated CBDS (suppurative cholangitis, severe pancreatitis), and highrisk patients, which are indications for endoscopic sphincterotomy (ES). The treatment of choledocholithiasis since the development of laparoscopic cholecystectomy has often been ES combined with laparoscopic cholecystectomy in a two-stage procedure that adds the complications of both procedures [15]. Therefore, it seemed logical to develop a mini-invasive onestage procedure using the laparoscopic approach. This study evaluates our results of laparoscopic common bile duct stones extraction in a series of 415 patients.

The aim of this study was to evaluate effectiveness of laparoscopic choledochotomy compared to ERCP/ES for large retained stones.

## Materials and methods

From September 1994 to June 2012 all patients who underwent a laparoscopic common bile duct stones extraction were included in a prospective study. They were managed in Odessa regional hospital. This series of 415 patients included 295 women and 120 men. The mean age was 64

years (range = 18–92). 321 patients were classified ASA I and ASA II and 94 were ASA III and ASA IV. Preoperative evaluation was done through medical history, biochemical tests, and ultrasonography. Common bile duct stones were diagnosed or suspected preoperatively in 306 patients (73.8%) or identified at intraoperative cholangiography (IOC) in 109 patients (26.2%).

The surgical technique described in detail previously is outlined [1].

The first step of the procedure is IOC which confirms or diagnoses CBDS and provides information about the number, size, and location of the stones and the anatomy of cystic and common bile ducts. The choice between transcystic duct extraction (TCDE) and choledochotomy depends on this information. The TCDE was used for small stones (< 7 mm) located below the cystic duct implantation on the common bile duct (CBD). In the majority of TCDE the cystic duct needs to be dilated. Dilatation is performed with blunt, flexible dilators introduced by a 5-mm trocar inserted upright to the cystic duct opening. After dilation a 3-mm flexible choledochoscope is introduced into the cystic duct. Small stones can be flushed or pushed through the papilla, but in the majority of cases the stones are extracted with a Dormia basket under choledochoscopic control. After extraction a completion cholangiography has to be performed because upper

bile ducts are accessible to choledochoscopy in only 10–15% of cases. Then the cystic duct is usually closed with an absorbable suture. A transcystic biliary drainage is used only in case of cholangitis.

## Choledochotomy

A choledochotomy is indicated for large stones (> 7 mm), numerous stones (> 5), or when the stones are located above the cystic duct implantation into the CBD and after failure of TCDE. The first step is to achieve good exposure of the porta hepatis. It is obtained by lifting the round ligament with a transparietal suture and by pulling the cystic duct up and laterally. The anterior aspect of common bile duct is cleared on a length of 10 to 20 mm. The choledochotomy is performed vertically on the supraduodenal part of the anterior aspect of the CBD. The CBDS extraction is the most difficult step. All the stones visible through the choledochotomy can be extracted with atraumatic forceps. Stones located in the lower part of the CBD can be pushed through choledochotomy by pressure on the CBD wall with blunt forceps or flushed through the choledochotomy with saline irrigation. The remaining stones are extracted with a Dormia basket under choledochoscopic guidance. The most difficult cases to manage are impacted stones because often they cannot be extracted with a Dormia basket so electrohydraulic lithotripsy needs to



be used. Once the stones are fragmented they are retrieved with a Dormia basket or pushed through the papilla. We have never used papilla dilation because of the risk of pancreatitis.

Once the stones extraction is over, the choledochotomy is closed with an absorbable running suture and a completion IOC is performed to check that there are no residual stones and to check the watertightness of the suture. A biliary drainage by T-tube rather than a transcystic drain is used in case of cholangitis, porta hepatitis inflammation, or when the number of stones is more than 5 or 6. In all cases a subhepatic drainage is used.

In case of biliary drainage a cholangiography is performed on the third postoperative day. If there is no residual stone, the drain is closed and will be removed on an outpatient basis on the 21st postoperative day.

## Results

From September 1994 to June 2012, a laparoscopic treatment of CBDS was performed in 415 patients with a success rate of 96.2%. A TCDE was attempted in 254 cases with success in 214 (51.5%) cases. The main causes of failure were impacted stones and stones larger than 5 mm. The 53 failures were managed by laparoscopic choledochotomy with success in 43 patients and by ES in 10 patients, four times intraoperatively and six times postoperatively. Stones extraction by laparoscopic choledochotomy was performed in 201 patients, by first intention in 171 patients and after failure of TCDE in 30 patients. The success rate was 97%. The overall success rate of laparoscopic treatment of CBDS was 96.2%. The mean operative time was 124 min (range = 40–360). It was 96 min in TCDE and 137 min in choledochotomy. The mean postoperative hospital stay was five days after TCDE and eight days after choledochotomy. The complication rate was 6.7%, in-

cluding 3.9% of local complications and 2.8% of general complications and the mortality rate was 1% (Table 1).

The most frequent local complications were biliary: three bilio-mas of which one needed a percutaneous drainage, and eight bile leaks of which one was managed laparoscopically, one by ES, and six stopped spontaneously. Two cases of cholangitis occurred in patients with T-tubes and were cured with antibiotics. There were two cases of biliary peritonitis, one at the time of T-tube ablation. They were managed by laparoscopy with one death due to cardiac failure. Two cases of pancreatitis occurred, with one managed conservatively and one needed reoperation for necrosectomy. There were 14 residual stones (3.37%): four after TCDE early in the series and ten after choledochomy. They were managed by 2 laparoscopies in three cases and postoperative ES in 11 cases, with four failures managed by laparotomy in one case and by laparoscopy in three cases.

The follow-up period ranged from 1 to 180 months (median = 108 months). Late complications occurred in 2.2% of patients (Table 2). There were six cases (1.44%) of recurrent lithiasis, one case of common bile duct stenosis (0.24%) due to a lost stone behind the CBD which was managed by a hepaticojejunostomy after failure of a biliary stent, and two cases of trocar site hernia.

## Discussion

Laparoscopic cholecystectomy is considered the gold standard for the treatment of symptomatic cholelithiasis. Therefore, it seemed logical to extend the benefits of the laparoscopic approach to the treatment of CBDS, with the aim of having less morbidity and mortality that is associated with open surgery, to avoid specific complications and sequelae of ES [2; 4], and to treat the patient with a single-

Table 1  
Complications of Laparoscopic Treatment of CBDS in 415 Patients

Complications	Number of patients
Port infection	1
Port hematoma	1
Infra-abdominal abscess	1
Infra-abdominal hematoma	4
Biloma	3
Bile leakage	6
Biliary peritonitis	2
TC drain displacement	1

Table 2  
Late Complications

Complications	Number of patients
Recurrent lithiasis	6
CBD stenosis	1
Trocar site hernia	2

stage procedure. The choice of the procedure (ES with subsequent LC or laparoscopic management) has to take into account several elements: the comorbidities of the patient, the complications of CBDS, a previous cholecystectomy, the skills of the surgeon and the endoscopist [8], and the early and late results of both procedures [4; 11; 16].

While in the early era of LC the majority of CBDS were managed by ES [5; 6] to avoid an open procedure, the development of laparoscopic techniques of stones extraction and their results have induced one to reconsider this approach. The systematic use of preoperative endoscopic retrograde cholangiopancreatography (ERCP) in patients with suspicion of CBDS results in a rate of 50–60% of negative exploration [2; 6]. ERCP can now be replaced by echoendoscopy, which is invasive and needs general anesthesia, or by resonance magnetic imaging cholangiography. On the other hand, when laparoscopic management is considered, there is no need for pre-





operative invasive exploration because the diagnosis of CBDS is based on routine IOC [1; 7; 10]. Because we do not perform preoperative exploration except liver function tests and ultrasonography, 26.2% of patients with CBDS in our series had stones diagnosed at IOC, confirming the fact that preoperative prediction of CBDS is poor.

Prospective studies of laparoscopic management of CBDS that included more than 200 patients [1; 7; 9] report success rates ranging from 88 to 97% (mean 92%), similar to ES success rates which range from 81 to 100% (mean 91%), but the clearance of CBDS after ES is obtained in 17–35% of cases after two to five attempts [1–14; 16], while laparoscopic treatment of CBDS is a one-stage procedure.

Comparing the use or the absence of biliary drainage after choledochotomy, Thompson and Tranter [15] reported a complication rate of 16% following the use of the T-tube, while it was only 5% for primary closure. However, in our series, as in that of Paganini and Lezoche [10], we did not have the same results. There were 13 biliary complications after choledochotomy: five occurred after primary closure of CBD, seven in patients with a T-tube, and one after transcystic drainage. We frequently used biliary drainage in our practice before but now we use it selectively, e.g., in case of cholangitis or porta hepatitis inflammation or when the number of stones is greater than six or seven because the risk of residual stones is increased in this case. It has been proposed that the T-tube be replaced by an antegrade stent [6], but this entails the risk of pancreatitis and a second procedure is needed to remove the stent.

Choledochotomy by first intention is indicated when the stones are larger than 7 mm, there are more than five or six, when the stones are located in

the proximal biliary tree. The necessary conditions to perform a choledochotomy are a CBD diameter of 5 mm or more and a proficiency in laparoscopic sutures. As for TCDE, the main cause of failure is impacted stones that can be fragmented with electrohydraulic lithotripsy. The rate of complications and the postoperative hospital stay depend on the technique of stones extraction used.

### Conclusion

The laparoscopic management of CBDS has the advantage over ES followed by LC because it is a onestage procedure. However, these two techniques are not opposite but complementary, each having its own indications. The laparoscopic treatment of CBDS is particularly indicated in ASA I and ASA II patients because it is a safe procedure in terms of short-term outcome and late sequelae. Any time it is feasible, transcystic extraction is preferable to choledochotomy because of its lower rate of complications and shorter hospital stay term.

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Ф. І. Костєв, Ю. М. Дехтяр, С. М. Руденко, О. С. Руденко,  
Р. Я. Пивоварчук, С. М. Хливненко

## РОЛЬ ДОБОВОГО МОНІТОРИНГУ УРОДИНАМІКИ В ДІАГНОСТИЦІ РОЗЛАДІВ СЕЧОВИПУСКАННЯ

Одеський національний медичний університет, Одеса, Україна

УДК 616.62-008.22-07

Ф. И. Костев, Ю. Н. Дехтярь, С. Н. Руденко, А. С. Руденко, Р. Я. Пивоварчук, С. М. Хливненко

### РОЛЬ СУТОЧНОГО МОНІТОРИНГА УРОДИНАМІКИ В ДІАГНОСТИКЕ РАССТРОЙСТВ МОЧЕИСПУСКАНИЯ

Одесский национальный медицинский университет, Одесса, Украина

Цель исследования было изучить диагностическое значение метода оценки функционального состояния нижних мочевых путей на основе суточного уродинамического мониторинга (УМ). Установлено, что у 15 (79 %) из 19 женщин с симптомами императивного мочеиспускания суточным УМ обнаружены признаки нестабильности детрузора, которая характеризовалась выраженным нарушением адаптации нижних мочевых путей, гипертонусом мышечных структур, повышенной рефлекторной возбудимостью со спонтанными сокращениями мочевого пузыря (от 1 до 12 незаторженных сокращений за одну фазу наполнения мочевого пузыря). У 4 (21 %) женщин с императивными дизурическими симптомами признаков гиперактивности детрузора не наблюдалось. Уродинамический мониторинг показал большую чувствительность по сравнению с лабораторной уродинамикой в оценке активности детрузора. Особенно ценен метод у больных, страдающих сложными формами дизурии или субклиническими проявлениями заболевания, когда стандартное уродинамическое исследование не выявляет изменений и наблюдается дискорреляция клинических проявлений заболевания и данных дополнительных обследований.

**Ключевые слова:** уродинамический мониторинг, стрессовое недержание мочи, гиперактивный мочевой пузырь, нестабильность детрузора.

