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· 专题研究 ·

程序化改良腹腔镜经胆囊管胆总管探查取石术的应用策略

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摘要

背景与目的: 腹腔镜经胆囊管胆总管探查取石术(LTCBDE)以创伤小、恢复快、并发症发生少等优势,已逐渐成为治疗继发性胆总管结石的首选方法。然而,术中胆囊管扩张、胆道镜置入、肝总管及肝内胆管探查仍是技术难点。本研究探讨程序化改良LTCBDE在治疗胆囊结石合并胆总管结石中的临床应用及其效果。

方法: 回顾性分析2018年1月—2024年1月期间,苏州大学附属苏州九院248例接受程序化改良LTCBDE患者的临床资料,总结其手术策略与治疗效果。同时,收集同期913例行腹腔镜胆总管切开探查取石术(LCBDE)的患者数据,比较两组患者的手术效果与术后并发症。

结果: 通过程序化手术步骤、创新“隔膜”切开技术及胆道探条的改良应用,共244例(98.4%)患者成功完成LTCBDE,4例因无法将4.9 mm胆道镜经胆囊管插入胆总管转为LCBDE。术后,1例(0.4%)发现胆道结石残留,后经T管窦道取石成功(该例术中转为LCBDE);另有1例胆汁漏及1例腹腔感染(各0.4%),经保守治疗恢复。术后未见腹腔出血、胆道狭窄或胆道损伤等其他并发症。程序化改良LTCBDE组的平均手术时间与LCBDE组相当(85.2 min vs. 88.0 min, $P=0.398$),但术后住院时间明显短于LCBDE组(6.2 d vs. 8.3 d, $P<0.001$),且并发症发生率更低(1.6% vs. 4.7%, $P=0.044$)。

结论: 程序化改良LTCBDE步骤规范、操作安全且疗效显著,具有较低的并发症发生率,值得在临床中进一步推广应用。

关键词

胆总管结石病; 胆囊管; 胆道探查; 隔膜切开; 程序化改良
中图分类号: R657.4

Application strategy of programmatic improvement in laparoscopic transcystic common bile duct exploration

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Abstract

Background and Aims: Laparoscopic transcystic bile duct exploration (LTCBDE) has become the preferred method for treating secondary bile duct stones due to its advantages of minimal trauma, fast recovery, and low complication rates. However, challenges remain in the dilation of the cystic duct, the

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insertion of the choledochoscope, and the exploration of the common hepatic duct and intrahepatic bile ducts. This study was performed to explore the clinical application and effectiveness of the programmed modified LTCBDE in the treatment of gallbladder stones combined with common bile duct stones.

Methods: A retrospective analysis was conducted on the clinical data of 248 patients who underwent programmed modified LTCBDE at the Affiliated Suzhou Ninth Hospital of Soochow University from January 2018 to January 2024. The surgical strategies and treatment outcomes were summarized. Data from 913 patients who underwent laparoscopic common bile duct exploration (LCBDE) during the same period were also collected to compare surgical outcomes and postoperative complications between the two groups.

Results: Through programmed surgical steps, the innovative "diaphragm" incision technique, and improved bile duct probe application, 244 patients (98.4%) successfully underwent LTCBDE, while 4 patients were converted to LCBDE due to failure to insert a 4.9 mm choledochoscope through the cystic duct. After operation, 1 patient (0.4%) had residual bile duct stones, which were successfully removed through T-tube tract stone extraction (this patient was converted to LCBDE during the procedure). Additionally, 1 case of bile leakage and 1 case of abdominal infection (each 0.4%) occurred, both of which resolved with conservative treatment. No cases of intra-abdominal bleeding, bile duct stenosis, or bile duct injury were reported. The average operative time in the programmed modified LTCBDE group was comparable to that of the LCBDE group (85.2 min vs. 88.0 min, $P=0.398$), but the postoperative hospital stay was significantly shorter (6.2 d vs. 8.3 d, $P<0.001$), and the incidence of complications was lower (1.6% vs. 4.7%, $P=0.044$).

Conclusion: The programmed modified LTCBDE is a standardized, safe, and effective procedure with a low complication rate. It is worthy of further clinical promotion and application.

Key words

Choledocholithiasis; Cystic Duct; Bile Duct Exploration; Diaphragm Incision; Programmatic Improvement

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胆囊合并胆总管结石是普通外科常见疾病,多采用微创治疗,常规方法通常包括:内镜下括约肌切开取石+腹腔镜下胆囊切除术,腹腔镜下胆囊切除+胆总管切开探查取石术(laparoscopic common bile duct exploration, LCBDE)和腹腔镜经胆囊管胆总管探查取石术(laparoscopic transcystic common bile duct exploration, LTCBDE)等^[1-5]。LTCBDE是近年来开展的临床新技术,并逐渐成为继发性胆总管结石的首选方法,特别是对于胆总管扩张不明显的患者^[6-8]。然而,传统观点认为LTCBDE手术适应证严格、学习曲线较长、手术要求相对较高,尤其是在肝总管及肝内胆管的探查及胆囊管的扩张方法等方面操作相对困难,导致成功率不高^[9-12]。笔者团队长期致力于探索LTCBDE治疗胆囊结石合并胆总管结石,并采用程序化改良技巧及策略,显著提高了LTCBDE成功率,取得了良好的效果,现报告如下。

1 资料与方法

1.1 一般资料

回顾性分析苏州大学附属苏州九院普通外科2018年1月—2024年1月248例程序化改良LTCBDE患者的临床资料,同时将同期行LCBDE的913例患者作为对照组,比较两组患者的手术效果及术后并发症情况。纳入标准:(1)术前行磁共振胰胆管成像(magnetic resonance cholangiopancreatography, MRCP)及肝胆B超检查确诊为胆总管结石,或术中胆道探查确诊为胆总管结石;(2)胆道解剖良好,胆囊管直径 ≥ 3 mm;(3)胆道感染或胆源性胰腺炎已基本得到控制。排除标准:(1)Mirizzi综合征等胆道结构变异;(2)胆总管结石长径 >1.5 cm;(3)合并胆道肿瘤;(4)需要经内镜逆行胆胰管造影(endoscopic retrograde cholangio-pancreatography, ERCP)处理的严重急性

胰腺炎；(5)腹腔镜手术禁忌证。本研究通过苏州大学附属苏州九院伦理委员会审批（审批号：KY2023-040-01），患者均签署知情同意书。

1.2 手术方法

手术设备通常包括Storz高清腹腔镜、Olympus胆道镜（直径4.9 mm）及其附属设备、取石网篮、胆道探条、腔镜分离钳、腔镜剪、电凝钩等常规腹腔镜手术器械。全麻成功后体位、气腹及Trocar布局与本手术团队既往报道^[10, 13]一致。

程序化改良LTCBDE步骤：(1)仔细解剖胆囊三角，可吸收夹夹闭离断胆囊动脉后充分游离胆囊管（或残余胆囊管），胆囊管远端予Hem-o-lok夹闭，可暂不离断，作牵引用。(2)腔镜剪或电凝钩先横行切开胆囊管前壁约1/2周径。(3)暂时拔除剑突下主操作孔Trocar，胆道探条头端予石蜡油充分润滑后快速经该戳孔置入胆囊管切开处，同时术者手指协助适当封堵胆道探条周围操作孔缝隙维持稳定CO₂气腹，采用胆道探条逐级扩张的方法（图1A-B）（必要时可在胆道探条的支撑指引与保护下在胆囊管前壁做一微T形切口或汇入部微切

开），即从3号胆道探条开始逐级扩张胆囊管，直至6号或7号探条能顺利经胆囊管进入胆总管。(4)经上述胆道探条逐级扩张后的胆囊管切开处置入胆道镜充分探查胆总管，并在取石网篮或激光碎石的配合下取出胆总管结石。(5)同法胆道探条向肝门部方向逐级扩张胆囊管，翻转胆道镜镜身向上探查肝总管及肝内胆管，如本手术团队既往报道^[10]一样，部分患者由于胆囊管与肝总管汇合处存在“隔膜”结构，导致胆道镜在向上探查时比较困难，可采用“隔膜”切开技术（图1C），即将胆道探条经胆囊管切开处进入胆总管，向上翻转插入肝总管，缓慢退出，沿肝总管方向挑起“隔膜”，并在胆道探条的指引与保护下使用电凝钩切开部分“隔膜”，同法胆道探条逐级向肝总管方向扩张，直至胆道镜可顺利通过并向上探查肝总管及肝内胆管（图1D），从而可避免转为LCBDE，而保持胆总管的完整性。(6)Hem-o-lok夹自胆囊管切开处下方夹闭并离断胆囊管，常规方法切除并取出胆囊，小网膜孔放置潘式引流管。

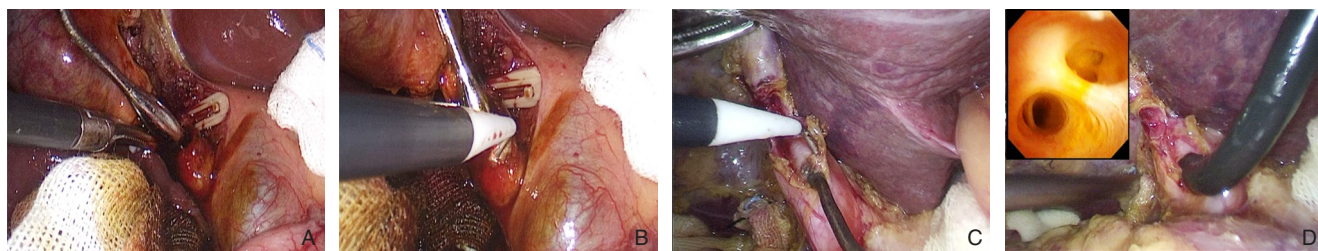


图1 胆总管结石患者程序化改良LTCBDE的关键技术 A: 胆道探条逐级扩张胆囊管；B: 胆道探条支撑引导与保护下在胆囊管前壁做一微T形切口或汇入部微切开；C: 胆道探条支撑引导下切开胆囊管与肝总管汇合处“隔膜”；D: 经胆道探条支撑与引导技巧或“隔膜”切开处理后，成功经胆囊管置入胆道镜后探查肝总管及肝内胆管

Figure 1 Key techniques of programmed modified LTCBDE for patients with common bile duct stones A: Gradual dilation of the cystic duct with a bile duct probe; B: Micro T-shaped incision or micro-incision at the confluence of the cystic duct under the support and guidance of the bile duct probe; C: Incision of the "diaphragm" at the junction of the cystic duct and common hepatic duct under the support and guidance of the bile duct probe; D: After bile duct probe support and guidance or "diaphragm" incision, successful insertion of the choledochoscope through the cystic duct to explore the common hepatic duct and intrahepatic bile ducts

LCBDE：手术体位、气腹及Trocar布局同程序化改良LTCBDE组，仔细解剖胆囊三角，可吸收夹及Hem-o-lok分别夹闭及离断胆囊动脉及胆囊管，充分显露胆总管，确认胆总管后于胆总管十二指肠上段处纵向切开8~10 mm，置入胆道镜探查并取出（配合取石网篮或激光）胆总管结石，向上探查肝总管及肝内胆管，然后根据胆管直径、炎症情况、术前相关指标、患者一般情况等决定行T管

置入或一期缝合，4-0/5-0单股可吸收缝线缝合固定T管或胆管壁，常规方法切除并取出胆囊，小网膜孔放置潘式引流管。

1.3 术后评估及随访

评估术中出血量、手术时间、术后住院时间。术后观察有无胆汁漏、腹腔出血、腹腔感染等并发症发生。患者术后1、6个月或有不适时至门诊复查，通常予问诊、肝功能及肝胆B超检查，少

部分患者随访过程中发现肝功能明显异常或持续右上腹隐痛时予 MRCP 评估。部分不便至门诊复查患者,可予电话随访。随访内容主要包括有无胆道狭窄、结石残留及复发等。随访截至 2024 年 7 月 15 日。

1.4 统计学处理

采用 SPSS 27.0 统计软件进行统计学分析。计量数据以均数 \pm 标准差 ($\bar{x} \pm s$) 表示,组间比较采用 t 检验;计数资料采用例 (百分数) [n (%)] 的形式表示,两组的比较采用 χ^2 检验或连续性校

正的 χ^2 检验。 $P < 0.05$ 为差异有统计学意义。

2 结果

2.1 两组患者基线资料比较

两组患者性别、年龄、既往史、ERCP 手术史、腹部手术史、合并胆源性胰腺炎、合并梗阻性黄疸等基线资料比较,差异均无统计学意义 (均 $P > 0.05$),具有可比性 (表 1)。

表 1 两组患者基线资料比较

Table 1 Comparison of the baseline data between the two groups of patients

临床参数	程序化改良 LTCBDE 组 (n=248)	LCBDE 组 (n=913)	t/χ^2	P
性别[n(%)]				
男	127(51.2)	451(49.4)	0.256	0.613
女	121(48.8)	462(50.6)		
年龄(岁, $\bar{x} \pm s$)	56.9 \pm 17.0	57.9 \pm 15.8	1.893	0.059
既往史[n(%)]				
高血压	80(32.3)	352(38.6)	3.309	0.069
糖尿病	29(11.7)	100(11.0)	0.108	0.742
心脏疾患 ¹⁾	10(4.0)	54(5.9)	1.327	0.249
ERCP 手术史	3(1.2)	8(0.9)	0.012	0.912
腹部手术史	20(8.1)	110(12.0)	3.113	0.078
合并胆源性胰腺炎[n(%)]	20(8.1)	70(7.7)	0.043	0.836
合并梗阻性黄疸[n(%)]	72(29.0)	320(35.0)	3.157	0.076

注:1)包括冠心病、房颤、心功能不全、心脏起搏器植入状态等

Note: 1) including coronary heart disease, atrial fibrillation, cardiac insufficiency, pacemaker implantation status, etc

2.2 两组患者手术方式情况

程序化改良 LTCBDE 组中通过程序化的手术步骤、“隔膜”切开技术的创新应用及胆道探条的改良使用技巧,244 例 (98.4%) 成功完成 LTCBDE 术,4 例因无法将 4.9 mm 胆道镜经胆囊管插入胆总管而转为 LCBDE。其中 19 例 (7.7%) 胆道镜可直接经胆囊管切开处进入胆总管及肝内胆管完成探查及取石;43 例 (17.3%) 行基于胆道探条支撑引导技巧下的“隔膜”切开技术辅助完成 LTCBDE;182 例 (73.4%) 行基于胆道探条支撑引导技巧下的汇入部微切开方式辅助完成 LTCBDE 术;无中转开放手术病例。LCBDE 组中胆总管切开探查取石后 541 例 (59.3%) 行胆管一期缝合术;367 例 (40.2%) 放置 T 管引流;5 例 (0.5%) 中转开放手术 (表 2)。

表 2 两组患者手术情况 [n (%)]

Table 2 Surgical details in both groups of patients [n (%)]

项目	数值
程序化改良 LTCBDE 组 (n=248)	
直接进入胆囊管	19(7.7)
汇入部微切开	182(73.4)
“隔膜”切开	43(17.3)
转 LCBDE	4(1.6)
中转开放手术	0(0.0)
LCBDE 组 (n=913)	
一期缝合	541(59.3)
放置 T 管	367(40.2)
中转开放手术	5(0.5)

2.3 两组患者术中及术后情况

程序化改良 LTCBDE 组平均手术时间并不长于 LCBDE 组 [(85.2 \pm 29.1) min vs. (88.0 \pm 36.4) min, $P=0.398$]; 平均术后住院时间较 LCBDE 组更短

[(6.2±1.9) d vs. (8.3±2.6) d, $P<0.001$]; 程序化改良 LTCBDE 组术后发生肺部感染 (0.4%)、胆汁漏 (0.4%)、腹腔感染 (0.4%) 各 1 例, 经保守治疗后好转, 术后 1 例 (0.4%) 发现胆道结石残留,

后经 T 管窦道取石成功 (该例术中转为 LCBDE); 但程序化改良 LTCBDE 组术后并发症发生率较 LCBDE 组更低 (1.6% vs. 4.7%, $P=0.044$) (表 3)。

表 3 两组患者术中及术后情况

Table 3 Intra- and postoperative variables of the two groups of patients

项目	程序化改良 LTCBDE 组(n=248)	LCBDE 组(n=913)	t/χ^2	P
平均手术时间(min, $\bar{x} \pm s$)	85.2±29.1	88.0±36.4	0.849	0.398
平均术后住院时间(d, $\bar{x} \pm s$)	6.2±1.9	8.3±2.6	8.773	<0.001
术后并发症[n(%)]	4(1.6)	43(4.7)		
腹腔出血	0(0.0)	2(0.2)		
胆汁漏	1(0.4)	17(1.9)		
肺部感染	1(0.4)	20(2.2)	4.051	0.044
腹腔感染	1(0.4)	2(0.2)		
胆道狭窄	0(0.0)	0(0.0)		
胆道损伤	0(0.0)	0(0.0)		
结石残留	1(0.4)	2(0.2)		
死亡[n(%)]	0(0.0)	0(0.0)	—	—

3 讨论

目前对于多数医院和基层医院, 腹腔镜胆总管手术仍以胆总管切开一期缝合或胆总管切开 T 管引流术为主^[3,14-16]。LTCBDE 是近年来治疗胆囊结石合并胆总管结石的临床新技术, 然而多限于较大医院或经验丰富的胆道外科中心推广应用, 其原因主要基于对于初学者而言 LTCBDE 手术适应证严格、学习曲线较长、手术要求相对较高, 导致成功率不高, 尤其是在胆囊管扩张操作、肝门部胆管探查等方面操作较为困难^[2,9-11,17]。程序化手术步骤能够使手术操作更加规范、缩短手术时间, 有助于提高手术的成功率及安全性, 有利于手术推广应用^[18-21]。此外, 不断地改良及创新手术操作技巧, 可以使手术化繁为简, 解决常规手术中的难点^[22-24]。近十余年来苏州大学附属苏州九院普外科长期致力于探索 LTCBDE 治疗胆囊结石合并胆总管结石, 在“隔膜”切开、胆道探条逐级扩张、胆道探条支撑引导等方面积累了丰富的经验, 程序化了手术步骤、改良创新了关键技术、突破了部分手术难点及技术壁垒^[10,13]。为了提高 LTCBDE 的成功率与安全性, 将 LTCBDE 术式的优势发挥到最大, 笔者总结与提出了程序化改良 LTCBDE 的应用策略与技巧, 取得了良好的效果。

程序化手术步骤主要包括六步, 即: 充分游

离胆囊管 (或残余胆囊管)、横行或微 T 形切开胆囊管前壁、胆道探条逐级扩张胆囊管、胆道镜充分探查及取石、肝门部胆管及肝内胆管探查、离断胆囊管及切除胆囊。其中贯穿于程序化步骤中第三步和第五步的胆道探条逐级扩张联合支撑引导技巧及第五步中的“隔膜”切开技术是改良创新方面。通过笔者团队成功完成 244 例 (98.4%) LTCBDE, 总结出此程序化改良术式的主要优势有以下几个方面: 第一, 所需操作器械简单, 传统开腹胆道探条即可, 且相对腹腔镜分离钳及扩张球囊, 胆道探条头端更圆润, 予石蜡油润滑后能快速自由进入胆囊管、汇入部及胆总管且长度足够。第二, 直视下胆道探条支撑引导保护下微 T 形切开胆囊管、汇入部微切开或“隔膜”切开, 有利于保护胆道后壁, 大大降低胆道损伤的风险。中国胆道外科之父黄志强院士^[25]曾将医源性胆管损伤称作是“胆道外科永远的痛”, 笔者将胆道探条支撑引导技巧作为改良创新的重要一步, 能极大地提高手术安全性。程序化改良 LTCBDE 组 248 例患者手术过程中无明显技术相关并发症发生, 术后未出现胆道出血、胆道损伤、胆道狭窄等并发症。第三, “隔膜”切开技术, 能解决经胆囊管入路探查肝总管及肝内胆管存在的困难之处, 突破 LTCBDE 肝门部胆管探查的弱势。腹腔镜胆总管手术不仅要向下探查胆总管, 还要向上探查肝门部

胆管及肝内胆管(可视部分),同笔者之前的报道一致,部分患者因胆囊管汇入肝总管处“隔膜”的存在,经胆囊管入路向上探查存在一定困难,部分术者可能存在侥幸心理而放弃向上探查肝门部胆管,导致肝总管或肝内胆管结石残留;还有部分术者为了继续向上探查胆管,而转为胆总管切开或汇入部微切开探查方式,存在一定概率的胆汁漏及胆管狭窄的风险^[2,10,26-28]。程序化改良LTCBDE组中43例行“隔膜”切开技术,突破“隔膜”壁垒,顺利完成肝门部及肝内胆管探查。因此,笔者的经验是在胆道镜镜身予石蜡油充分润滑后通常能很顺利地通过经胆道探条逐级扩张后的胆囊管进入胆总管,若胆道镜仍不能顺畅进入,则可在胆道探条支撑引导下行胆囊管汇入部微切开后置入胆道镜,经过上述方法经胆囊管置入胆道镜行胆总管下段的探查及取石。完成胆总管探查后勿将胆道镜完全退出,而是在胆道镜镜头退至汇入部时,通过左手胆道镜适配器上的软镜角度控制器翻转镜头,类似“雨刮器”动作,使镜头滑入肝总管,从而行肝总管及肝内胆管的探查。部分患者因胆囊管汇入肝总管处“隔膜”的存在,导致胆道镜镜头向上翻转滑入肝总管比较困难,则可在胆道探条支撑与保护下行“隔膜”切开,从而顺利滑入肝总管完成向上探查。第四,该程序化改良术式,不需要特殊器械,不额外增加手术费用,且操作便捷,不额外增加操作孔,不影响整体手术时间。

此外,值得注意的是,大多数诊疗技术的改良与程序化操作除了具有较大的优势与创新性,也可能存在不同程度的经验性、主观性及局限性,在实施过程中需灵活应用,不能一味墨守成规^[29-30]。首先,程序化改良LTCBDE对术者腹腔镜胆管手术及胆道镜使用水平具有较高要求,需要一定学习曲线,初学者不论是在胆囊管扩张技巧还是“隔膜”切开操作,都需要避免胆道损伤。其次,对于部分急性发作患者,胆囊三角炎性水肿、结构常常显示欠清,胆道探条逐级扩张胆囊管容易造成胆囊管撕裂甚至胆道损伤,宜及时采用LCBDE。此外,对于胆囊管直径明显偏细者、胆道本身结构变异者,如Mirizzi综合征、胆囊管与肝总管低位汇合、胆囊管汇入右肝管或副右肝管等,也应避免盲目追求LTCBDE,这些情况下不论是采用胆道探条逐级扩张及支撑引导还是“隔

膜”切开,都可能费时费力而且扩张及探查效果差,最终还是需要放弃经胆囊管这一途径,而且容易损坏胆道镜,甚至导致胆道损伤,出现严重并发症。所以,对于这些存在胆囊管直径偏细、胆道结构变异者,也建议及时行LCBDE。令人欣慰的是,MRCP检查已逐渐成为胆道疾病术前的常规检查,不仅可提高诊断率,更主要的是可以评估胆囊及胆道炎症情况,胆囊管、胆总管直径大小、胆道有无解剖结构变异等情况^[8,31],对患者是否可行LTCBDE及可能需要何种改良操作技巧具有一定的术前指导与参考作用,有利于制定合理的手术方案,提高手术的成功率与安全性。本团队已对每例胆道疾病患者常规行肝胆B超、CT及MRCP检查,获得了较为满意的效果。然而,还需要注意的是,由于本研究为单中心回顾性研究,仍存在一定局限性,未来还需要开展多中心、高质量的前瞻性随机对照研究及长期的临床观察与随访加以验证。

LTCBDE是近年来治疗胆囊结石合并胆总管结石的临床新技术,常规观点认为此术式对术者熟练程度具有较高要求,需要一定学习曲线,笔者通过程序化手术步骤及改良创新操作要领,使手术更加规范化与简易化,提高了手术成功率与安全性,造福广大胆囊结石合并胆总管结石患者。此外程序化改良LTCBDE有利于缩短年轻医师的学习曲线、提高手术信心,值得临床进一步推广和应用,并且有望成为胆囊结石合并胆总管结石微创治疗的首选及标准术式之一。

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