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· 专题研究 ·

## 自制腹腔镜胆道冲洗器在腹腔镜胆总管取石术中的应用： 双中心经验总结

陈漩<sup>1</sup>，吴嘉艺<sup>2</sup>，胡建玲<sup>1</sup>，覃超<sup>1</sup>，沈从彬<sup>1</sup>

(1.福建省浦城县医院 外三科，福建 南平 353400；2.福建省立医院 肝胆胰外科，福建 福州 350001)

### 摘要

**背景与目的：**腹腔镜胆总管探查取石术(LCBDE)是治疗胆总管结石的主要治疗方式，但在LCBDE过程中，由于术中缺少窦道支撑，经典的胆道镜下网篮取石相对较为困难，对术者的操作技术要求高，反复的胆道镜取石也容易造成胆道镜损坏或胆管壁损伤。为了更好地提高取石效率，降低手术难度，笔者对胆道镜取石术进行改良，即LCBDE术中采用自制腹腔镜胆道冲洗器配合胆道镜取石。本研究总结两个中心应用该方法的临床效果。

**方法：**回顾2017年1月—2021年1月福建省立医院和福建省浦城县医院收治的313例LCBDE术中应用自制腹腔镜胆道冲洗器治疗的胆总管结石患者的临床资料，分析患者围手术期情况及近期预后。

**结果：**313例患者中，男132例，女181例；平均年龄(56.3±13.2)岁；173例患者为胆总管单发结石，140例患者为胆总管多发结石(结石最多者为10枚)；中位结石直径为0.5(0.2~3.1)cm，中位胆总管直径为1.2(0.6~3.3)cm。手术均顺利完成，无中转开腹。其中281例(89.8%)患者使用自制腹腔镜胆道冲洗器取净结石，32例(10.2%)患者术中联合网篮取石。307例(98.1%)患者一期取净结石，6例(1.9%)患者残留结石；157例(50.2%)术后一期缝合胆总管，156例(49.8%)术后留置T管引流。平均手术时间(109.3±29.4)min，平均术中出血量(42.5±8.4)mL，平均术后住院时间(7.6±3.2)d。术后12例出现胆汁漏，12例出现腹腔感染，9例出现肺部感染，7例出现切口感染，1例出现术后出血，均经保守治疗后痊愈。6例无法一期取净结石患者均于术后1.5个月行经T管窦道胆道镜取净结石。术后随访6~12个月，无胆管结石复发、胆道狭窄等其他并发症。

**结论：**LCBDE术中应用自制腹腔镜胆道冲洗器安全可靠，取石效率高，故推荐使用。

### 关键词

胆总管结石病；碎石术；腹腔镜；胆道镜

中图分类号：R657.4

## Application of self-designed laparoscopic bile duct irrigator in laparoscopic common bile duct exploration: a two-center experience

CHEN Xuan<sup>1</sup>, WU Jiayi<sup>2</sup>, HU Jianling<sup>1</sup>, QIN Chao<sup>1</sup>, SHEN Congbin<sup>1</sup>

(1. Department of Surgery III, Pucheng Hospital, Nanping, Fujian 353400, China; 2. Department of Hepatobiliary and Pancreatic Surgery, Fujian Provincial Hospital, Fuzhou 350001, China)

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作者简介：陈漩，福建省浦城县医院副主任医师，主要从事肝胆管结石及肝胆胰恶性肿瘤方面的研究。

通信作者：沈从彬，Email: shcb3193@163.com

**Abstract**

**Background and Aims:** Laparoscopic common bile duct exploration (LCBDE) is the main method for the treatment of common bile duct stones. However, due to the lack of sinus tract support, the traditional laparoscopic choledocholithotomy using basket forceps under choledochoscopic guidance is relatively difficult with high technical requirement. Repeated stone extraction may easily cause the damage of the choledochoscopy or injury of the bile duct wall. For the purpose of achieving a high stone extraction rate and low technical requirement, the authors modified the choledochoscopic stone removal procedure by using a self-designed laparoscopic bile duct irrigator to assist choledochoscopic lithotripsy during LCBDE. This study was conducted to summarize the clinical effect of using this method in two centers.

**Methods:** The clinical data of 313 eligible patients with common bile duct stones treated with self-designed laparoscopic bile duct irrigator during LCBDE in Fujian Provincial Hospital and Fujian Pucheng County Hospital from January 2017 to January 2021 were reviewed. The perioperative data and short-term outcomes of the patients were analyzed.

**Results:** Of the 313 patients, 132 cases were males and 181 cases were females with a mean age of (56.3±13.2) years, 173 cases had solitary stone and 140 patients had multiple stones (the maximum number of stone amount was 10); The median diameter of the stones was 0.5 (0.2–3.1) cm and the median common bile duct diameter was 1.2 (0.6–3.3) cm. All the 313 cases were successfully performed without conversion to open surgery. The stones were completely removed by laparoscopic bile duct irrigator in 281 cases (89.8%), and in 32 cases were extracted in combination with a stone basket. The stones were completely removed in one session in 307 patients (98.1%) while residual stones were found in 6 patients; 157 patients received primary closure and 156 patients underwent T-tube drainage of the common bile duct after operation. The mean operative time was (109.3±29.4) min, the mean intraoperative blood loss amount was (42.5±8.4) mL, and the average length of postoperative hospital stay was (7.6±3.2) d. There were 12 cases of bile leakage, 12 cases of abdominal infection, 9 cases of pulmonary infection, 7 cases of incision infection, and 1 case of postoperative bleeding after operation. All of them were cured after non-surgical approach. The residual stones in all the 6 patients with failure of complete stone removal in the first session were completely cleared by choledochoscopic lithotripsy through the T-tube tract 1.5 months after the operation. Postoperative follow-up was conducted for 6 to 12 months, and no recurrent bile duct stones and biliary stenosis or other complications were noted.

**Conclusion:** Using self-designed laparoscopic bile duct irrigator in LCBDE is safe and reliable with high efficiency. It is recommended to be used.

**Key words**

Choledocholithiasis; Lithotripsy; Laparoscopes; Choledochoscopes

**CLC number:** R657.4

胆总管结石是肝胆外科的常见病、多发病,约占胆石症的10%~20%<sup>[1-2]</sup>,其临床表现为反复发作的上腹痛、发热、黄疸等,严重时可发展为急性重症胰腺炎、急性梗阻性化脓性胆管炎、多器官功能障碍综合征等,甚至危及生命<sup>[3]</sup>。

目前,对于胆总管结石治疗首选手术取石,常见取石方法包括开腹胆总管切开取石、经内镜逆行性胰胆管造影术(endoscopic retrograde cholangiopancreatography, ERCP)及腹腔镜胆总管探查取石(laparoscopic common bile duct exploration, LCBDE)<sup>[3-7]</sup>。随着腹腔镜和胆道镜技术的发展,

LCBDE越来越多地应用于胆总管结石治疗<sup>[6-8]</sup>。但是在LCBDE取石过程中,由于术中缺少窦道支撑,经典的胆道镜下网篮取石相对较为困难,对术者的操作技术要求高,反复的胆道镜取石也容易造成胆道镜损坏或胆管壁损伤。这些都限制了LCBDE的广泛开展。目前,对于经典胆道镜下网篮取石的改良术式较少,多为硬镜取石或开放取石钳取石<sup>[9-11]</sup>。硬镜取石相对软镜粗暴、灵活性差,亦存在胆道损伤风险,应用受限。福建省立医院肝胆胰外科经过多年临床实践,创新性地将自制腹腔镜胆道冲洗器应用于LCBDE术中,取得

了满意的临床疗效。本研究回顾性分析采用自制腹腔镜胆道冲洗器在LCBDE术中的应用情况，现报告如下。

## 1 资料与方法

### 1.1 一般资料

回顾性分析2017年1月—2021年1月福建省立医院及浦城县医院采用自制腹腔镜胆道冲洗器应用于行LCBDE术患者的临床资料。入组患者共313例，其中男132例，女181例；平均年龄 $(56.3 \pm 13.2)$ 岁；既往上腹部手术史29例。所有患者术前均完善B超、CT或磁共振胰胆管成像(MRCP)，明确胆总管结石的部位、大小和数目，评估胆总管结石是否嵌顿。173例患者为胆总管单发结石，140例患者为胆总管多发结石，结石最多者为10枚，中位结石直径为 $0.5 (0.2 \sim 3.1)$  cm，中位胆总管直径为 $1.2 (0.6 \sim 3.3)$  cm。

本研究符合医学伦理学要求，术术前已征得所有患者或者近亲家属同意并签署知情同意书。

### 1.2 纳入标准及排除标准

纳入标准：(1)经B超、CT或MRCP确诊胆总管结石，并采用LCBDE治疗患者；(2)患者无胆总管结石严重嵌顿或胆源性胰腺炎急性期。排除标准：(1)非采用自制腹腔镜胆道冲洗器取石患者；(2)合并肝内胆管结石或肝内外胆管狭窄患者；(3)合并胆总管肿瘤或括约肌功能失调患者；(4)资料不全者。

### 1.3 腹腔镜胆道冲洗器的制作

胆道冲洗器取材自一次性球式灌洗器弯头(上海上医康鸽, 60 mL)，裁剪剪取远端约10 cm，套入腹腔镜冲洗器，弯头覆盖住腹腔镜冲洗器侧孔(图1)。

### 1.4 手术方法

气管插管全身麻醉，取头高脚低仰卧位，左倾 $15 \sim 30^\circ$ ，建立 $\text{CO}_2$ 气腹，气腹压 $12 \sim 15$  mmHg ( $1 \text{ mmHg} = 0.133 \text{ kPa}$ )。采用4孔法放置Trocar，脐下缘放置10 mm观察孔，中上腹剑突下放置12 mm主操作孔，右锁骨中线及右腋前线肋缘下2 cm分别放置5 mm辅助操作孔。解剖胆囊三角，仔细辨认胆总管、肝总管、胆囊管关系，Hem-o-lock (Teleflex, 美国)分别夹闭胆囊动脉及胆囊管，顺逆结合切除胆囊。暴露胆总管前壁，于胆总管前壁纵行切开 $6 \sim 20$  mm (稍大于胆总管结石最大径)。自剑突下主操作孔送入自制腹腔镜胆道冲洗器，弯头朝向胆总管远端，置入深约3 cm，加压冲洗(图2A)，取石钳配合取净胆总管切口下结石(图2B)，如此反复1~3次；必要时联合网篮辅助取石。胆道镜(Olympus, 日本)探查确定肝内外无结石残留，十二指肠乳头通畅无反流。根据术中胆道炎症情况、结石取净程度，酌情一期缝合胆总管或者放置T管引流。术区仔细止血，于文氏孔放置腹腔引流管。

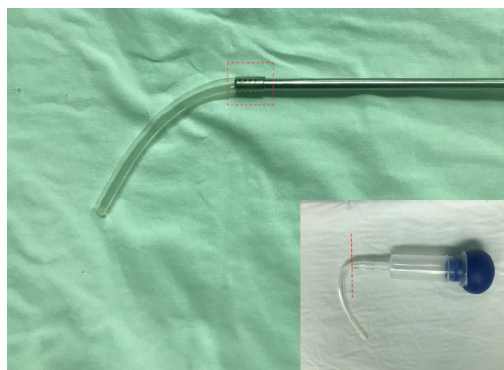


图1 腹腔镜胆道冲洗器制作

Figure 1 Preparation of the laparoscopic bile duct irrigator

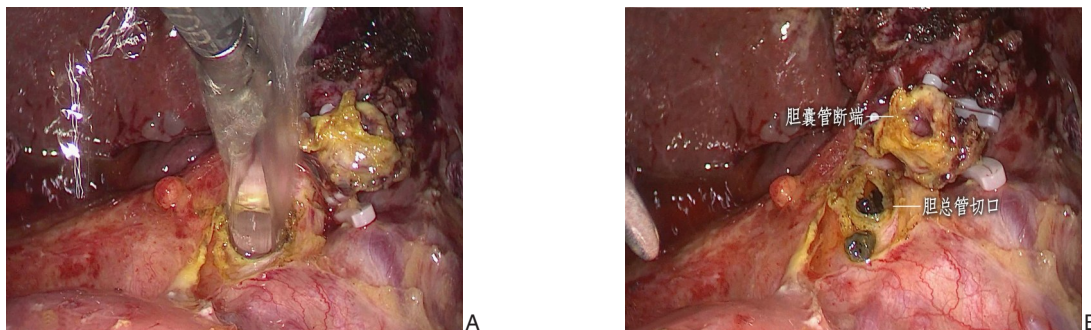


图2 术中照片 A: 腹腔镜胆道冲洗器冲洗; B: 结石冲洗至胆总管切口附近

Figure 2 Intraoperative images A: Intraoperative flushing with the laparoscopic bile duct irrigator; B: The stones moving to the opening of the common bile duct incision after flush

## 1.5 观察指标

手术情况:手术完成情况、是否联合网篮取石、是否留置T管、总手术时间及术中出血量;术后并发症情况及术后住院时间。随访情况:胆道狭窄、结石复发情况。

## 1.6 随访

术中留置T管者于术后1~1.5个月行经T管窦道胆道镜探查或取石术。所有患者术后3个月及1年随访复查上腹部CT或MRCP了解有无结石残留及胆道狭窄。门诊或电话随访6~12个月。

# 2 结果

## 2.1 手术情况

313例手术均顺利完成,无中转开腹;其中281例(89.8%)患者使用自制腹腔镜胆道冲洗器取净结石,32例患者因结石难以取净术中联合网篮取石;307例(98.1%)患者一期取净结石,6例患者因残留结石留置T管;157例术后一期缝合胆总管,156例术后留置T管引流。平均手术时间( $109.3 \pm 29.4$ ) min,平均术中出血量( $42.5 \pm 8.4$ ) mL。

## 2.2 术后情况

术后12例出现胆汁漏,12例腹腔感染,9例肺部感染,7例切口感染,1例术后出血,均经保守治疗后痊愈。术后住院时间( $7.6 \pm 3.2$ ) d。6例无法一期取净结石患者,均于术后1.5个月行经T管窦道胆道镜取净结石。

## 2.3 长期随访情况

所有患者门诊或电话随访6~12个月,平均随访( $9.7 \pm 1.2$ )个月,无胆管结石复发、胆道狭窄等其他并发症发生。

# 3 讨论

近年,随着人们生活水平的提高,饮食结构的变化,胆石症患者人数呈现增长态势<sup>[12-13]</sup>。指南均推荐无论胆总管结石有无症状,都应取石治疗<sup>[2, 12-13]</sup>,仅当手术或者内镜治疗风险高、年老体弱不能耐受手术时才考虑保守治疗。开腹胆总管切开取石是治疗胆总管结石的经典术式,近年来随着内镜技术及腹腔镜技术的发展,开腹手术方式已较少应用于临床。ERCP无需全身麻醉,且创

伤较小,尤为适用于老年高龄患者、胆总管不扩张及多次手术患者。但其需要切开十二指肠乳头括约肌,术后存在乳头括约肌松弛、肠液反流风险,并且绝大部分患者合并胆囊结石需要二期手术切除胆囊,因此其临床应用受限<sup>[14-16]</sup>。LCBDE具有微创、切口小、出血少、一期取净结石、近远期并发症少等优点,已逐渐成为治疗胆总管结石的主要手术方式<sup>[1-3, 14-19]</sup>。

然而,不同于开放手术或者经窦道取石,LCBDE术中缺乏固定及支撑物,胆道镜下网篮取石往往费时、费力、学习曲线长,且反复取石过程中容易损坏胆道镜,使得部分初学者或年轻外科医生“忘石兴叹”,限制了该术式推广。此外,由于解剖学原因,胆总管结石易嵌顿于胆总管下段,甚至嵌顿于胆总管括约肌与壶腹部括约肌之间,由于嵌顿结石的压迫以及胆管炎症的刺激,网篮难以张开取石,术中网篮反复机械性刺激导致胆管壁进一步充血水肿或Oddi括约肌水肿,增大取石难度和结石嵌顿风险。目前,对于胆道镜取石的改良报道相对较少,多为小儿输尿管硬镜取石、开放取石钳取石<sup>[9-11]</sup>,其灵活性差,亦存在胆道损伤风险,故限制其推广。自制腹腔镜胆道冲洗器相当于提供“人工窦道支撑”,较好地解决以上各个问题。

自制腹腔镜胆道冲洗器的制作来源于福建省立医院肝胆胰外科,我科自学习开展以来,大大提高取石效率,降低胆道镜及网篮使用次数。对比常规网篮取石,自制腹腔镜胆道冲洗器的优点如下:(1)自制腹腔镜胆道冲洗器制作简单、成本低廉,不增加患者经济负担;(2)自制腹腔镜胆道冲洗器操作简单,其前端部分刚柔适中,质地介于软硬镜之间;既有硬镜的可操作性,有利于术中控制冲洗方向,又有软镜的灵活性,不易造成胆管壁损伤,降低初学者术中胆道镜取石难度;(3)较网篮机械性取石相比,自制腹腔镜胆道冲洗器取石成功率高,尤其是对于胆总管下段结石患者,自制腹腔镜胆道冲洗器不会加重胆管壁充血水肿及括约肌痉挛,减少结石嵌顿风险,增加一期取净结石成功率,本研究一期取净结石率高达98.1%;(4)自制腹腔镜胆道冲洗器取石效率高,通过胆总管腔内外压力差,胆总管结石自行冲出胆总管切口,本研究中89.8%患者无需网篮取石,大

大提高取石效率；(5)减少术中胆道镜和取石网篮的使用频率，延长了胆道镜及网篮的使用寿命。

总结自制腹腔镜胆道冲洗器在LCBDE中应用体会如下：(1)胆总管切开长度：自制腹腔镜胆道冲洗器是通过胆总管腔内外压力差将胆总管结石冲出胆总管切口处，因此，胆总管切开长度应长于胆总管结石最大径，以确保足够的压力差将结石冲出胆总管切口。本研究中无术中将胆总管结石冲洗至肝内胆管病例，合适的胆总管切开长度是关键；(2)减少术后结石残留风险：随着技术及快速康复理念的深入，近年来胆总管切口一期缝合比例越来越高，术中确保取净结石是不可避免的。术前仔细阅片，了解胆总管结石数目及大小，与术中取出结石数量及大小相匹配是关键。

虽然自制腹腔镜胆道冲洗器取石效率高，但仍不能替代网篮取石，仍有少部分患者需要术中联合网篮取石。部分患者结石严重嵌顿，反复大量的胆道冲洗容易胆道逆行性感染，此时仍建议术中留置T管，以待于术后胆道炎症消退后二期经T管窦道取石。本研究6例术中残余结石均为结石嵌顿于胆总管括约肌与壶腹部括约肌之间，造成术中取石困难，经T管引流减压后二期取净结石。此外，自制腹腔镜胆道冲洗器的安全性及有效性仍有待进行临床大样本的前瞻性随机对照研究证实。

综上，本文通过回顾性病例研究，发现LCBDE术中使用自制腹腔镜胆道冲洗器取石安全可靠、简单方便、取石效率高，值得推广。

利益冲突：所有作者均声明不存在利益冲突。

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