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❖临床医学研究❖

腹腔镜胆道镜联合取石一期胆总管缝合对老年胆总管结石伴胆囊结石的疗效

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【摘要】**目的**:分析腹腔镜胆道镜联合取石一期胆总管缝合(PDC)对老年胆总管结石(CBDS)伴胆囊结石的临床疗效。**方法**:回顾性收集102例老年CBDS伴胆囊结石患者的临床资料,按治疗方案不同将患者分为A组(行腹腔镜胆道镜联合取石+PDC治疗,$n=51$)和B组(行腹腔镜胆道镜联合取石+T管引流治疗,$n=51$)。比较两组患者手术相关指标、术后72 h肝功能和炎症应激指标水平,记录两组患者并发症发生情况及术后复查情况。**结果**:A组手术用时、肛门排气时间和住院时间均短于B组($P<0.05$),住院总费用少于B组($P<0.05$)。术后72 h,两组患者ALP、TBIL水平均低于术前($P<0.05$),IL-6、CRP、E和Cor水平均高于术前($P<0.05$),但A组上述各指标水平均低于B组($P<0.05$)。两组患者并发症总发生率及术后复查情况无统计学差异($P>0.05$)。**结论**:老年CBDS伴胆囊结石的腹腔镜胆道镜联合取石术中应用PDC与T管引流治疗的远期效果相当,但PDC在缩短手术和住院时间、促进术后恢复、改善肝功能和炎症反应方面更具优势。

【关键词】老年胆总管结石;胆囊结石;腹腔镜;胆道镜;一期胆总管缝合;临床疗效;肝功能
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Efficacy of laparoscopy with choledochoscopy for lithotomy combined with primary duct closure on elderly common bile duct stones with gallbladder stones

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【**Abstract**】**Objective**: To analyze the clinical efficacy of laparoscopy with choledochoscopy for lithotomy + primary duct closure (PDC) on elderly common bile duct stones (CBDS) with gallbladder stones. **Methods**: 102 elderly patients with CBDS and gallbladder stones in the hospital were retrospectively collected. According to different treatment regimens, the enrolled patients were divided into group A (laparoscopy with choledochoscopy for lithotomy + PDC therapy, $n=51$) and group B (laparoscopy with choledochoscopy for lithotomy + T tube drainage, $n=51$). The surgery-related indicators, liver function and inflammatory stress indicators at 72 h after surgery were compared between groups of patients, and the incidence rates of complications and postoperative review conditions were recorded in the two groups of patients. **Results**: The surgical time, anal exhaust time and hospital stay in the group A were shorter than those in the group B ($P<0.05$), and the total hospitalization cost was less than that in the group B ($P<0.05$). The levels of ALP and TBIL in both groups were lower at 72 h after surgery than those before surgery ($P<0.05$) while the levels of IL-6, CRP, E and Cor were higher than those before surgery ($P<0.05$), but the levels of the above indicators were lower in the group A than those in the group B ($P<0.05$). There were no statistical differences in the total incidence rate of complications and postoperative review conditions between the two groups ($P>0.05$). **Conclusion**: The long-term effects of PDC and T tube drainage during laparoscopy with choledochoscopy for lithotomy are similar in the treatment of elderly CBDS with gallbladder stones, but PDC has more advantages in shortening surgical time and hospital stay, promoting postoperative recovery and improving liver function and inflammatory stress response.

【**Key words**】Elderly common bile duct stones; Gallbladder stones; Laparoscopy; Choledochoscopy; Primary duct closure; Clinical efficacy; Liver function

胆总管结石(common bile duct stones, CBDS)以腹痛、发热、黄疸为主要临床表现,结石虽主要位于整个肝外胆管,但有原发性和继发性结石之分,前者发生率存在地域差异,后者临床上较为普遍,病因多

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与胆囊结石有关,且发病率呈升高趋势[1]。目前,腹腔镜胆道镜联合+T管引流术成为治疗CBDS伴胆囊结石的经典术式,能快速缓解病情,达到减黄减压及减少术后胆漏发生的目的[2-3]。但有学者[4]认为,T管的放置不仅会增加T管特有并发症,还会影响患者术后生活质量,不利于老年患者术后恢复。一期胆总管缝合术(primary duct closure,PDC)是指结石取尽后不采用任何引流措施直接缝闭胆总管切口,具有操作简单、并发症相对较少、利于老年患者术后康复等特点,但可能会增加胆漏发生率[5-6]。以取石术后应直接行一期缝合还是常规行T管引流至今尚未有统一定论。基于此,本研究在治疗老年CBDS伴胆囊结石中对腹腔镜胆道镜联合取石+PDC或T管引流的效果及安全性进行比较。

1　资料与方法

1.1　一般资料

回顾性分析2020年3月至2024年3月咸阳市中心医院收治的102例老年CBDS伴胆囊结石患者的临床资料。纳入标准:(1)术前已确诊为CBDS伴胆囊结石[7];(2)年龄≥60岁;(3)临床资料完整,无手术禁忌证。排除标准:(1)合并其他胆管疾病者,如胆道蛔虫、胆管炎、胆源性胰腺炎等;(2)肝胆系统肿瘤者;(3)既往有手术治疗史者;(4)伴有血液、免疫系统疾病者;(5)重要脏器功能严重受损者;(6)有意识障碍或精神病症者;(7)术中中转开腹者。将入选患者按治疗方案不同分为A组和B组,每组各51例。两组患者一般资料(性别、年龄、胆总管直径、胆总管结石数目及胆囊结石数目)比较,差异无统计学意义($P>0.05$)。见表1。

1.2　治疗方法

两组均常规进行术前准备,包括术前常规检查和胆道系统检查,在此基础上A组行腹腔镜胆道镜联合取石+PDC治疗。采用三孔法建立操作孔,具体为:麻醉方式为全身麻醉,术中体位常规取左倾仰卧位,麻醉生效后术区常规消毒、铺巾,先用气腹针(Veress针)在脐下缘穿刺建立CO_2人工气腹,在穿刺处依次置入Trocar(10 mm,观察孔)、腹腔镜,在腹腔镜直视下建立2个操作孔,位置是剑突下稍靠右侧1 cm处(10 mm Trocar)和右腋前线肋下3 cm处(5 mm Trocar),戳孔完成后先对腹腔整体情况进行探查,游离出胆囊动脉、胆囊管,夹闭后再离断,切除胆囊。显露胆总管,确认无误(细针穿刺有胆汁溢出即为胆总管)后,于胆总管上段前壁纵行切开约1.0~1.5 cm,将胆汁吸出后,置入胆道镜,镜子直视下取石,探查胆总管、左右肝管内、肝总管内均无结石残留,且十二指肠乳头无异常后,缝合胆总管前壁切口(4-0可吸收线),先于切口一侧缝合一针打结,然后向下或者向上连续缝合,至切口另一侧打结(针距约2 mm,边距约1.5 mm)。对于胆囊管较粗的患者,可以经胆囊管切开,胆道镜经胆囊管伸入胆总管内取石后夹闭或者4-0可吸收线缝合胆囊管残端。冲洗局部腹腔,确保无活动性出血、胆漏后,放置引流管,经右侧肋缘下Trocar牵出并固定于腹壁,缝合各切口。B组行腹腔镜胆道镜联合取石+T管引流治疗,采用四孔法建立操作孔,在A组基础上于右侧锁骨中线肋下3 cm处再置入一5 mm Trocar打孔建立第四个操作孔,手术取石方法同A组,待胆道镜探查无结石残留后,将修剪好的T形引流管短臂放置于胆总管切口内,并于切口上下端间断缝合1~2针,关闭T形引流管上下胆总管切口。检查胆总管切口无渗漏后将T形引流管和腹腔引流管分别经右肋缘下Trocar孔牵出并固定于腹壁,缝合腹壁小切口。术后处理:两组术后均给予常规护理,包括普通给氧、心电监护、饮食护理、拔除引流管及抑酸、护肝、抗炎、补液等预防治疗;A组术后进食后无不适、有排便、戳孔愈合良好等即可安排出院,术后2周行磁共振胰胆管成像确认无残余结石或胆道狭窄;B组术后2周无不适(试夹T管无腹痛腹胀感)即可给予T管夹闭。术后3个月再次复查,如无不适,且无结石残留,拔除T管。

表1　两组患者一般资料比较[$\bar{x}\pm s$,n(%)]

组别	性别		年龄(岁)	胆总管直径(cm)	胆总管结石数目		胆囊结石数目	
	男	女			<2枚	≥2枚	<2枚	≥2枚
A组(n=51)	18(35.29)	33(64.71)	70.58±5.35	1.04±0.22	6(11.76)	45(88.23)	28(54.90)	23(45.10)
B组(n=51)	20(39.22)	31(60.78)	70.24±5.07	1.01±0.25	8(15.69)	43(84.31)	31(60.78)	20(39.22)
t/χ^2值	0.168		0.329	0.643	0.331		0.362	
P值	0.682		0.743	0.521	0.565		0.547	

1.3　观察指标

(1)手术相关指标:包括手术用时、肛门排气时间、住院时间和住院总费用。(2)肝功能指标:包括碱性磷酸酶(ALP)和总胆红素(TBIL),取患者空腹

静脉血5 mL,离心(3 000 r/min,8 min)取血清,于术前、术后72 h采用全自动生化分析仪进行检测。(3)炎症应激指标:包括白细胞介素6(IL-6)、C反应蛋白(CRP)、肾上腺素(E)、皮质醇(Cor),取血清(方法同上),于术前、术后72 h采用酶联免疫吸附法进行检测。(4)并发症:记录术后并发症发生情况。(5)术后复查情况:比较两组患者术后结石清除情况及随访6个月后结石复发情况。

1.4 统计学分析

数据采用SPSS 22.0统计软件进行分析。计量资料以($\bar{x} \pm s$)形式表示,组间比较采用独立样本t检验,组内比较采用配对样本t检验;计数资料以[n(%)]表示,组间比较采用独立样本χ^2检验。$P<0.05$为差异有统计学意义。

2 结果

2.1 两组患者手术相关指标比较

A组手术用时、肛门排气时间和住院时间均短于B组($P<0.05$),住院总费用少于B组($P<0.05$)。见表2。

2.2 两组患者肝功能指标比较

术前,A组与B组肝功能指标比较,差异无统计学意义($P>0.05$);术后72 h,A组与B组ALP和TBIL水平均低于术前($P<0.05$),且A组各指标水平均低于B组($P<0.05$)。见表3。

表2 两组患者手术相关指标比较($\bar{x} \pm s$)

组别	手术用时(min)	肛门排气时间(h)	住院时间(d)	住院总费用(万元)
A组(n=51)	88.56±12.45	15.94±3.08	9.68±1.75	2.37±0.58
B组(n=51)	96.92±13.63	23.58±4.72	12.93±2.54	3.12±0.61
t值	3.234	9.681	7.525	6.363
P值	0.002	<0.001	<0.001	<0.001

表3 两组患者肝功能指标比较($\bar{x} \pm s$)

组别	ALP(U/L)		TBIL(μmol/L)	
	术前	术后72 h	术前	术后72 h
A组(n=51)	201.51±21.91	94.07±13.75①	38.19±9.11	19.57±4.72①
B组(n=51)	198.04±20.14	113.15±15.83①	38.02±8.89	24.49±5.82①
t值	0.833	6.498	0.095	4.689
P值	0.407	<0.001	0.924	<0.001

①$P<0.05$,与同组术前比较。

2.3 两组患者炎症应激指标水平比较

术前,两组患者炎症应激指标水平比较,差异均无统计学意义($P>0.05$);术后72 h,两组患者IL-6、CRP、E和Cor水平均高于术前($P<0.05$),但A组各炎症应激指标水平均低于B组($P<0.05$)。见表4。

表4 两组患者炎症应激指标水平比较($\bar{x} \pm s$)

组别	IL-6(pg/mL)		CRP(mg/L)		E(ng/L)		Cor(ng/L)	
	术前	术后72 h	术前	术后72 h	术前	术后72 h	术前	术后72 h
A组(n=51)	15.06±3.44	19.46±4.28①	5.22±1.24	7.14±1.75①	96.31±10.44	120.46±14.83①	98.44±12.28	124.52±15.36①
B组(n=51)	14.94±3.31	24.53±5.14①	5.16±1.13	9.71±1.98①	96.09±11.17	127.51±15.43①	97.20±13.14	133.19±18.55①
t值	0.179	5.413	0.255	6.945	0.103	2.353	0.492	2.574
P值	0.858	<0.001	0.799	<0.001	0.918	0.021	0.623	0.023

①$P<0.05$,与同组术前比较。

2.4 两组患者术后并发症发生情况比较

术后两组患者并发症总发生率比较,差异无统计学意义($P>0.05$)。见表5。

表5 两组患者术后并发症发生情况比较[n(%)]

组别	切口感染	胆漏	T管滑脱	梗阻性黄疸	胆汁性腹膜炎	合计
A组(n=51)	1(1.96)	2(3.92)	0(0.00)	0(0.00)	0(0.00)	3(5.88)
B组(n=51)	2(3.92)	1(1.96)	1(1.96)	1(1.96)	1(1.96)	6(11.76)
χ^2值						1.097
P值						0.295

2.5 两组患者术后复查情况比较

两组患者术后结石残留率及随访6个月结石复发率比较,差异均无统计学意义($P>0.05$)。见表6。

表6 比较两组患者术后复查情况[n(%)]

组别	结石清除情况		结石复发情况	
	清除	残留	清除	残留
A组(n=51)	51(100.00)	0(0.00)	0(0.00)	51(100.00)
B组(n=51)	50(98.04)	1(1.96)	2(3.92)	49(96.08)
χ^2值	1.011		2.040	
P值	0.315		0.153	

3 讨论

研究[8]发现,CBDS伴胆囊结石具有起病急和进展快的特点,若未得到及时有效治疗,可引起黄疸、胰腺炎、胆管炎、感染等并发症,故治疗以手术为主。目前,临床上治疗该病的术式虽较多,但因老年患者身体机能、自身抵抗力、手术耐受性等均减弱,

且合并基础疾病如高血压、糖尿病、心脏病等的机率增加,因此选择疗效确切、创伤小、安全高的治疗方案对老年患者而言极为关键[9-10]。

较传统开腹手术方式而言,二镜联合的方式结束了手术“大切口”时代,在保留 Oddi 括约肌正常生理功能的基础上确切解决结石问题,实现对 CBDS 伴胆囊结石的微创治疗,尤其符合老年患者的治疗需求[11]。研究[12]发现,取石术后留置 T 形管引流有助于降低胆道压力,起到预防胆漏发生的作用,还能起到一定的支撑作用预防胆总管狭窄发生,且能为后续检查及处理残余结石提供通道。但相关研究[13-14]表明,术后患者需常规带 T 管 1 ~ 3 个月,T 管引流的同时大量胆汁、电解质等也会丢失,进而延长患者术后肛门排气时间,甚至会引起术后消化功能不良,同时因 T 管与外界接通,本身又具有异物性,长期引流时胆道感染、T 管滑脱及拔管相关并发症等难以避免,促使机体应激反应及患者生活和心理负担加重,进而影响术后恢复,尤其是老年患者日常生活能力和基础情况均较年轻人差,致使微创优势相对降低。

既往研究[15]显示,CBDS 伴胆囊结石患者肝功能大都存在异常,而胆总管术后的 T 管可能会因水肿减退发生松动,使其位置发生变化影响引流量,或是胆总管壁的水肿增加了胆道压力,影响胆汁引流速率,从而影响围术期肝功能改善效果[16-17]。本研究发现,A 组手术相关指标更优,肝功能指标水平和炎症应激指标水平明显降低,但两组患者术后并发症总发生率、结石残留率及复发率无明显差异,表明腹腔镜胆道镜联合取石 + PDC 治疗老年 CBDS 伴胆囊结石疗效可靠、安全,能有效改善患者肝功能并减轻围术期炎症反应,促进术后恢复,与何松狮等[18]研究结论相似。分析可能原因,首先取石术后直接行 PDC 能使最大程度的保留胆总管的完整性,促使术后胆总管的生理功能尽早恢复至正常,利于老年患者术后康复,且直接缝闭胆总管切口的操作较为简单,可缩短手术时间,即使针眼处存在发生胆漏的风险,但在腹腔引流管的作用下也不会明显增高[19];其次,PDC 较 T 管引流创伤较小,患者体内胆汁、电解质等也不会大量流失,且因没有留置 T 管,患者卧床时间相对较短,有利于创伤恢复,与术后排气更早、住院时间更短、住院总费用更低、围术期炎症反应更轻、肝功能改善更佳的结果是相符的[20]。

但取石术后直接行 PDC 仍有一定局限性,即需确保胆道无结石残留,否则需二次手术,且对术者要求较高,须具有熟练的腹腔镜、胆道镜技术和娴熟的镜下缝合、打结技术。此外,还需明确该术式适应症,从理论上来讲,开腹手术禁忌者(如高龄、肥胖、糖尿病等)、单纯胆总管结石、肝内胆管结石(Ⅰ、Ⅱ级)、胆总管直径≥10 mm 均是其适应症,而重症胆管炎、肝内胆管结石Ⅲ级以上、胆道畸形、胆总管明显狭窄、局部粘连严重、凝血机制障碍等不适采用本术式。

综上,老年 CBDS 伴胆囊结石的腹腔镜胆道镜联合取石术中应用 PDC 与 T 管引流治疗的远期效果相当,但 PDC 在促进术后恢复、改善肝功能和炎症反应方面更具优势,值得推荐,但术式的选择需结合患者综合情况。

参考文献

[1] Wang Y, Huang Y, Shi C, *et al*. Efficacy and safety of laparoscopic common bile duct exploration via choledochotomy with primary closure for the management of acute cholangitis caused by common bile duct stones [J]. Surgical Endoscopy, 2022, 36 (7): 4869 - 4877.

[2] 王卫伟,王忠玉. 腹腔镜联合胆道镜治疗急性胆源性胰腺炎伴胆囊结石疗效及对患者血清巨噬细胞炎性蛋白-1α、巨噬细胞炎性蛋白-1β 和单核细胞趋化因子蛋白-1 水平的影响[J]. 陕西医学杂志,2021,50(9):1114 - 1118.

[3] Zhuang L, Li Y, Zhang L, *et al*. A comparison of the therapeutic outcomes between primary duct closure and T-tube drainage after laparoscopic common bile duct exploration: a single-centre retrospective study [J]. Videosurgery and Other Miniinvasive Techniques, 2023, 18(1): 108 - 116.

[4] 朱绍凤,张立娟,刘奇,等. 腹腔镜胆总管切开 T 管引流术胆道压力测定的护理[J]. 中国微创外科杂志,2020,20(2):191 - 192.

[5] Yin Y, He K, Xia X. Comparison of primary suture and T-tube drainage after laparoscopic common bile duct exploration combined with intraoperative choledochoscopy in the treatment of secondary common bile duct stones: a single-center retrospective analysis [J]. Journal of Laparoendoscopic & Advanced Surgical Techniques Part A, 2022, 32(6): 612 - 619.

[6] Zhang Z, Shao G, Li Y, *et al*. Efficacy and safety of laparoscopic common bile duct exploration with primary closure and intraoperative endoscopic nasobiliary drainage for choledocholithiasis combined with cholecystolithiasis [J]. Surgical Endoscopy, 2023, 37 (3): 1700 - 1709.

[7] 何兴图,范存斌. 胆石症防治指南[M]. 上海:上海科学普及出版社,2004:67 - 72.

[8] Han SJ, Chang JH, Gweon TG, *et al*. Analysis of symptomatic recurrences of common bile ducts stones after endoscopic removal: Factors related to early or multiple recurrences [J]. Medicine, 2022, 101(3): e28671.

[9] 王磊,刘康伟,段玉灵,等. 老年胆囊结石并胆总管结石病人经内镜下逆行胰胆管造影术后序贯腹腔镜胆囊切除术治疗手术时机的研究[J]. 临床外科杂志,2021,29(6):559 - 561.

[10] Fan L, Wang Y, Wu M, *et al*. Laparoscopic common bile duct exploration with primary closure could be safely performed among

elderly patients with choledocholithiasis [J]. BMC Geriatrics, 2023,23(1):486.
[11] Chiu BY, Chuang SH, Chuang SC, *et al*. Laparoscopic common bile duct exploration to treat choledocholithiasis in situ s inversus patients: a technical review [J]. World Journal of Clinical Cases, 2023,11(9):1939 - 1950.
[12] Chen JM, Yan XY, Zhu T, *et al*. T-tube drainage versus choledochojejunostomy in hepatolithiasis patients with sphincter of Oddi laxity: study protocol for a randomized controlled trial [J]. Trials, 2020,21(1):586.
[13] Zhu T, Lin H, Sun J, *et al*. Primary duct closure versus T-tube drainage after laparoscopic common bile duct exploration: a meta-analysis [J]. Journal of Zhejiang University Science B, 2021, 22(12):985 - 1001.
[14] 冯嘉楠,蔡磊,何国林,等.腹腔镜胆总管切开探查取石一期缝合的安全性与疗效:附128例分析[J].中华肝脏外科手术学电子杂志,2024,13(4):543 - 550.
[15] 张建波,陈济民.腹腔镜联合ERCP对老年胆囊结石伴胆总管结石患者肝功能和血液粘度指标的影响观察[J].老年医学与保健,2020,26(4):636 - 639.
[16] 张吉祥,何希平,张娟,等.腹腔镜胆囊切除术+LCBDE胆管一期缝合术与ERCP+腹腔镜胆囊切除术两种手术方式的疗效和安全性对比[J].实用医学杂志,2021,37(12):1574 - 1579.
[17] Rudiman R, Hanafi RV, Almawijaya, *et al*. Complications of biliary stenting versus T-tube insertion after common bile duct exploration: a systematic review and meta-analysis [J]. PLoS One, 2023, 18(1):e0280755.
[18] 何松狮,王志伟.腹腔镜胆囊切除术联合胆道镜胆总管取石、胆道支架及胆总管Ⅰ期缝合治疗胆囊结石合并胆总管结石疗效分析[J].中国临床医生杂志,2021,49(10):1213 - 1217.
[19] Xiang L, Li J, Liu D, *et al*. Safety and feasibility of primary closure following laparoscopic common bile duct exploration for treatment of choledocholithiasis [J]. World Journal of Surgery, 2023,47(4): 1023 - 1030.
[20] Jan Y, Hussain M, Aman Z, *et al*. Primary closure vs T-tube drainage following open choledochotomy for CBD (common bile duct) stones [J]. Cureus, 2023,15(3):e35846.

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(上接第839页)

[4] 刘成,邵怡,夏磊,等.超脉冲光纤铥激光碎石术腔内治疗泌尿系结石的有效性和安全性研究[J].中华医学杂志,2023,103(30):2302 - 2306.
[5] Akram M, Jahrreiss V, Skolarikos A, *et al*. Urological guidelines for kidney stones: overview and comprehensive update [J]. Journal of Clinical Medicine, 2024,13(4):1114.
[6] 汪磊,魏勇,董玉花,等.体外冲击碎石术、输尿管硬镜钬激光碎石术及经皮肾镜取石术治疗输尿管上段结石的疗效对比分析[J].川北医学院学报,2021,36(7):894 - 897.
[7] Zhang Z, Xie T, Li F, *et al*. Comparison of traditional and novel tip-flexible suctioning ureteral access sheath combined with flexible ureteroscope to treat unilateral renal calculi [J]. World Journal of Urology, 2023,41(12):3619 - 3627.
[8] 戴建航,肖云新,杨伟明,等.末端可弯曲输尿管吸引鞘与负压吸引鞘辅助输尿管软镜治疗<2 cm肾结石疗效比较的随机对照研究[J].现代泌尿外科杂志,2024,29(5):417 - 420.
[9] Matlaga BR, Chew B, Eisner B, *et al*. Ureteroscopic laser lithotripsy: a review of dusting vs fragmentation with extraction [J]. Journal of Endourology, 2018,32(1):1 - 6.
[10] Chiron P, Berthe L, Haddad M, *et al*. PD59-06 in vitro comparison of efficiency between superpulsed thulium fiber laser and HO:YAG laser for endocorporeal lithotripsy [J]. Journal of Urology, 2019, 201:e1093.
[11] Solano C, Corrales M, Panthier F, *et al*. Navigating urolithiasis treatment: assessing the practicality and performance of thulium fiber laser, holmium YAG, and thulium YAG in real-world scenarios [J]. World Journal of Urology, 2023,41(10):2627 - 2636.
[12] Hardy LA, Vinnichenko V, Fried NM. High power holmium: YAG versus thulium fiber laser treatment of kidney stones in dusting mode: ablation rate and fragment size studies [J]. Lasers in Surgery and Medicine, 2019,51(6):522 - 530.
[13] Gu R, Li Z, Lei C, *et al*. Thulium-doped fiber laser and its application in urinary lithotripsy [J]. Journal of Medical and Biological Engineering, 2023,43(4):351 - 361.
[14] Traxer O, Thomas A. Prospective evaluation and classification of ureteral wall injuries resulting from insertion of a ureteral access sheath during retrograde intrarenal surgery [J]. The Journal of Urology, 2013,189(2):580 - 584.
[15] 胡智盛,张春霆,刘庆,等.泌尿系结石患者微创手术后结石残留的影响因素分析及与CT值的关系[J].现代实用医学,2023,35(11):1488 - 1491.
[16] 李彬,杨嗣星.上尿路结石手术中肾盂内压的影响因素[J].国际泌尿系统杂志,2021,41(6):1098 - 1100.
[17] 朱贤鑫,宋乐明,杜传策,等.智能控压输尿管软镜吸引取石术的疗效分析[J].中华泌尿外科杂志,2018,39(4):256 - 260.
[18] 孙大开,何昊阳,谢波涛,等.智能控压负压吸引联合输尿管软镜碎石取石术在上尿路结石中的应用[J].临床泌尿外科杂志,2024,39(8):734 - 738.
[19] Zhang H, Jiang T, Gao R, *et al*. Risk factors of infectious complications after retrograde intrarenal surgery: a retrospective clinical analysis [J]. Journal of International Medical Research, 2020, 48(9):300060520956833.

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