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# 微通道经皮肾镜碎石取石术治疗复杂性肾结石的临床疗效及安全性观察\*

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**摘要 目的:**探讨标准通道及微通道经皮肾镜取石术(PCNL)对复杂性肾结石患者的临床疗效及安全性。**方法:**140例行PCNL治疗的复杂性肾结石患者,根据手术通道的不同分为(对照组,n=70)及(研究组,n=70),比较两组治疗效果、手术情况、手术前后肾小球滤过率变化、术后并发症及手术前后血清炎症因子水平变化。**结果:**研究组治疗效果显著优于对照组( $P<0.05$ );研究组术中出血量明显少于对照组( $P<0.05$ ),但手术持续时间明显长于对照组( $P<0.05$ );研究组术后下床活动时间、住院天数均明显短于对照组( $P<0.05$ );研究组结石清除率与对照组比较差异无统计学意义( $P>0.05$ );研究组术后并发症发生率低于对照组( $P<0.05$ );两组术前的肾小球滤过率比较,无差异( $P>0.05$ );两组术后肾小球滤过率均有升高,研究组术后的肾小球滤过率高于对照组( $P<0.05$ );与术前比较术后3d两组血清降钙素原(PCT)以及研究组血清C反应蛋白(CRP)水平均升高,且研究组上述指标均高于对照组( $P<0.01$ )。**结论:**微通道经皮肾镜碎石取石术治疗复杂性肾结石的效果显著,具有创伤小、术中出血少、术后恢复快且并发症发生率低等优点,可更有效改善血清炎症因子水平,值得推广应用。

**关键词:**微通道;经皮肾镜碎石取石术;复杂性肾结石;临床疗效;安全性

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## Clinical Efficacy and Safety of Microchannel Percutaneous Nephrolithotomy in Treatment of Complex Renal Calculi\*

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**ABSTRACT Objective:** To investigate the clinical efficacy and safety of standard channel and micro-channel percutaneous nephrolithotomy (PCNL) in patients with complex kidney stones. **Methods:** A total of 140 patients with complex kidney stones treated with PCNL were divided into two groups according to the different surgical channels (control group, n = 70) and (study group, n = 70). The treatment effect, operation condition, changes in glomerular filtration rate before and after operation, postoperative complications and changes in serum inflammatory factors before and after operation were compared between the two groups. **Results:** The treatment effect of the study group was significantly better than that of the control group ( $P<0.05$ ). The amount of intraoperative blood loss in the study group was significantly less than that in the control group ( $P<0.05$ ), but the duration of operation was significantly longer than that in the control group ( $P<0.05$ ). Postoperative ambulation time and hospitalization days in the study group were significantly shorter than those in the control group ( $P<0.05$ ). There was no significant difference in stone clearance rate between the study group and the control group ( $P>0.05$ ). The incidence of postoperative complications in the study group was lower than that in the control group ( $P<0.05$ ). There was no difference in the preoperative glomerular filtration rate between the two groups ( $P>0.05$ ). The postoperative glomerular filtration rate of the two groups was increased, and that of the study group was higher than that of the control group ( $P<0.05$ ). Compared with pre-operative and postoperative 3 d, serum PCT and CRP levels in the two groups were both increased, and the above indexes in the study group were higher than those in the control group ( $P<0.01$ ). **Conclusion:** The micro-channel percutaneous nephrolithotomy is effective in the treatment of complex kidney stones. It has the following advantages: less trauma, less intraoperative bleeding, faster postoperative recovery, and low complication rate. It can more effectively improve serum inflammation, which is worthy of promotion and application.

**Key words:** Micro channel; Percutaneous nephrolithotomy; Complex kidney stones; Clinical efficacy; Security

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### 前言

复杂性肾结石指的是患者体内结石的成分、体积以及形状

等过于复杂,主要包括多发性肾结石、功能异常结石以及鹿角形状结石等<sup>[1]</sup>。针对复杂性肾结石通常是采用外科手术治疗,然而常规性的手术治疗的治疗效果却不是理想,手术时间也过

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长,导致患者在术中的出血量大幅上升,造成患者在术后很容易出现多种严重的并发症,难以保证患者的预后效果<sup>[2]</sup>。而随着现代医疗技术的迅猛发展,促使治疗肾结石的新技术不断的涌现。其中效果最为显著的术式就是经皮肾镜钬激光碎石以及经皮肾镜气压弹道超声碎石术,这两种技术都是用来治疗泌尿系统结石的新技术,对复杂性肾结石进行治疗有着十分显著的效果,相比传统的开放式手术治疗,这两种手术方式不仅可以大幅提高结石的清除效果,还能够有效缩短手术治疗时间,还不会对患者造成过大的创伤,从而能够有效的避免患者出现并发症,保证患者的预后<sup>[3]</sup>。本研究选取 140 例复杂性肾结石患者作为研究对象,观察微通道经皮肾镜取石术对复杂性肾结石患者的临床疗效及安全性。现报道如下。

## 1 资料与方法

### 1.1 临床资料

2017 年 1 月至 2018 年 12 月本院收治的复杂性肾结石患者 140 例,患者均经术前肾功能检测、腹部平片、泌尿系彩超和 CT 或静脉泌尿系造影检测确诊,并行经 PCNL 治疗。据手术通道的不同分为对照组(对照组,n=70)及研究组(研究组,n=70),对照组:男 44 例,女 26 例;平均年龄(51.24± 6.85)岁;结石直径 2.2~5.7 cm。研究组:男 43 例,女 27 例;平均年龄(51.37± 7.02)岁;结石直径 2.1~5.6 cm。两组一般资料比较差异均无显著性( $P>0.05$ ),具有可比性。患者均获知情同意。

### 1.2 纳入标准与剔除标准

纳入标准<sup>[4]</sup>:① 确诊为复杂性肾结石;② 自愿参加此次研究;③ 患者机体出现腰部疼痛、酸胀等症状。剔除标准:① 中途退出者;② 对药物过敏者;③ 精神系统疾病;④ 凝血障碍。

### 1.3 手术方法

两组患者均采用气管插管全身麻醉。麻醉成功后,患者取截石位,输尿管上段结石置入 F5 输尿管导管于患侧输尿管内,常规留置导尿管。用注射器经延长导管与输尿管导管连接,向输尿管内推注生理盐水。全身情况允许的情况下在穿刺之前予以静脉推注速尿 10 mg。在超声引导下选择最佳穿刺点,一般

采取后组中盏较多,输尿管结石较低者,可采用上盏穿刺进针。采用 18 G 肾穿刺针对目标肾盏穹隆进行穿刺,将针芯拔出见尿液流出,表明穿刺成功,置入斑马导丝。然后用筋膜扩张器进行顺序扩张,研究组扩张至 F18,留置 Peel-away 皮鞘,建立碎石通道,置入 Wolf 短输尿管镜,连接钬激光进行碎石取石。对照组扩张至 F24,留置 Peel-away 皮鞘,建立手术通道,置入 F20Wolf 肾镜,采用钬激光或气压弹道碎石系统完成碎石取石。取石完成后,给预先置入输尿管导管者直视下顺行置入输尿管内支架管,同时拔除输尿管导管。腰部置入相应型号的肾造瘘管并予以缝合固定。根据情况,适时夹闭或开放肾造瘘管。术后予以抗感染治疗,检查感染相关指标,以防发生重症感染。

### 1.4 观察标准

(1)治疗疗效:① 显效标准:实行 MPCNL 治疗后患者病情明显好转,结石取出。② 有效标准:患者疾病恢复较好,但尚未痊愈,仍然存在结石引起的临床表现。③ 无效标准:患者经过治疗后,临床状态无明显好转,甚至加重<sup>[5]</sup>。(2)观察两组患者术中出血量、手术持续时间、结石清除率,术后下床活动时间、住院天数<sup>[6]</sup>。(3)两组术前、术后的肾小球滤过率,结合患者的肌酐值、年龄、体重计算<sup>[7]</sup>。(4)统计两组术后相关并发症发生情况。(5)分别于术前及术后 3 d 采集空腹静脉血 3 mL,经离心分离血清,以 ELISA 法检测并比较两组血清炎症因子 C 反应蛋白(CRP)、降钙素原(PCT)等指标水平的变化<sup>[8]</sup>。

### 1.5 统计学方法

将本研究收集的数据用 SPSS18.0 分析,用( $\bar{x} \pm s$ )表示计量资料,均值进行 t 检验,方差不齐用 t' 检验;干预前后均值对比,用配对 t 检验;用 Fisher $\chi^2$  检验计数资料;方差不齐或非正态分布时采用秩和检验。假设检验标准: $\alpha=0.05, P<0.01$  及  $P<0.05$  被认为存在显著性差异, $P>0.05$  为无显著性差异。

## 2 结果

### 2.1 两组患者总有效率比较

经不同方法治疗后对照组患者总有效率明显低于研究组患者,结果具有统计学意义( $P<0.05$ ),见表 1。

表 1 两组患者治疗效果比较(n,%)  
Table 1 Treatment results of the two groups (N, %)

Groups	n	Significant	Effective	Invalid	Therapeutic efficiency
The control group	70	33(47.14)	21(30.00)	16(22.86)	54(77.14)
The team	70	41(58.57)	26(37.14)	3(4.29)	67(95.71)
$\chi^2$	/	/	/	/	5.106
P	/	/	/	/	0.012

### 2.2 术中及术后恢复情况

研究组结石清除率与对照组相当,两组之间差异无统计学意义( $P>0.05$ )。研究组术中出血量明显少于对照组,差异有统计学意义( $P<0.05$ )。而研究组手术时间明显长于对照组,差异有统计学意义( $P<0.05$ )。研究组术后下床活动时间、术后住院时间明显短于对照组,差异均有统计学意义( $P<0.05$ ),见表 2。

### 2.3 两组术前术后的肾小球滤过率比较

两组术前的肾小球滤过率比较,无差异( $P>0.05$ );两组术后肾小球滤过率均有升高,研究组术后的肾小球滤过率高于对照组( $P<0.05$ )。见表 3。

### 2.4 两组并发症发生情况比较

与对照组比较,研究组总并发症发生率显著低于对照组,

比较差异具有显著性( $P < 0.05$ ),见表 4。

水平明显升高( $P < 0.01$ ),且研究组上述指标显著高于对照组( $P < 0.01$ ),见表 5。

2.5 两组手术前后炎症因子水平比较

与术前比较,术后 3 d 两组血清 PCT 以及研究组血清 CRP

表 2 两组患者术中及术后恢复情况比较(n, %)

Table 2 Comparison of intraoperative and postoperative recovery of patients between two groups (n, %)

Groups	n	Stone clearance rate	Bleeding(mL)	Operation time (min)	Time to get out of bed(d)	Postoperative hospital stay(d)
The control group	70	47(97.92)	129.85± 23.43	64.26± 10.02	5.26± 1.59	7.12± 2.40
The team	70	48(100.00)	74.69± 18.27	98.11± 16.35	3.14± 1.25	4.29± 1.85
t	/	1.011	5.185	5.624	6.015	5.891
P	/	0.068	0.010	0.008	0.012	0.007

表 3 两组患者手术前后肾小球滤过率比较( $\bar{x} \pm s$ )

Table 3 Comparison of glomerular filtration rate before and after operation between two groups( $\bar{x} \pm s$ )

Groups	n	Preoperative	Postoperative	t	P
The control group	70	21.43± 4.22	40.87± 4.02	3.434	0.01
The team	70	21.25± 4.18	65.44± 4.06	8.009	0.01
t	/	0.115	12.113	-	-
P	/	0.34	0.01	-	-

表 4 两组患者并发症发生率比较(n, %)

Table 4 Comparison of complications between two groups(n, %)

Groups	n	Fever	Sepsis	bleeding	Septic shock	Complication rate
The control group	70	6(8.57)	6(8.57)	3(4.29)	2(2.86)	17(24.29)
The team	70	1(1.43)	2(2.86)	0(0.00)	2(2.86)	5(7.14)
$\chi^2$	/	/	/	/	/	6.859
P	/	/	/	/	/	0.010

表 5 两组患者手术前后炎症因子水平比较( $\bar{x} \pm s$ )

Table 5 Comparison of inflammatory factors before and after operation between two groups( $\bar{x} \pm s$ )

Groups	time	PCT(ng/L)	CRP(mg/L)
The control group	Preoperative	0.44± 0.18	37.06± 9.35
	Postoperative 3 d	0.65± 0.19	40.72± 9.15
The team	Preoperative	0.45± 0.18	36.89± 9.23
	Postoperative 3 d	0.93± 0.22	49.88± 9.09

3 讨论

肾结石为钙、草酸、尿酸、胱氨酸等一些晶体物质在肾脏的异常聚积所致,为泌尿系统的常见病、多发病。泌尿系统任何部位均可发生结石,但常始发于肾,肾结石形成时多位于肾盂或肾盏,可排入输尿管和膀胱,输尿管结石几乎全部来自肾脏<sup>[9]</sup>。肾结石比其它部位的结石对肾脏损害严重,早期进行及时的诊断与治疗具有重要的意义<sup>[10]</sup>。经皮肾镜取石术是肾结石治疗的现代微创技术,医生通过肾镜的显示屏观察结石在体内的形态、大小、位置、与周围组织的关系等,根据结石的位置及特性

进行碎石并清除,整个手术过程完全可视,安全可靠,在临床上得到了广泛的应用,基本取代了传统的开放式取石术<sup>[11]</sup>。

PCNL 的标准通道术中扩张较大,一般需扩至 24~26 F,配合钬激光碎石术可大大提高临床疗效,但其对肾脏的伤害较大,易造成肾盏撕裂、大出血等,危险性比较高,严重影响患者术后康复<sup>[12]</sup>。随着腔镜微创技术的不断发展,目前已经出现了一种微通道 Pcnl,即术中将取石通道直径缩小为 14~18F。通道的大小直接关系到肾脏的损伤、出血、肾盂内压与取石效率,但目前有关两者对复杂性肾结石的疗效及安全性方面仍无确切定论<sup>[13]</sup>。研究报道较小的通道可降低术中对患者肾脏的损

伤,减少出血量,提高手术安全性;但也有学者不认同该说法,认为通道缩小会影响术中取石及碎石,疗效不佳<sup>[14]</sup>。本研究结果显示较对照组比较,研究组手术时间明显延长,术中输血量也明显降低。提示大通道取石效率高,但肾脏损伤和大出血比较严重;小通道可尽量降低出血风险,但由于通道较小,为术中处理结石带来一定不便,导致手术时间明显延长<sup>[15]</sup>。

此外,本研究中两组间肾结石清除率差异均无统计学意义。提示微通道 PCNL 相对于标准通道并不会影响结石清除率,两者均具有较好的治疗效果,通道大小不会影响患者术后恢复。临床研究认为,在清除人体肾结石的过程中,高灌注压可有效阻滞人体肾脏内小动脉的血流,可改变人体的凝血功能,可导致肾脏发生实质性、缺血性改变,甚至会导致肾脏发生局灶性缺血梗死,影响患者的肾功能。临床有研究指出,相较于标准通道经皮肾镜取石术,微通道经皮肾镜取石术的治疗效果更优(85% VS 75%),患者的肾功能水平更佳。本研究结果与以上观点存在一定差异,本研究结果显示,研究组的并发症发生率低于对照组,研究组术后肾小球滤过率高于对照组。可见微通道经皮肾镜取石术治疗复杂性肾结石患者,效果更优,对肾功能的影响更小。尽管 PCNL 具有创伤小、恢复快的优点,但手术操作不可避免会对患者造成一定程度的机械性损伤,在应激刺激下,机体单核巨噬细胞、成纤维细胞等分泌多种刺激因子,如 CRP、PCT 等,诱导炎症反应,其水平的高低与炎症反应程度密切相关<sup>[16,17]</sup>。Quanbin G<sup>[18]</sup>研究结果显示 PCNL 术中由于微通道较标准通道直径小,故其经皮肾穿刺肾损害较轻,出血较少,因而患者术后炎症反应较轻,安全性较好。本研究中术后 3 d 两组血清 PCT 及研究组血清 CRP 水平均较术前升高,且研究组显著高于对照组。与 Qin X 等<sup>[19]</sup>研究结果相似。微通道 PCNL 虽对肾实质的损伤较轻微,但术野小致使碎石器械受限,为保证手术视野清晰,必须借助高压水泵不断进行冲洗,灌注压显著升高,结石中的致热源或肾盂内细菌等随冲洗液经肾盂静脉、淋巴管等逆流至血液,导大部分患者术后伴有各种严重并发症<sup>[20]</sup>。感染发热是经皮肾镜碎石手术的重要并发症之一<sup>[21]</sup>。本研究中,研究组术后并发症发生率低于对照组,可能与对照组手术采用气压弹道碎石过程中肾盂内压力增大有关。研究表明 mPCNL 术中肾盂内压总的趋势是小于国内外一般认为的引起肾实质返流的极限(30 mmHg)<sup>[22-25]</sup>。但是术中任何引起灌注液流出受阻的因素(摆动输尿管镜压迫剥皮鞘、持续的灌注、输尿管镜进入狭窄的肾盏或肾盏憩室、肾收集系统内碎石堆积过多等),均可引起肾盂内压明显增高,术者应该调整操作手法(及时调整输尿管镜与剥皮鞘的位置、避免紧捏剥皮鞘、间断式灌注、采用激光或负压吸引超声碎石、及时清理结石碎片等),以降低肾盂内压<sup>[26]</sup>。另外,本组研究中术前会予以速尿静脉推注,促进肾脏利尿排泄功能,一方面使肾积水更加明显,有利于术中穿刺<sup>[27]</sup>;另一方面也增加肾小管的滤过压,减少尿液中毒性物质的重吸收,也减少术后尿源性脓毒血症及重症感染的发生<sup>[28]</sup>。

综上所述,微通道经皮肾镜碎石取石术治疗复杂性肾结石的临床疗效显著,其具有创伤小、出血少、术后恢复快且并发症发生率低等优点,值得进一步临床推广应用。

## 参考文献(References)

- [1] Lifan Y, Urology D O. Clinical efficacy of percutaneous nephrolithotripsy in the treatment of complex renal calculi and its effects on renal function [J]. Acta Medicinæ Sinica, 2019, 163(5): 562-565
- [2] Qin-Jun W, Tong-Zu L, Shao-Hong F, et al. Comparative study of flexible ureteroscopy and percutaneous nephrolithotomy in the treatment of renal calculi less than 2 cm in diameter [J]. Hainan Medical Journal, 2018, 209(7): 1003-1005
- [3] T D, Girisha, Preetham, et al. Single-step dilatation in percutaneous nephrolithotomy, its safety and efficacy: A prospective, single-center study[J]. Urology annals, 2019, 181(2): 171-174
- [4] Tao C, Weihao X, Yulun C, et al. Safety and Efficacy of Guidezilla Extension Catheter for the Percutaneous Treatment of Complex Coronary Lesions[J]. The heart surgery forum, 2020, 213(2): E147-E150
- [5] Zhang X, Cao D, Liu J, et al. Efficacy and safety of Lianhua Qingwen combined with conventional antiviral Western Medicine in the treatment of coronavirus disease (covid-19) in 2019: Protocol for a systematic review and meta-analysis[J]. Medicine, 2020, 164(07): 99-104
- [6] Qiangli G, Yongfa L I, Junxian Y, et al. The treatment of complex renal calculi with simultaneous single-channel percutaneous nephrolithotomy combined with choledochoscopy[J]. Journal of Clinical Surgery, 2018, 118(10): 185-189
- [7] Ke W, Hospital X G. Effects of percutaneous nephrolithotomy and extracorporeal shock wave lithotripsy in the treatment of renal calculi [J]. Clinical Research and Practice, 2019, 175(06): 365-369
- [8] Jiaoshuai D. Percutaneous nephrolithotomy combined with electronic ureteroscopy in the treatment of complex renal calculi [J]. Chinese Community Doctors, 2018, 251(11): 585-590
- [9] Ting-Zhi D, Fu-Lin L I, Lie-Qian C, et al. Comparison of Clinical Efficacy between Ureteroscopic Lithotripsy and Percutaneous Nephrolithotomy for Renal Calculi with Diameter ≤ 2 cm[J]. Medical Information, 2019, 124(9): 452-455
- [10] Kai X U, XiaoLi W, Zhe W U. Shenshu granule assisted microchannel percutaneous nephrolithotomy for the treatment of renal calculi and its effects on NAG, CysC and free radical levels [J]. Acta Medicinæ Sinica, 2018, 188(11): 285-289
- [11] Yong G U, Jianjun L, Yong L I. Efficacy and Safety of Percutaneous Nephrolithotomy under Modified Valdi via Posture for Renal Calculi [J]. Heb Medicine, 2018, 175(12): 352-356
- [12] Shengming L U, Guangchen Z, Xuefei D, et al. Comparison of Clinical Effect of Ureteroscopy and Percutaneous Nephrolithotomy in the Treatment of Renal Calculi[J]. China Continuing Medical Education, 2018, 210(12): 385-389
- [13] Wu-Rong L I. Application Effect Observation of Microchannel Percutaneous Nephrolithotomy in Treatment of Renal Calculi[J]. World Latest Medicine Information, 2019, 178(10): 685-689
- [14] Dian-Bao M, Urology D O. Clinical observation of electronic ureteroscopy and holmium laser lithotripsy in the treatment of complex renal calculi[J]. Psychology monthly, 2019, 167(11): 855-859
- [15] Lushuang L, Xiaomin Z, Lian G. Clinical Effect of Minimally Inva-

- sive Percutaneous Nephrolithotomy for Complicated Renal Calculi in the Elderly[J]. Sichuan Medical Journal, 2018, 122(08): 656-659
- [16] Xu Y, Urology D O, Hospital B P. Clinical Analysis of Percutaneous Nephrolithotomy in the Treatment of Renal Calculi [J]. World Latest Medicine Information, 2018, 167(10): 485-488
- [17] Fei C, Urology D O. Clinical effect observation of extracorporeal lithotripsy combined with drugs in the treatment of renal calculi[J]. China Practical Medicine, 2018, 18(13): 669-672
- [18] Quanbin G, Urology D O. Clinical effect of microchannel percutaneous nephrolithotomy for lithotripsy in the treatment of renal calculi [J]. Chinese Community Doctors, 2018, 213(8): 968-1003
- [19] Qin X, Yue-Guang L, Wen-Ke L I, et al. Effect of flexible ureteroscope lithotripsy and percutaneous nephrolithotripsy in the treatment of renal calculi and its effect on the stress response [J]. Hainan Medical Journal, 2018, 157(12): 275-279
- [20] Wen-Li H E, Hai-Dong W, Urology D O. Effect of percutaneous nephrolithotomy combined with ureteroscope in the treatment of complicated renal ureteral calculi with supine anterolateral lithotomy position[J]. China Modern Medicine, 2018, 128(15): 652-657
- [21] Ke C, Baocheng H, Qiang L, et al. Clinical analysis of flexible ureteroscope (combined type) combined with holmium laser in the treatment of renal calculi[J]. Chinese Community Doctors, 2018, 235(12): 283-286
- [22] FENG Hai-hang, LIANG Gao-zhao, WANG Qing, et al. Clinical analysis of GPS navigation ultrasound system guided percutaneous nephrolithotomy in the treatment of 26 patients with complex renal calculi[J]. Hainan Medical Journal, 2018, 154(02): 352-356
- [23] Han Z, Peng-Tao W, Wen-Wei L, et al. Clinical comparative study of percutaneous nephrolithotomy and transurethral ureteroscopic lithotripsy in the treatment of unilateral renal calculi [J]. Journal of Community Medicine, 2018, 117(10): 332-336
- [24] Jun W, Ting R, Kun J, et al. Clinical observation of standard channel percutaneous nephrolithotomy holmium laser lithotripsy combined with microchannel technology in treating of complex nephrolithiasis [J]. Journal of Clinical Surgery, 2018, 201(11): 185-189
- [25] Zaixiong S, Zhouda Z, Haili L, et al. Clinical effect of single-channel minimally invasive percutaneous nephrolithotomy combined with ureteroscopic treatment on complicated renal calculi [J]. China Modern Doctor, 2018, 147(10): 562-566
- [26] Lin D, Li Z, Han L I, et al. Clinical efficacy and safety of ureteroscopic holmium laser lithotripsy in the treatment of renal calculus[J]. Practical Journal of Clinical Medicine, 2018, 148(10): 376-380
- [27] Kunbin K E, Yin C, Peng G U, et al. Comparisons of the efficacy of multi-channel percutaneous nephrolithotomy and multi-endoscopy techniques in the treatment of complex renal calculi[J]. The Journal of Practical Medicine, 2019, 135(10): 525-528
- [28] Xiao Y, Jing Y, Qiang W. Effect and Prognostic Impact of Soft Mirror combined with Percutaneous Nephrolithotomy in the treatment of Complex Renal Calculi[J]. Heb Medicine, 2018, 115(10): 363-367

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- [17] Melillo C, Downs K, Dillahunt-Aspillaga C, et al. Action Ethnography of Community Reintegration for Veterans and Military Service Members With Traumatic Brain Injury: Protocol for a Mixed Methods Study[J]. JMIR Res Protoc, 2019, 8(11): e14170
- [18] 肖萌, 金保哲, 张岱男, 等. 微透析技术在创伤性颅脑损伤临床治疗与基础研究中的应用 [J]. 中华神经外科杂志, 2018, 34(7): 748-751
- [19] Li F, Wang X, Zhang Z, et al. Dexmedetomidine Attenuates Neuroinflammatory-Induced Apoptosis after Traumatic Brain Injury via Nrf2 signaling pathway[J]. Ann Clin Transl Neurol, 2019, 6(9): 1825-1835
- [20] 何炳华, 郭庆聪, 黄德辉. 右美托咪定对重度颅脑创伤急救患者脑保护作用及其对炎症因子的影响 [J]. 药物生物技术, 2018, 25(6): 496-499
- [21] 赵丽, 荣晓姗, 沈丽, 等. 早期目标导向型镇静联合 RASS 评分在重度创伤性颅脑损伤病人中的应用[J]. 蚌埠医学院学报, 2019, 44(8): 1107-1110
- [22] Hundeshagen G, Kramer GC, Ribeiro Marques N, et al. Closed-Loop and Decision-Assist-Guided Fluid Therapy of Human Hemorrhage[J]. Crit Care Med, 2017, 45(10): e1068-e1074
- [23] 刘朋, 刘睽, 郝继山. 右美托咪定在中型颅脑损伤患者镇静治疗中的应用[J]. 创伤外科杂志, 2017, 19(5): 358-362
- [24] Gao J, Wei L, Xu G, et al. Effects of dexmedetomidine vs sufentanil during percutaneous tracheostomy for traumatic brain injury patients: A prospective randomized controlled trial [J]. Medicine (Baltimore), 2019, 98(35): e17012
- [25] Ding M, Chen Y, Luan H, et al. Dexmedetomidine reduces inflammation in traumatic brain injury by regulating the inflammatory responses of macrophages and splenocytes [J]. Exp Ther Med, 2019, 18(3): 2323-2331
- [26] Som A, Maitra S, Bhattacharjee S, et al. Goal directed fluid therapy decreases postoperative morbidity but not mortality in major non-cardiac surgery: a meta-analysis and trial sequential analysis of randomized controlled trials[J]. J Anesth, 2017, 31(1): 66-81
- [27] Chio CC, Lin HJ, Tian YF, et al. Exercise attenuates neurological deficits by stimulating a critical HSP70/NF- $\kappa$ B/IL-6/synapsin I axis in traumatic brain injury rats[J]. J Neuroinflammation, 2017, 14(1): 90
- [28] Wang WT, Sun L, Sun CH. PDIA3-regulated inflammation and oxidative stress contribute to the traumatic brain injury (TBI) in mice[J]. Biochem Biophys Res Commun, 2019, 518(4): 657-663
- [29] Wang D, Xu X, Wu YG, et al. Dexmedetomidine attenuates traumatic brain injury: action pathway and mechanisms [J]. Neural Regen Res, 2018, 13(5): 819-826
- [30] Zhang MH, Zhou XM, Cui JZ, et al. Neuroprotective effects of dexmedetomidine on traumatic brain injury: Involvement of neuronal apoptosis and HSP70 expression [J]. Mol Med Rep, 2018, 17(6): 8079-8086