doi: 10.13241/j.cnki.pmb.2020.01.024

腹腔镜精准肝切除对原发性肝癌患者肝功能、免疫功能及炎性因子的影响*

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摘要 目的:探讨腹腔镜精准肝切除对原发性肝癌(PHC)患者肝功能、免疫功能及炎性因子的影响。**方法:**选取 2013 年 2 月~2018 年 12 月期间我院收治的 PHC 患者 117 例,按随机数字表法分为对照组(n=58)和研究组(n=59),对照组给予开腹常规肝切除术治疗,研究组给予腹腔镜精准肝切除治疗。比较两组患者围术期指标、肝功能、免疫功能、炎性因子、并发症。**结果:**研究组术中出血量少于对照组,住院时间短于对照组(P<0.05);两组手术时间比较差异无统计学意义(P>0.05)。两组患者术后谷氨酸氨基转移酶(ALT)、天冬氨酸氨基转移酶(AST)、总胆红素(TBIL)均升高,但研究组低于对照组(P<0.05);两组患者术后白介素 -6(IL-6)、肿瘤坏死因子 -α(TNF-α)、C 反应蛋白(CRP)水平均升高,但研究组低于对照组(P<0.05);两组患者术后 $CD3^+$、$CD4^+$、$CD4^+/CD8^+$ 均降低,但研究组高于对照组(P<0.05);$CD8^+$ 升高,但研究组低于对照组(P<0.05)。研究组术后并发症发生率低于对照组(P<0.05)。**结论:**腹腔镜精准肝切除治疗有助于保护 PHC 患者肝功能、免疫功能,改善炎性因子水平并减少术中出血量、住院时间,同时还可减少并发症发生率。

关键词:腹腔镜;精准肝切除;原发性肝癌;肝功能;免疫功能;炎性因子

中图分类号:R735.7 **文献标识码:**A **文章编号:**1673-6273(2020)01-110-05

Effect of Laparoscopic Precise Hepatectomy on Liver Function, Immune Function and Inflammatory Factors in Patients with Primary Hepatocellular Carcinoma*

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ABSTRACT Objective: To investigate the effect of laparoscopic precise hepatectomy on liver function, immune function and inflammatory factors in patients with primary hepatocellular carcinoma (PHC). **Methods:** 117 patients with PHC who were admitted to our Hospital from February 2013 to December 2018 were randomly divided into control group (n=58) and study group (n=59). The control group was treated with routine open hepatectomy and the study group was treated with precise laparoscopic hepatectomy. Perioperative indexes, liver function, immune function, inflammatory factors and complications were compared between the two groups. **Results:** The amount of bleeding during operation in the study group was less than that in the control group, and the hospitalization time was shorter than that in the control group (P < 0.05); there was no significant difference in the operation time between the two groups (P > 0.05). The levels of glutamate aminotransferase (ALT), aspartate aminotransferase (AST) and total bilirubin (TBIL) increased in both groups, but the levels of interleukin-6 (IL-6), tumor necrosis factor-α (TNF-α) and C-reactive protein (CRP) in the study group were lower than those in the control group (P < 0.05). The levels of $CD3^+$, $CD4^+$, $CD4^+/CD8^+$ in the study group were lower than those in the control group (P < 0.05), while the levels of $CD8^+$ in the study group were higher than those in the control group (P < 0.05), but the levels of $CD8^+$ in the study group were lower than those in 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). **Conclusion:** Laparoscopic precise hepatectomy can protect the liver function and immune function of PHC patients, improve the level of inflammatory factors, reduce intraoperative bleeding and hospital stay, and reduce the incidence of complications.

Key words: Laparoscopy; Precise hepatectomy; Primary liver cancer; Liver function; Immune function; Inflammatory factors

Chinese Library Classification(CLC): R735.7 Document code: A

Article ID: 1673-6273(2020)01-110-05

* 基金项目:湖南省卫生计生委科研基金项目(B201701217)

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(收稿日期:2019-06-18 接受日期:2019-07-13)

前言

原发性肝癌(Primary hepatic cancer,PHC)起源于肝内胆管上皮及肝细胞,该肿瘤恶性程度高,预后极差[1]。据统计[2],全球每年新发 PHC 人数约为 62 万人，而我国约占其中的一半以上。手术切除是治疗 PHC 的主要手段,传统的肝切除手术主要依据肝功能 Child-Pugh 分级、肝脏计算机断层扫描(Computed tomography,CT)等手段进行术前评估,存在术后创伤大、并发症多的缺陷，且手术成功率与施术者的临床经验密切相关,影响其疗效准确性[3]。随着医学科学的蓬勃发展、人文医学的兴起," 以最小创伤获取最佳康复 " 成为现代外科手术追求的目标。精准肝切除的核心内容为术前精准评估与规划、术中精细操作、术后精心护理,尽量保留患者残余脏器功能[4,5]。精准肝切除的手术方式有开腹、腹腔镜及机器人手术,以往研究显示[6],开腹精准肝切除应用于肝癌可获得较传统肝切除手术更好的治疗效果，但有关腹腔镜下精准肝切除治疗 PHC 的临床疗效的相关临床报道尚不多见,鉴于此,本研究通过探讨腹腔镜精准肝切除治疗 PHC 患者的临床疗效,旨在为 PHC 患者术式的选择提供数据支撑。

1 资料与方法

1.1 临床资料

选取我院于 2013 年 2 月 ~2018 年 12 月期间收治的 117 例 PHC 患者。此次研究已获湖南省人民医院伦理委员会批准。纳入标准:(1)PHC 诊断标准参考《原发性肝癌诊断标准》[7];(2)经影像学、实验室检查等确诊;(3)肝功能 Child-Pugh 分级为 A 级或 B 级;(4) 预计生存期超过 3 个月;(5) 单发肿瘤直径≤ 5 cm,病灶个数≤ 3 个;(6)患者对本研究知情并签署了同意书。排除标准:(1)病灶出现转移者;(2)免疫性疾病者;(3)心肺肾等脏器功能严重异常者;(4)手术不耐受者;(5)合并其他恶性肿瘤、感染性疾病者。采用随机数字表法将患者分为对照组(n=58)和研究组(n=59),其中对照组男 37 例,女 21 例,年龄 42~68 岁,平均(52.83± 3.42)岁;Child-Pugh 分级:A 级 32 例,B 级 26 例;病灶直径 1~5 cm,平均(3.19± 0.56)cm;肿瘤个数 1~3 个,平均(2.24± 0.26)个。研究组男 39例,女 20 例,年龄 40~69 岁,平均(52.96± 4.26)岁;Child-Pugh 分级:A 级 33 例,B 级 26 例;病灶直径 1~5cm,平均(3.25± 0.48)cm;肿瘤个数 1~3 个,平均(2.38± 0.29)个。两组一般资料比较无差异(P>0.05)。

1.2 治疗方法

术前均给予积极的保肝、营养支持、抗病毒等常规处理,同时向患者及其家属详细介绍治疗方案,提醒患者注意事项。在此基础上,对照组给予开腹常规肝切除术治疗,具体操作如下:取仰卧位,全麻,切口为反正中 L 形切口,手术时首先阻断第一肝门,使用钳夹法对肝组织进行结扎,随即缝合包扎肝创面组织。研究组给予腹腔镜精准肝切除术治疗,具体操作如下:取仰卧位,全麻,建立人工气腹,观察孔选择脐下 2 cm,肝左叶病变者主操作孔选择左锁骨中线下 2～3 cm,肝右叶病变者主操作孔选择剑突下 2～3 cm,使用超声刀充分游离肝圆韧带和肝镰状韧带,行超声检查确定手术范围。游离病变所在位置相应部分的肝脏,放置血管阻断带,缺血段出现后用超声刀切除病变肝损组织,清洗创面,采用血管缝合线缝合止血。术后均给予常规消炎、抗感染治疗。

1.3 观察指标

(1)于手术前后抽取患者清晨空腹静脉血 4 mL,4200 r/min 离心 10 min,离心半径 16 cm,取上清液,分为两管置于 -40℃冰箱中待测。一管采用美国贝克曼 DXC800 全自动生化检测仪检测肝功能指标谷氨酸氨基转移酶（Alanine aminotransferase,ALT)、天冬氨酸氨基转移酶(Aspartate aminotransferase,AST)、总胆红素(Total bilirubin,TBIL)以及免疫功能指标 $CD3^+$、$CD4^+$、$CD8^+$,并计算 $CD4^+/CD8^+$。一管采用酶联免疫吸附法检测白介素 -6(Interleukin-6,IL-6)、肿瘤坏死因子 -α(Tumor necrosis factor-α,TNF-α)、C 反应蛋白(C-reactive protein,CRP)水平,试剂盒购自美国 IDEXX 公司,严格遵守试剂盒说明书进行操作。(2)记录两组患者手术时间、术中出血量、住院时间、术后并发症发生情况。

1.4 统计学方法

采用 SPSS25.0 进行统计分析,计数资料以率的形式表示,采用卡方检验,计量资料以($\bar{x}\pm s$)的形式表示,采用 t 检验。以 α=0.05 为检验标准。

2 结果

2.1 围术期指标比较

两组患者手术时间比较无差异(P>0.05);研究组术中出血量少于对照组,住院时间短于对照组(P<0.05);详见表 1。

表 1 两组围术期指标比较($\bar{x}\pm s$)

Table 1 Comparison of perioperative indicators between two groups($\bar{x}\pm s$)

Groups	Operation time(min)	Intraoperative bleeding volume (mL)	Hospitalization time(d)
Control group(n=58)	98.54± 8.64	381.07± 28.35	13.12± 1.89
Study group (n=59)	101.49± 10.93	214.10± 30.27	8.93± 1.43
t	1.618	30.783	13.537
P	0.108	0.000	0.000

2.2 肝功能指标比较

两组患者术前 ALT、AST、TBIL 比较差异无统计学意义(P>0.05);两组患者术后 ALT、AST、TBIL 均升高,但研究组低于对照组(P<0.05);详见表 2。

表 2 肝功能指标比较($\bar{x}\pm s$)

Table 2 Comparison of liver function indexes($\bar{x}\pm s$)

Groups	ALT(U/L)		AST(U/L)		TBIL(μmol/L)	
	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative
Control group (n=58)	55.35± 8.56	72.87± 12.63[a]	78.24± 14.86	99.35± 13.48[a]	37.08± 3.86	55.99± 8.59[a]
Study group (n=59)	56.41± 9.62	63.05± 10.31a	79.05± 13.03	87.68± 12.32[a]	36.97± 5.31	43.16± 6.74[a]
t	0.629	8.346	0.314	16.931	0.128	9.382
P	0.520	0.000	0.754	0.000	0.898	0.000

Note: Compared with preoperative, [a]$P < 0.05$.

2.3 炎性因子指标比较

两组患者术前 IL-6、CRP、TNF-α 水平比较无差异($P>0.05$)；两组患者术后 IL-6、CRP、TNF-α 水平均升高，但研究组低于对照组($P<0.05$)；详见表 3。

表 3 炎性因子指标比较($\bar{x}\pm s$)

Table 3 Comparison of inflammatory factors($\bar{x}\pm s$)

Groups	IL-6(pg/mL)		CRP(mg/L)		TNF-α(ng/ml)	
	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative
Control group (n=58)	92.65± 10.31	132.76± 16.49[a]	14.58± 3.41	29.46± 3.44[a]	12.84± 1.57	21.32± 3.85[a]
Study group (n=59)	91.73± 9.34	113.68± 12.81[a]	13.97± 2.39	21.78± 3.63a	12.92± 1.51	16.41± 3.97[a]
t	0.506	6.996	1.122	11.743	0.281	6.790
P	0.614	0.000	0.264	0.000	0.779	0.000

Note: Compared with preoperative, [a]$P < 0.05$.

2.4 免疫功能指标比较

两组患者术前 $CD3^+$、$CD4^+$、$CD8^+$、$CD4^+/CD8^+$ 比较差异无统计学意义（$P>0.05$）；两组患者术后 $CD3^+$、$CD4^+$、$CD4^+/CD8^+$ 均降低，但研究组高于对照组($P<0.05$)；$CD8^+$ 升高，但研究组低于对照组($P<0.05$)；详见表 4。

表 4 免疫功能指标比较($\bar{x}\pm s$)

Table 4 Comparison of Immune Function Indicators($\bar{x}\pm s$)

Groups	$CD3^+$(%)		$CD4^+$(%)		$CD8^+$(%)		$CD4^+/CD8^+$	
	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative
Control group (n=58)	61.44± 6.28	49.15± 4.24[a]	35.38± 3.76	20.12± 3.27[a]	27.26± 3.27	34.03± 3.25[a]	1.30± 0.18	0.59± 0.08[a]
Study group (n=59)	61.56± 6.72	55.47± 3.93[a]	35.46± 4.34	26.25± 4.03[a]	27.19± 4.32	30.42± 3.34[a]	1.30± 0.25	0.86± 0.12[a]
t	0.100	8.364	0.106	9.026	0.099	5.924	0.000	14.295
P	0.920	0.000	0.915	0.000	0.922	0.000	1.000	0.000

Note: Compared with preoperative, [a]$P < 0.05$.

2.5 术后并发症发生率比较

研究组术后并发症总发生率 15.25%(9/59) 低于对照组 41.38%(24/58)($P<0.05$)；详见表 5。

3 讨论

PHC 作为我国常见的恶性肿瘤，手术切除是其治疗的首选办法。自 1888 年德国外科医生 Langenbuch 成功完成世界首例肝脏切除术以后，伴随着科学的进步，肝脏切除术经历了楔形肝切除、规则性肝切除、不规则性肝切除、解剖性肝脏切除等发展阶段[8-10]。这些肝脏切除术主要是在全入肝血流阻断后采用钳夹指碎法切肝并对创面进行对拢缝合，操作手法相对粗糙，具有一定的盲目性，术后创伤大，不良反应多，且可对患者机体各项功能造成不同程度的影响[11,12]。随着微创理念的诞生，PHC 的手术治疗成功目标不仅仅是完整切除病灶，减少创伤，还要求残肝功能可维持机体生理需求，于是精准肝切除术式应运而生[13,14]。精准肝切除包括病情评估、外科决策、手术规划、手术操

表 5 术后并发症发生率比较 [n(%)]

Table 5 Comparisons of postoperative complications [n(%)]

Groups	Abdominal and thoracic infection	Pulmonary infection	Bile leakage	Liver failure	Total incidence
Control group(n=58)	8(13.79)	5(8.62)	5(8.62)	6(10.34)	24(41.38)
Study group (n=59)	3(5.08)	2(3.39)	3(5.08)	1(1.69)	9(15.25)
x^2					9.858
P					0.002

作等过程,涵盖了以手术为中心的外科治疗全过程[15]。此外,随着腹腔镜技术提高,腹腔镜的应用范围逐渐扩大,已在不少复杂的外科手术如胰腺十二指肠切除术中取得了较好的疗效[16,17]。而肝脏由于其解剖结构的特殊性,腹腔镜下精准肝切除仍被认为是风险较大的手术,进展缓慢[18]。

本次研究结果显示,研究组住院时间、术中出血量、并发症发生率均优于对照组,可见腹腔镜精准肝切除对患者造成的创伤较小、并发症发生率低,有利于术后恢复,这主要是因为腹腔镜精准肝切除治疗术前可准确评估肝脏切除的体积及残肝功能,并根据评估结果设计手术方案,同时术中精细离断肝断面及肝实质,因此可有效减少术中损伤[19,20]。术后也会施行精准管理,快速处理各项并发症,促进患者康复[21]。而两组手术时间比较相差不大,可能由于器械的局限性,行腹腔镜精准肝切除时肝脏病变部位暴露困难,致使操作难度较大。既往研究表明[22],术后肝功能的恢复可直接影响患者的预后及生存质量。ALT、AST、TBIL 均是临床常见的肝功能指标,其水平升高可反映肝功能损伤严重程度。而本研究结果中两组患者肝功能指标水平虽升高,但研究组低于对照组,这可能与腹腔镜下精准肝切除术采用超声刀或精准的钳夹法进行肝实质离断,更好的保留了肝组织及其残余功能有关。肝切除术作为一个有创术式,可使患者产生较为严重的应激反应。IL-6、TNF-α 是由机体免疫细胞产生的炎性因子,CRP 是一种急性时相反应蛋白, 上述炎性指标均可在应激状态下诱导炎性反应的进一步激化,对局部和整个机体均造成损伤,直接引起免疫功能的下降,易导致肿瘤细胞的转移和扩散,影响患者手术效果[23-25]。本研究中两组患者术后均出现炎性因子水平上升、免疫功能下降现象,但研究组免疫功能、炎性因子水平受到的影响轻于对照组,这是因为腹腔镜精准肝切除治疗可做到选择性甚至高选择性的肝门阻断,减少术中出血量,同时还可免去残留肝热缺血再灌注损伤[26-28]。此外,该手术方式在腹腔镜下进行,手术创伤小,可有效减轻机体刺激,保护患者免疫功能[29,30]。

综上所述,腹腔镜精准肝切除治疗 PHC 患者,可有效改善部分围术期指标,有助于保护 PHC 患者肝功能,缓解免疫功能下降,减少炎性应激,同时还可降低并发症发生率。

参 考 文 献(References)

[1] Martin SP, Wang XW. The evolving landscape of precision medicine in primary liver cancer[J]. Hepat Oncol, 2019, 6(2): HEP12

[2] 张俊雅, 温晓斐, 闫鹏, 等. 原发性肝癌的介入治疗现状与进展[J].现代生物医学进展, 2016, 16(29): 5797-5800

[3] Sparrelid E, van Gulik TM. Tumor progression in two-stage liver resections-is the shorter inter-stage period in associated liver partition and portal vein ligation for staged hepatectomy (ALPPS) of benefit to the patient?[J]. Hepatobiliary Surg Nutr, 2019, 8(3): 316-317

[4] Chen SW, Xia HX, Fan QQ, et al. Recise hepatectomy in the treatment of patients with primary liver cancer [J]. J Biol Regul Homeost Agents, 2019, 33(1): 225-230

[5] Luo WL, Zhang J, Qiu X, et al. Electric- Field-Modified In Situ Precise Deposition of Electrospun Medical Glue Fibers on the Liverfor Rapid Hemostasis[J]. Nanoscale Res Lett, 2018, 13(1): 278

[6] Lv A, Li Y, Qian HG, et al. Precise Navigation of the Surgical Plane with Intraoperative Real-time Virtual Sonography and 3D Simulation in Liver Resection[J]. J Gastrointest Surg, 2018, 22(10): 1814-1818

[7] 杨秉辉, 任正刚. 原发性肝癌诊断标准[J].中华肝脏病杂志, 2000, 8(3): 135-135

[8] Aji T, Dong JH, Shao YM, et al. Ex vivo liver resection and autotransplantation as alternative to allotransplantation for end-stage hepatic alveolar echinococcosis[J]. J Hepatol, 2018, 69(5): 1037-1046

[9] Takamoto T, Sano K, Hashimoto T, et al. Practical Contribution of Virtual Hepatectomy for Colorectal Liver Metastases: a Propensity-Matched Analysis of Clinical Outcome [J]. J Gastrointest Surg, 2018, 22(12): 2037-2044

[10] Maki H, Sakamoto Y, Kawaguchi Y, et al. Anatomical Boundary Between the Caudate Lobe of the Liver and Adjacent Segments Based on Three-Dimensional Analysis for Precise Resections [J]. J Gastrointest Surg, 2018, 22(10): 1709-1714

[11] Chanwat R. seful maneuvers for precise laparoscopic liver resection [J]. Asian J Endosc Surg, 2018, 11(2): 93-103

[12] Miyazaki Y, Kokudo T, Amikura K, et al. Albumin-Indocyanine Green Evaluation Grading System Predicts Post-Hepatectomy Liver Failure for Biliary Tract Cancer[J]. Dig Surg, 2019, 36(1): 13-19

[13] Han YS, Ha H, Kwon HJ, et al. Pure laparoscopic donor right hepatectomy in a living donor with type 3a biliary variation: A case report[J]. Medicine (Baltimore), 2017, 96(38): e8076

[14] Uchiyama H, Harimoto N, Itoh S, et al. Pleural Effusion After Hepatectomy for Hepatocellular Carcinoma: Risk Factor Analyses and Its Impact on Oncological Outcomes [J]. World J Surg, 2017, 41(4): 1089-1099

[15] Kurimoto A, Yamanaka J, Hai S, et al. Parenchyma-preserving hepatectomy based on portal ramification and perfusion of the right anterior section: preserving the ventral or dorsal area [J]. J Hepatobiliary Pancreat Sci, 2016, 23(3): 158-166

[16] 林荣贵, 黄鹤光, 陈燕昌, 等. 腹腔镜胰十二指肠切除术胰腺颈部离断的方法选择[J].中华外科杂志, 2017, 55(9): 667-670

[17] 金巍巍, 鲁超, 牟一平, 等. 腹腔镜胰十二指肠切除时邻近器官病变的处理策略[J].中华外科杂志, 2018, 56(7): 522-527

[18] Wang PF, Li CH, Zhang AQ, et al. A New Segmental Hepatectomy Approach Using Ultrasound-Guided Portal Branch Infusion of a Thermosensitive Gel in Pigs[J]. J Invest Surg, 2015, 28(5): 276-282

[19] Yin DL, Jiang HC, Liang YJ, et al. Precise hepatectomy guided by minimally invasive surgery: a novel strategy for liver resection [J]. Hepatogastroenterology, 2012, 59(118): 1951-1959

[20] 李幼安, 张起帆, 蔡庆, 等. 原发性肝癌精准肝切除与不规则性肝切除的对比研究[J].实用医学杂志, 2017, 33(20): 3429-3433

[21] Yigitbas H, Yazici P, Taskin HE, et al. New Technique of Radiofrequency-assisted Ultrasound-guided Needle-localized Laparoscopic Resection of Disappearing Colorectal Liver Metastases [J]. Surg Laparosc Endosc Percutan Tech, 2017, 27(1): e1-e5

[22] 刘浩, 徐琴, 孙晓凤, 等. 中晚期肝癌介入治疗患者的生存质量及预后影响因素分析[J].川北医学院学报, 2016, 31(5): 693-695

[23] 徐继威, 温苑章, 李嘉, 等. 腹腔镜精准肝切除临床应用价值分析[J].中国微创外科杂志, 2016, 16(7): 590-593

[24] Huang B, Yu Y, Zhao S, et al. Precise hepatectomy based on the optimized technique of hepatic blood flow occlusion combined with the curettage and cut technique by electrotome [J]. Minerva Chir, 2017, 72(1): 1-9

[25] Wei W, Zhang T, Zafarnia S, et al. Establishment of a rat model: Associating liver partition with portal vein ligation for stagedhepatectomy[J]. Surgery, 2016, 159(5): 1299-1307

[26] Schiergens TS, Lindenthaler A, Thomas MN, et al. Time-dependent impact of age and comorbidities on long-term overall survival after liver resection[J]. Liver Int, 2016, 36(9): 1340-1350

[27] Wen H, Dong JH, Zhang JH, et al. Ex Vivo Liver Resection and Autotransplantation for End-Stage Alveolar Echinococcosis: A Case Series[J]. Am J Transplant, 2016, 16(2): 615-624

[28] Chen XP, Zhang WD, Wang D, et al. Lmage classification of liver cancer surrounding right hepatic pedicle and its guide to precise liver resection[J]. Int J Clin Exp Med, 2015, 8(7): 11093-11100

[29] Onoe S, Kaneoka Y, Maeda A, et al. Hepatectomy of segment 4b and 5 with extrahepatic bile duct resection for pT2 gallbladder carcinoma is valid: a single-institution result [J]. Updates Surg, 2015, 67 (3): 265-271

[30] Aoki T, Murakami M, Koizumi T, et al. Preoperative Tattooing for Precise and Expedient Localization of Landmark in Laparoscopic Liver Resection[J]. J Am Coll Surg, 2015, 221(5): e97-e101

(上接第 45 页)

[20] Buchholz B M, Kaczorowski D J, Sugimoto R, et al. Hydrogen Inhalation Ameliorates Oxidative Stress in Transplantation Induced Intestinal Graft Injury[J]. American journal of transplantation: official journal of the American Society of Transplantation and the American Society of Transplant Surgeons, 2008, 8(10): 2015-2024

[21] Cui Y, Zhang H, Ji M, et al. Hydrogen-rich saline attenuates neuronal ischemia-reperfusion injury by protecting mitochondrial function in rats[J]. Journal of Surgical Research, 2014, 192(2): 564-572

[22] 张蕾, 李新, 贾济, 等. 氨磷汀对氧糖剥夺引起的 PC12 细胞缺血再灌注损伤的保护作用研究 [J]. 现代生物医学进展, 2011, 11(6): 1110-1113

[23] Mo Z T, Fang Y Q, He Y P, et al. β-Asarone protects PC12 cells against OGD/R-induced injury via attenuating Beclin-1-dependent autophagy[J]. Acta Pharmacologica Sinica, 2012, 33(6): 737-742

[24] Lakhan S E, Kirchgessner A, Hofer M. Inflammatory mechanisms in ischemic stroke: therapeutic approaches [J]. Journal of Translational Medicine, 2009, 7(1): 97

[25] Wen Y, Yu Y, Fu X. LncRNA Gm4419 contributes to OGD/R injury of cerebral microglial cells via IκB phosphorylation and NF-κB activation[J]. Biochemical and Biophysical Research Communications, 2017, 487(4): 923

[26] CXCL10/CXCR3 在感染 PRRSV 猪肺组织和巨噬细胞中的表达[D]. 华中农业大学, 2016

[27] Dufour J H, Dziejman M, Liu M T, et al. IFN-γ-inducible protein 10 (IP-10; CXCL10) -deficient mice reveal a role for IP-10 in effector T cell generation and trafficking[J]. Immunol, 2002, 168: 3195-3204

[28] 段钟平, 白丽, 翟原, 等. 趋化因子 CXCL10 与肝病关系的研究进展[J]. 北京医学, 2010, 32(3): 227-230

[29] Piper K P, Horlock C, Curnow S J, et al. CXCL10-CXCR3 interactions play an important role in the pathogenesis of acute graft-versus-host disease in the skin following allogeneic stem-cell transplantation[J]. Blood, 2007, 110(12): 3827

[30] 聂莉, 李婷, 刘淑华, 等. 慢性阻塞性肺疾病患者外周血单个核细胞 CXC 趋化因子受体 3 表达的意义 [J]. 临床内科杂志, 2012, 29 (3): 170-172