

doi: 10.13241/j.cnki.pmb.2019.10.034

超早期立体定向手术治疗高血压脑出血的疗效及对患者炎症因子和生活质量的影响*

石立科 王玉海 董吉荣 何建青 向定朝

(中国人民解放军联勤保障部队第904医院神经外科 江苏 无锡 214044)

摘要 目的:探讨超早期立体定向手术治疗高血压脑出血(HICH)的疗效及对患者炎症因子和生活质量的影响。**方法:**选取2016年3月~2018年1月期间我院收治的HICH患者93例,两组均给予立体定向手术治疗,根据手术时机将患者分为早期组($n=45$,发病6~24h内手术)和超早期组($n=48$,发病6h内手术),比较两组疗效相关指标、炎症因子和生活质量,观察两组术后并发症发生情况。**结果:**超早期组病死率低于早期组,格拉斯哥昏迷评分(GOS)优良率高于早期组($P<0.05$),两组术后再出血率对比差异无统计学意义($P>0.05$)。两组患者术后2周白介素-6(IL-6)、超敏C反应蛋白(hs-CRP)、肿瘤坏死因子- α (TNF- α)水平均降低,且超早期组低于早期组($P<0.05$)。术后3个月、术后6个月超早期组心理健康、躯体健康、社会功能、物质生活等维度评分均高于早期组($P<0.05$)。超早期组术后并发症总发生率低于早期组($P<0.05$)。**结论:**超早期立体定向手术治疗HICH,疗效显著,可有效改善炎症因子水平及患者的生活质量,同时还可减少术后并发症的发生率。

关键词:超早期;立体定向手术;高血压脑出血;疗效;炎症因子;生活质量

中图分类号:R743.34 **文献标识码:**A **文章编号:**1673-6273(2019)10-1962-04

Efficacy of Ultra-early Surgery for Hypertensive Intracerebral Hemorrhage and its Effect on Inflammatory Factors and Quality of Life in Patients with Hypertensive Intracerebral Hemorrhage*

SHI Li-ke, WANG Yu-hai, DONG Ji-rong, HE Jian-qing, XIANG Ding-chao

(Department of Neurology, The 904th Hospital of the PLA Joint Logistics Support Force, Wuxi, Jiangsu, 214044, China)

ABSTRACT Objective: To investigate the effect of ultra-early stereotactic surgery on hypertensive intracerebral hemorrhage (HICH) and its influence on inflammatory factors and quality of life. **Methods:** 93 patients with HICH who were admitted to our hospital from March 2016 to January 2018 were selected, and they were divided into early group ($n=45$, operation within 6-24 hours of onset) and super-early group ($n=48$, operation within 6 hours of onset) according to the timing of operation. Relevant indexes of curative effect, inflammatory factors and quality of life were compared between the two groups, and the occurrence of postoperative complications was observed. **Results:** The mortality of super-early group was lower than that of early group, and the Glasgow coma score (GOS) excellent and good rate was higher than that of early group ($P<0.05$). There was no significant difference in the postoperative rebleeding rate between the two groups ($P>0.05$). The levels of interleukin-6 (IL-6), high-sensitivity C-reactive protein (hs-CRP) and tumor necrosis factor- α (TNF- α) were decreased in the two groups at 2 weeks after operation, and those in the ultra-early group were lower than those in the early group ($P<0.05$). The scores of mental health, physical health, social function and material life in the ultra-early group at 3 months and 6 months after operation were higher than those in the early group ($P<0.05$). The total incidence of postoperative complications in the ultra-early group was lower than that in the early group ($P<0.05$). **Conclusion:** Ultra-early stereotactic surgery for HICH has remarkable curative effect, which can effectively improve inflammatory factors and quality of life, and it can also reduce the incidence of postoperative complications.

Key words: Ultra-early; Stereotactic surgery; Hypertensive intracerebral hemorrhage; Efficacy; Inflammatory factors; Quality of life

Chinese Library Classification(CLC): R743.34 **Document code:** A

Article ID: 1673-6273(2019)10-1962-04

前言

高血压脑出血(Hypertensive intracerebral hemorrhage, HICH)是临床常见的脑实质内出血,也是高血压最严重的并发

症之一,多发于50~70岁,男性发病率稍高些^[1,2]。据相关报道统计^[3],HICH占全部脑卒中的17.1%~39.4%。HICH发病急骤,病情进展迅速,其病死率高达30%以上,即使存活,也会遗留不同程度的神经功能障碍,影响患者生活质量^[4,5]。目前,立体定向手

* 基金项目:江苏省卫生厅科研项目(BRA2015358)

作者简介:石立科(1983-),男,硕士,主治医师,研究方向:神经疾病手术治疗, E-mail: shilike@163.com

(收稿日期:2019-01-07 接受日期:2019-01-30)

术仍是治疗 HICH 的主要方式,通过手术可完全清楚血肿、解除脑组织压迫、降低颅内压^[6,7]。然而目前临床对于 HICH 患者手术适应证、手术时机仍存在一定争议,超早期手术是指自发病至手术时间为 6h 内,在此期间进行手术可解除血肿对脑组织的机械性压迫,将血肿分解产物对脑周围神经组织的损伤减到最低,最大限度恢复患者神经功能^[8-10]。本研究通过对我院收治的部分 HICH 患者行超早期立体定向手术治疗,取得了不错的疗效,现报道如下。

1 资料与方法

1.1 一般资料

选取 2016 年 3 月~2018 年 1 月期间我院收治的 HICH 患者 93 例,纳入标准:(1)均有明确的高血压史,经头颅 CT 证实为脑出血,出血量大于 30 mL;(2)发病至手术时间 1~24h;(3)均具备手术指征;(4)患者家属对本研究知情同意。排除标准:(1)心肺功能已衰竭或在手术过程中停止呼吸者;(2)位于脑干及小脑的脑内血肿;(3)存在血液系统疾病,及有长期服用抗凝药物治疗史者;(4)家属放弃手术治疗的病例;(5)伴有多灶性出血、癫痫史者;(6)随访期间失联者。根据手术时机将患者分为早期组(n=45)和超早期组(n=48),其中男 28 例,女 17 例;年龄 43~76 岁,平均(52.68±6.49)岁;出血部位:脑皮层下 17 例,丘脑 16 例,壳核 12 例;入院时格拉斯哥昏迷评分(Glasgow coma score, GOS)^[11] 1~6 分,平均(3.46±0.95)分;高血压病程 1~9 年,平均(4.93±1.06)年;出血量 31~43 mL,平均(36.19±1.36)mL。超早期组男 30 例,女 18 例;年龄 42~75 岁,平均(53.18±6.54)岁;出血部位:脑皮层下 19 例,丘脑 15 例,壳核 14 例;入院时 GOS 评分 1~5 分,平均(3.52±1.07)分;高血压病程 1~10 年,平均(5.06±1.12)年;出血量 32~45 mL,平均(36.28±1.42)mL。两组基线资料对比无显著性差异($P>0.05$),具有可比性。本研究已获取我院伦理学委员会批准同意。

1.2 治疗方法

两组患者均给予立体定向手术,早期组于发病 6~24h 内手术,超早期组于发病 6h 内手术,手术方式具体如下:采用安科公司生产的 ASA-602 型脑立体定向仪,在 CT 机的引导下计算出相应靶点,选取患侧血肿区域附近的相对无功能区进行入路,钻孔,将排空器置于血肿中心,经阿基米德钻搅碎后抽吸血

肿,抽吸压力 <30.0 Kpa,抽吸完成后置引流管于血肿腔内,每日注射尿激酶溶解血肿,经引流管引流至体外,术后动态复查头颅 CT,待血肿基本排空或次全排空后,将引流管拔除。术后视患者具体情况给予降低颅内压、抗感染、营养支持、保护胃黏膜以及康复治疗等。

1.3 观察指标

观察两组患者病死率、术后再出血率,比较术后 2 周的 GOS 优良率,其中 GOS 评分如下:优(5 分):术后恢复良好,遗留轻度神经功能障碍,但不影响生活;良(4 分):遗留中度神经功能障碍,但生活可自理;中(3 分):遗留重度神经功能障碍,生活不能自理;差(1~2 分):植物人状态或死亡者;GOS 优良率=优率+良率。于术前、术后 2 周抽取患者肘静脉血 6 mL,经 3500 r/min 离心 10 min,离心半径 12 cm,分离上清液,放置于 -30℃ 冰箱中待测。采用酶联免疫吸附法检测白介素 -6 (Interleukin-6, IL-6)、超敏 C 反应蛋白 (High-sensitivity C-reactive protein, hs-CRP)、肿瘤坏死因子 - α (Tumor necrosis factor- α , TNF- α) 水平,试剂盒采购自武汉华美生物科技有限公司,严格按照说明书操作进行。采用电话询问或门诊复查等方式对所有患者进行为期 6 个月的随访,随访终止指征为患者死亡,于术后 3 个月、术后 6 个月采用生活质量(Quality of life, QOL)^[12]评分对所有患者生活质量进行评价,其中 QOL 量表包括心理健康、躯体健康、社会功能以及物质生活这 4 个维度,每项总分 100 分,分数越高,生活质量越好。记录两组术后并发症发生情况。

1.4 统计学方法

本研究数据均采用 SPSS20.0 软件进行统计分析,计数资料以率(%)表示,采用 χ^2 检验,计量资料以($\bar{x}\pm s$)表示,采用 t 检验; $P<0.05$ 表示差异具有统计学意义。

2 结果

2.1 两组术后相关指标比较

两组术后 2 周内均无病死病例,早期组术后 3 个月内病死 5 例,术后 4 个月~术后 6 个月病死 4 例;超早期组术后 4 个月~术后 6 个月病死 2 例。超早期组病死率低于早期组,GOS 优良率高于早期组($P<0.05$),两组术后再出血率对比差异无统计学意义($P>0.05$),详见表 1。

表 1 两组术后相关指标比较 例(%)

Table 1 Comparisons of two groups of relevant indexes after operation n(%)

Groups	Mortality	Postoperative rebleeding rate	GOS excellent and good rate				Excellent and good rate
			Excellent	Good	Medium	Poor	
Early group (n=45)	9(20.00)	9(20.00)	9(20.00)	11(24.44)	14(31.11)	11(24.45)	20(44.44)
Super-early group(n=48)	2(4.17)	5(10.42)	15(31.25)	20(41.67)	9(18.75)	4(8.33)	35(72.92)
χ^2	5.583	1.698		-			4.186
P	0.018	0.167		-			0.041

2.2 两组炎症因子水平比较

两组患者术前 IL-6、hs-CRP、TNF- α 水平比较差异无统计

学意义($P>0.05$),两组患者术后 2 周 IL-6、hs-CRP、TNF- α 水平均降低,且超早期组低于早期组($P<0.05$),详见表 2。

2.3 两组患者生活质量比较

会功能、物质生活等维度评分均高于早期组($P<0.05$),详见表3、表4。

术后3个月、术后6个月超早期组心理健康、躯体健康、社

表2 两组炎症因子水平比较($\bar{x}\pm s$)

Table 2 Comparison of inflammatory factors between two groups($\bar{x}\pm s$)

Groups		IL-6(ng/L)		hs-CRP(mg/L)		TNF- α (g/L)	
Before operation	Before operation	2 weeks after operation	Before operation	2 weeks after operation	Before operation	2 weeks after operation	
Early group(n=45)	46.92 $\pm$ 5.17	31.82 $\pm$ 4.13*	13.53 $\pm$ 2.14	10.46 $\pm$ 1.12*	65.51 $\pm$ 5.27	51.18 $\pm$ 4.36*	
Super-early group(n=48)	46.88 $\pm$ 6.18	17.71 $\pm$ 4.21*	13.21 $\pm$ 2.09	7.37 $\pm$ 0.95*	64.98 $\pm$ 6.35	39.56 $\pm$ 5.38*	
t	0.034	16.301	0.729	14.379	0.436	11.398	
P	0.973	0.000	0.468	0.000	0.664	0.000	

Note: Compared with before operation, * $P<0.05$.

2.4 两组术后并发症发生情况比较

染、1例消化道出血、2例高血糖,并发症总发生率为10.42%(5/48),超早期组术后并发症总发生率低于早期组($\chi^2=4.106$, $P=0.043$)。

早期组术后发生4例感染、3例消化道出血、5例高血糖,并发症总发生率为26.67%(12/45),超早期组术后发生2例感

表3 两组术后3个月生活质量比较($\bar{x}\pm s$,分)

Table 3 Comparison of quality of life in two groups at 3 months after operation ($\bar{x}\pm s$, scores)

Groups	Mental health	Physical health	Social function	Material life
Early group(n=40)	46.61 $\pm$ 6.51	41.15 $\pm$ 6.34	55.04 $\pm$ 5.42	59.18 $\pm$ 9.95
Super-early group(n=48)	52.41 $\pm$ 7.43	48.18 $\pm$ 6.57	62.13 $\pm$ 6.33	68.25 $\pm$ 10.73
t	3.855	5.078	5.580	4.080
P	0.000	0.000	0.000	0.000

表4 两组术后6个月生活质量比较($\bar{x}\pm s$,分)

Table 4 Comparison of quality of life between the two groups at 6 months after operation($\bar{x}\pm s$, scores)

Groups	Mental health	Physical health	Social function	Material life
Early group(n=36)	51.64 $\pm$ 5.47	47.74 $\pm$ 7.53	62.88 $\pm$ 6.78	67.54 $\pm$ 7.32
Super-early group(n=46)	60.63 $\pm$ 6.52	57.35 $\pm$ 5.46	73.04 $\pm$ 7.65	75.66 $\pm$ 8.01
t	6.922	6.926	6.529	4.923
P	0.000	0.000	0.000	0.000

3 讨论

HICH 是一类严重危害人类健康的危急重症,其致死率、病死率较高,治疗效果不佳,预后较差^[13]。HICH 的治疗目的是尽早清除血肿,降低颅内压,以防止或减轻出血后一系列病理损伤导致的继发性神经损伤^[14,15]。立体定向手术为 HICH 的微创治疗外科拓展了空间,该手术方式定位精准、手术创伤小、安全性高,对于丘脑、重要功能区等深部血肿及无法耐受开颅手术者,疗效明确^[16,17]。虽然立体定向手术在 HICH 的治疗地位不容置疑,且现有不少研究普遍认为发病至手术 24h 内手术效果较佳,但有关具体的手术时机仍存在一定争议。以往报道指出^[18], HICH 发病 20~30 min 内,血肿即可形成,6~7h 出血则逐渐停止,紧靠血肿的脑实质开始出现坏死现象,随着时间的延长,水

肿范围不断向脑实质内扩大,加重患者病情。由此可见,在血肿形成 6h 后,周围脑组织即开始发生变性,故而有研究提出可在血肿造成此类不可逆损伤之前将血肿清除,可有效减少继发性损害^[19]。邱学才等^[20]学者认为,患者发病 6h 内,出血尚未完全停止,在此时间段内实施手术可增加再出血发生率。而许光涛等^[21]学者却认为,尽早清除血肿,可有效减少血肿对周围神经组织的压迫,提高治疗效果,减少继发性神经损伤。因此,选择合适的 HICH 的治疗时机具有积极的临床意义。

本次研究结果中,超早期组病死率、并发症总发生率低于早期组,GOS 优良率高于早期组,可见尽早进行手术是改善患者预后的关键,脑出血一方面可使出血部位脑组织受到破坏,同时压迫周围组织引起局部微血管痉挛、坏死,另一方面由于血肿部位的分解产物毒性作用,使血肿周围脑组织发生由近及

远的水肿、变性及坏死,进行超早期手术后,可解除血肿压迫,打破血肿部位细胞分解代谢、水肿扩散等一系列病理变化所引起的恶性循环^[22-24]。同时两组术后再出血率对比无差异,可见超早期组并不增加再出血发生率,这可能与手术过程中严格控制患者血压、血肿引流量以及引流速度等因素的稳定有关^[25]。既往有研究报道显示^[26,27],HICH 发病期间,血肿及其周围组织易发生炎性反应,分泌多种炎性细胞因子如 IL-6、hs-CRP 以及 TNF- α ,上述炎性因子水平的升高,可导致脑微血管通透性及血脑屏障通透性,参与着血肿周围组织损伤的病理进程,且其水平高低与损伤程度呈现一定的正相关性。而本研究结果中超早期组术后 2 周 IL-6、hs-CRP、TNF- α 水平明显低于早期组,可见越早进行手术,可尽早阻断炎性反应-脑水肿-神经损伤这一系列恶性循环,最终改善治疗效果,减少神经损伤^[28,29]。同时本次研究还显示,超早期组术后 3 个月、术后 6 个月生活质量改善效果更佳,这可能与超早期及时进行手术,消除血肿占位现象,减少患者继发性损害,改善患者预后,进而有效提高生活质量有关^[30]。

综上所述,HICH 患者于超早期进行立体定向手术治疗,可有效改善病死率、GOS 优良率,同时还可有效减轻机体炎性因子水平,改善患者术后生活质量,减少术后并发症发生率,临床应用价值较高。

参考文献(References)

- [1] Sun G, Li X, Chen X, et al. Comparison of keyhole endoscopy and craniotomy for the treatment of patients with hypertensive cerebral hemorrhage[J]. *Medicine (Baltimore)*, 2019, 98(2): e14123
- [2] 宋贺, 焦庆芳, 胡显红, 等. 脑室镜辅助与常规开颅手术治疗中等量高血压脑出血的研究[J]. *河北医药*, 2013, 35(13): 2019-2020
- [3] 贺亚龙, 李兵, 吕超, 等. 微创颅内血肿清除术治疗高血压脑出血的效果分析[J]. *现代生物医学进展*, 2016, 16(26): 5175-5178
- [4] Luan L, Li M, Sui H, et al. Efficacies of minimally invasive puncture and small bone window craniotomy for hypertensive intracerebral hemorrhage, evaluation of motor-evoked potentials and comparison of postoperative rehemorrhage between the two methods[J]. *Exp Ther Med*, 2019, 17(2): 1256-1261
- [5] Ye Z, Ai X, Hu X, et al. Comparison of neuroendoscopic surgery and craniotomy for supratentorial hypertensive intracerebral hemorrhage: A meta-analysis[J]. *Medicine (Baltimore)*, 2017, 96(35): e7876
- [6] 孙伟. 立体定向手术与传统开颅手术治疗基底节区高血压脑出血的疗效比较[J]. *中国实用神经疾病杂志*, 2016, 19(16): 114-115
- [7] 孙霄, 陶英群, 金海, 等. ROSA 与立体定向框架辅助手术治疗高血压脑出血的对比研究[J]. *中华神经外科杂志*, 2018, 34(7): 674-677
- [8] Hegde A, Menon G. Modifying the Intracerebral Hemorrhage Score to Suit the Needs of the Developing World[J]. *Ann Indian Acad Neurol*, 2018, 21(4): 270-274
- [9] Chen T, Xu G, Tan D, et al. Effects of platelet infusion, anticoagulant and other risk factors on the rehaemorrhagia after surgery of hypertensive cerebral hemorrhage [J]. *Eur Rev Med Pharmacol Sci*, 2015, 19(5): 795-799
- [10] 杨川, 勾俊龙, 毛群, 等. 立体定向手术治疗基底核区高血压性脑出血手术时机的探讨[J]. *中国微创外科杂志*, 2017, 17(8): 710-713
- [11] 杨金华, 孙转妮, 杨香丽, 等. 高血压脑出血术后使用腰大池引流加鞘内注射的临床观察及对颅内感染的影响[J]. *中西医结合心脑血管病杂志*, 2017, 15(15): 1946-1949
- [12] 王爱凤, 王正梅, 金妍, 等. 个性化护理干预对高血压脑出血患者生活质量的影响[J]. *中华现代护理杂志*, 2016, 22(3): 360-363
- [13] Ding W, Gu Z, Song D, et al. Development and validation of the? hypertensive intracerebral hemorrhage prognosis models[J]. *Medicine (Baltimore)*, 2018, 97(39): e12446
- [14] Tang Y, Yin F, Fu D, et al. Efficacy and safety of minimal invasive surgery treatment in hypertensive intracerebral hemorrhage: a systematic review and meta-analysis [J]. *BMC Neurol*, 2018, 18(1): 136
- [15] Zhang J, Lu S, Wang S, et al. Comparison and analysis of the efficacy and safety of minimally invasive surgery and craniotomy in the treatment of hypertensive intracerebral hemorrhage[J]. *Pak J Med Sci*, 2018, 34(3): 578-582
- [16] Xu X, Zheng Y, Chen X, et al. Comparison of endoscopic evacuation, ?stereotactic aspiration and craniotomy for the treatment of supratentorial hypertensive intracerebral haemorrhage: study protocol for a randomised controlled trial[J]. *Trials*, 2017, 18(1): 296
- [17] Watson K, Broschius R, Devabhakthuni S, et al. Focused Update on Pharmacologic Management of Hypertensive Emergencies [J]. *Curr Hypertens Rep*, 2018, 20(7): 56
- [18] Zhao J, Mao Q, Qian Z, et al. Effect of mild hypothermia on expression of inflammatory factors in surrounding tissue after minimally invasive hematoma evacuation in the treatment of hypertensive intracerebral hemorrhage [J]. *Exp Ther Med*, 2018, 15(6): 4906-4910
- [19] Sun Y, Xu B, Zhang Q. Nerve growth factor in combination with Oxiracetam in the treatment of Hypertensive Cerebral Hemorrhage[J]. *Pak J Med Sci*, 2018, 34(1): 73-77
- [20] 邱学才, 常魏, 张丽娟, 等. 发病后不同时间手术治疗高血压脑出血的临床研究[J]. *现代预防医学*, 2014, 41(4): 757-759
- [21] 许光涛, 侯庆田, 王淑霞, 等. 超早期双通道多靶点治疗老年重症高血压脑出血的临床研究[J]. *中国急救医学*, 2015, 35(z2): 362-363
- [22] Vedicherla SV, Foo AS, Sharma VK, et al. The "Blush" Sign on Computed Tomography Angiography is an Independent Predictor of Hematoma Progression in Primary Hypertensive Hemorrhage [J]. *J Stroke Cerebrovasc Dis*, 2018, 27(7): 1878-1884
- [23] Kojima D, Komoribayashi N, Omama S, et al. Crossed Cerebellar Tracer Uptake on Acute-Stage 123I-Iomazenil SPECT Imaging Predicts 3-Month Functional Outcome in Patients With Nonfatal Hypertensive Putaminal or Thalamic? Hemorrhage[J]. *Clin Nucl Med*, 2018, 43(6): 396-401
- [24] Ma R, Fang SK, Hou S, et al. Suspected brain metastasis from lung cancer mimicking intracerebral hemorrhage: A case report [J]. *Medicine (Baltimore)*, 2018, 97(10): e0106
- [25] Gavito-Higuera J, Khatri R, Qureshi IA, et al. Aggressive blood pressure treatment of hypertensive intracerebral hemorrhage may lead to global cerebral hypoperfusion: Case report and imaging perspective [J]. *World J Radiol*, 2017, 9(12): 448-453
- [26] 刘新志, 赵恒, 晏文强, 等. 银杏叶提取物对高血压脑出血术后患者神经功能、血清炎症因子、MMP-9 和 AQP-4 水平的影响[J]. *实用药物与临床*, 2018, 21(11): 1220-1224

其准确性进行评估。除此之外,wang 等^[24]提出一种通过优化 AL 来提高第三代公式准确性的方法,其准确性有待进一步验证。

综上所述,在现有样本量的研究下,当 $26\text{ mm} \leq \text{AL} < 28\text{ mm}$, 我们建议使用 SRK/T、Barrett Universal II 公式,当 $\text{AL} \geq 28\text{ mm}$, 建议应用 Barrett Universal II 公式,其次为 Haigis 公式。

参考文献(References)

- [1] Kora Y, Koike M, Suzuki Y, et al. Errors in IOL power calculations for axial high myopia[J]. *Ophthalmic Surg*, 1991, 22(2): 78-81
- [2] Aristodemou P, Knox CN, Sparrow JM, et al. Formula choice: Hoffer Q, Holladay 1, or SRK/T and refractive outcomes in 8108 eyes after cataract surgery with biometry by partial coherence interferometry[J]. *J Cataract Refract Surg*, 2011, 37(1): 63-71
- [3] Ghanem AA, El-Sayed HM. Accuracy of intraocular lens power calculation in high myopia[J]. *Oman J Ophthalmol*, 2010, 3(3): 126-130
- [4] Bang S, Edell E, Yu Q, et al. Accuracy of intraocular lens calculations using the IOLMaster in eyes with long axial length and a comparison of various formulas[J]. *Ophthalmology*, 2011, 118(3): 503-506
- [5] Zhu X, Zhang K, He W, et al. Proinflammatory status in the aqueous humor of high myopic cataract eyes[J]. *Exp Eye Res*, 2016, 142: 13-18
- [6] Olsen T. Calculation of intraocular lens power: a review [J]. *Acta Ophthalmol*, 2007, 85(5): 472-485
- [7] Bielos Roncevic M, Busic M, Cima I, et al. Intraobserver and interobserver repeatability of ocular components measurement in cataract eyes using a new optical low coherence reflectometer [J]. *Graefes Arch Clin Exp Ophthalmol*, 2011, 249(1): 83-87
- [8] Rohrer K, Frueh BE, Walti R, et al. Comparison and evaluation of ocular biometry using a new noncontact optical low-coherence reflectometer[J]. *Ophthalmology* 2009, 116(11): 2087-2092
- [9] Narver K, Frueh BE, Walti R, et al. Comparison and evaluation of ocular biometry using a new noncontact optical laday 1, Holladay 2, and SRK/T formulas[J]. *J Cataract Refract Surg*, 2006, 32(12): 2050-2053
- [10] 刘珣, 王欣玲, 柏全豪, 等. IOLMaster 与四种人工晶状体屈光度计算公式的准确性研究[J]. *眼科新进展*, 2013, 33(2): 143-146
- [11] Bang S, Edell E, Yu Q, et al. Accuracy of intraocular lens calculations using the IOLMaster in eyes with long axial length and a comparison of various formulas [J]. *Ophthalmology*, 2011, 118(3): 503-506
- [12] Cooke DL, Cooke TL. Comparison of 9 intraocular lens power calculations formulas[J]. *J Cataract Refract Surg*. 2016, 42: 1157-1164
- [13] 臧晶, 陈立伦, 鲍炯琳, 等. IOL-Master 在不同公式下对轴性高度近视眼术后屈光准确度评估[J]. *眼科新进展*, 2016, 36(6): 554-558
- [14] Retzlaff J, Sanders D, Kraff M. Development of the SRK/T intraocular lens implant power calculation formula [J]. *J Cataract Refract Surg*, 1990, 16(3): 333-340
- [15] Cho BJ, Shin JY, Yu HG. Complications of pathologic myopia[J]. *Eye Contact Lens*, 2016, 42(1): 9-15
- [16] Haigis W, Lege B, Miller N, et al. Comparison of immersion ultrasound biometry and partial coherence interferometry for intraocular lens calculation according to Haigis[J]. *Graefes Arch Clin Exp Ophthalmol*, 2000, 238(9): 765-773
- [17] Abulafia A, Barrett GD, Rotenberg M, et al. Intraocular lens power calculation for eyes with an axial length greater than 26.0 mm: comparison of formulas and methods [J]. *J Cataract Refract Surg*, 2015, 41(3): 548-556
- [18] Kane JX, Van Heerden A, Atik A, et al. Intraocular lens power formula accuracy: Comparison of 7 formulas [J]. *J Cataract Refract Surg*, 2016, 42(10): 1490-1500
- [19] Roberts TV, Hodge C, Sutton G, et al. Comparison of Hill-radial basis function, Barrett Universal and current third generation formulas for the calculation of intraocular lens power during cataract surgery [J]. *Clin Exp Ophthalmol*, 2018, 46(3): 240-246
- [20] Haigis W. Intraocular lens calculation in extreme myopia [J]. *J Cataract Refract Surg*, 2009, 35(5): 906-911
- [21] Wang L, Shirayama M, Ma XJ, et al. Optimizing intraocular lens power calculations in eyes with axial length above 25.0 mm [J]. *J Cataract Refract Surg*, 2011, 37(1): 2018-2027
- [27] 曹新建, 王嵘, 王学军, 等. 大黄蛰丹汤对高血压脑出血术后病灶周围炎性细胞因子及预后的影响[J]. *国际中医中药杂志*, 2018, 40(8): 690-693
- [28] Pasi M, Charidimou A, Boulouis G, et al. Mixed-location cerebral hemorrhage/microbleeds: Underlying microangiopathy and recurrence risk[J]. *Neurology*, 2018, 90(2): e119-e126
- [29] Mori S, Takahashi S, Hayakawa A, et al. Fatal Intracranial Aneurysms and Dissections Causing Subarachnoid Hemorrhage: An Epidemiological and Pathological Analysis of 607 Legal Autopsy Cases[J]. *J Stroke Cerebrovasc Dis*, 2018, 27(2): 486-493
- [30] Herweh C, Nordlohne S, Sykora M, et al. Climatic and Seasonal Circumstances of Hypertensive Intracerebral Hemorrhage in a Worldwide Cohort[J]. *Stroke*, 2017, 48(12): 3384-3386