

可调压分流管 LPS 术和 VPS 术治疗交通性脑积水患者的疗效

吴波 邓达 王维波

成都中医药大学附属资阳医院, 四川 资阳 641300

通信作者: 吴波

【摘要】目的 探究可调压分流管腰大池腹腔分流术(LPS)和侧脑室腹腔分流术(VPS)对交通性脑积水患者疗效与血清红细胞分布宽度(RDW)、中枢神经特异性蛋白(S100B)、转化生长因子- β 1(TGF- β 1)的影响及预后相关因素分析。**方法** 前瞻性选取 2018-01—2021-11 在成都中医药大学附属资阳医院收治的交通性积水患者 300 例为研究对象。按随机数字表法将 300 例患者随机分为研究组与对照组各 150 例,对照组行 VPS 术治疗,研究组行 LPS 术治疗。比较 2 组术后 6 个月疗效、加拿大神经病学量表(CNS)、改良 Rankin 量表(mRS)评分、术后 1 周 RDW、S100B、TGF- β 1 水平与术后并发症。根据术后是否发生迟发性颅内出血(DICH)将患者分为 DICH 组与非 DICH 组,采用二元 Logistic 回归分析 DICH 发生影响因素。**结果** 2 组疗效存在明显差异,研究组优于对照组(93.33% vs 83.33%)($\chi^2=7.278$, $P<0.05$)。2 组治疗后的 CNS 评分,较治疗前均显著升高(7.96 ± 0.81 vs 5.06 ± 0.56 / 7.01 ± 0.69 vs 5.05 ± 0.65), mRS 评分均显著降低(2.03 ± 0.42 vs 4.07 ± 0.65 / 2.85 ± 0.39 vs 3.98 ± 0.55)($t=16.213/11.353$, $32.285/9.281$, $P<0.05$),且研究组 CNS 评分(7.96 ± 0.81 vs 7.01 ± 0.69)高于对照组, mRS 评分(2.03 ± 0.42 vs 2.85 ± 0.39)均低于对照组($t=10.935$, 17.522 , $P<0.05$)。与治疗前相比(2.21 ± 0.31 / 2.22 ± 0.34 , 16.35 ± 2.34 / 16.87 ± 2.26 , 2718.50 ± 703.58 / 2798.08 ± 729.76), 2 组患者治疗后的 S100B、RDW、TGF- β 1 水平(1.28 ± 0.27 / 1.73 ± 0.32 , 12.58 ± 1.58 / 14.28 ± 1.55 , 1664.76 ± 625.59 / 2304.26 ± 692.44)均显著降低($t=27.707/12.853$, $16.353/11.575$, $13.708/6.012$, $P<0.05$),且治疗后研究组 S100B、RDW、TGF- β 1(1.28 ± 0.27 , 12.58 ± 1.58 , 1664.76 ± 625.59)均低于对照组(1.73 ± 0.32 , 14.28 ± 1.55 , 2304.26 ± 692.44)($t=13.163$, 9.407 , 8.393 , $P<0.05$)。研究组患者术后 DICH 与总并发症发生率均低于对照组($\chi^2=14.451$, $P<0.05$)。多因素 Logistic 回归分析显示,年龄、糖尿病、高血压、术后 1 周内调节分流管阀门、术后硬膜下有积液均为交通性脑积水患者术后 DICH 发生的相关影响因素($P<0.05$)。**结论** 可调压分流管 LPS 术相比 VPS 术治疗交通性脑积水效果更好,可有效改善患者神经损伤情况,降低 RDW、S100B、TGF- β 1 水平,减少术后并发症发生率,且高龄、糖尿病、高血压、术后 1 周内调节分流管阀门、术后硬膜下有积液均为交通性脑积水患者术后 DICH 发生的相关危险因素。

【关键词】 交通性脑积水;可调压分流管腰大池腹腔分流术;侧脑室腹腔分流术;红细胞分布宽度;转化生长因子- β 1;预后

【中图分类号】 R651.1⁺1 **【文献标识码】** A **【文章编号】** 1673-5110(2022)07-0832-07

基金项目: 四川省科技厅科研项目(编号: 2020YFH0096)

Study on the efficacy of LPS and VPS with adjustable pressure shunt in patients with communicating hydrocephalus

WU Bo, DENG Da, WANG Weibo

DOI: 10.12083/SYSJ.220704

本文引用信息: 吴波, 邓达, 王维波. 可调压分流管 LPS 术和 VPS 术治疗交通性脑积水患者的疗效[J]. 中国实用神经疾病杂志, 2022, 25(7): 832-838. DOI: 10.12083/SYSJ.220704

Reference information: WU Bo, DENG Da, WANG Weibo. Study on the efficacy of LPS and VPS with adjustable pressure shunt in patients with communicating hydrocephalus [J]. Chinese Journal of Practical Nervous Diseases, 2022, 25(7): 832-838. DOI: 10.12083/SYSJ.220704

Ziyang Hospital Affiliated to Chengdu University of traditional Chinese Medicine, Ziyang 641300, China

Corresponding author: WU Bo

[Abstract] Objective To explore the efficacy of adjustable pressure shunt lumbar peritoneal shunt (LPS) and lateral ventriculoperitoneal shunt (VPS) in patients with communicating hydrocephalus, serum red blood cell distribution width (RDW), central nervous system specific protein (S100B), transformation Analysis of the influence of growth factor- β 1 (TGF- β 1) and prognostic factors. **Methods** A total of 300 patients with traffic-related hydrops who were admitted to our hospital from January 2018 to November 2021 were prospectively selected as the research subjects. According to the random number table method, 300 patients were randomly divided into the study group and the control group, 150 cases in each, the control group was treated with VPS, and the study group was treated with LPS. The curative effect, Canadian Neurology Scale (CNS), Modified Rankin Scale (mRS) score, RDW, S100B, TGF- β 1 levels and postoperative complications at 1 week after operation were compared between the two groups. According to whether delayed intracranial hemorrhage (DICH) occurred after operation, the patients were divided into DICH group and non-DICH group. Binary Logistic regression was used to analyze the influencing factors of DICH. **Results** There was a significant difference in the therapeutic efficacy between the two groups, and the treatment group in the study group was higher than that in the control group (93.33% vs 83.33%) ($\chi^2=7.278, P<0.05$). After treatment, the CNS scores in both groups were significantly increased (7.96 ± 0.81 vs $5.06\pm 0.56/7.01\pm 0.69$ vs 5.05 ± 0.65), and the mRS scores were significantly decreased (2.03 ± 0.42 vs $4.07\pm 0.65/2.85\pm 0.39$ vs 3.98 ± 0.55) ($t=16.213/11.353, 32.285/9.281, P<0.05$), and the CNS score of the study group (7.96 ± 0.81 vs 7.01 ± 0.69) was higher than that of the control group, and the mRS score (2.03 ± 0.42 vs 2.85 ± 0.39) were lower than the control group ($t=10.935, 17.522, P<0.05$). Compared with before treatment ($2.21\pm 0.31/2.22\pm 0.34, 16.35\pm 2.34/16.87\pm 2.26, 2718.50\pm 703.58/2798.08\pm 729.76$), the levels of s100B, RDW and TGF- β 1 in the two groups after treatment ($1.28\pm 0.27/1.73\pm 0.32, 12.58\pm 1.58/14.28\pm 1.55, 1664.76\pm 625.59/2304.26\pm 692.44$) were significantly decreased ($t=27.707/12.853, 16.313/11.575, 13.708/6.012, P<0.05$), and the study group s after treatment, RDW, TGF- β 1 ($1.28\pm 0.27, 12.58\pm 1.58, 1664.76\pm 625.59$) were lower than those in the control group ($1.73\pm 0.32, 14.28\pm 1.55, 2304.26\pm 692.44$) ($t=13.163, 9.407, 8.393, P<0.05$). The incidences of postoperative DICH and total complications in the study group were lower than those in the control group ($\chi^2=14.451, P<0.05$). Multivariate Logistic regression analysis showed that age, diabetes mellitus, hypertension, adjustment of shunt valve within 1 week after operation, and postoperative subdural effusion were all related factors for postoperative DICH in patients with communicating hydrocephalus ($P<0.05$). **Conclusion** Compared with VPS, the adjustable pressure shunt LPS has better effect in the treatment of communicating hydrocephalus, which can effectively improve the nerve damage of patients, reduce the levels of RDW, S100B, TGF- β 1, and reduce the incidence of postoperative complications. In addition, advanced age, diabetes, hypertension, adjustment of shunt valve within 1 week after operation, and postoperative subdural effusion are all related risk factors for postoperative DICH in patients with communicating hydrocephalus.

[Key words] Communicating hydrocephalus; Adjustable pressure shunt lumbar peritoneal shunt; Lateral ventricle peritoneal shunt; Red blood cell volume distribution width; S100B; Transforming growth factor- β 1; Prognosis

交通性脑积水指因脑脊液循环发生堵塞,从而导致脑脊液回流产生障碍,积聚于脑室与蛛网膜下腔发生的脑组织功能障碍^[1-2]。既往采用侧脑室腹腔分流术(ventriculoperitoneal shunt, VPS)作为临床主要治疗方式,但该术式再手术率与术后并发症发生率较高,不利于改善患者术后生活质量^[3-4]。可调压分流管腰大池腹腔分流术(lumboperitoneal shunt, LPS)通过利用脑室相通腰大池生理优势,避免脑组织内操作,有效减少颅内并发症发生概率,近年来LPS被广泛应用于临床^[5-6]。迟发性颅内出血(delayed intracerebral hemorrhage, DICH)是交通性脑积水患者腹腔分流术后相对少见并发症,但其严重时可对分流效果与患者生命安全产生严重影响,且现阶段DICH发病机制尚不明了,分析交通性脑积水患者腹腔分流术后DICH发生相关影响因素对临床防治具有重要作用^[7]。基于此,本研究旨在探讨

LPS和VPS对交通性脑积水患者疗效与血清红细胞分布宽度(RDW)、中枢神经特异性蛋白(S100B)、转化生长因子- β 1(TGF- β 1)的影响及DICH发生相关因素分析。

1 资料和方法

1.1 一般资料 选取2018-01—2021-11成都中医药大学附属资阳医院收治的交通性积水患者300例为研究对象进行前瞻性研究。纳入标准:(1)均经头颅MRI/CT检查确诊;(2)临床资料完整;(3)患者及家属均知情同意并签署承诺书者。排除标准:(1)入院前接受其他相关治疗;(2)合并脏器功能重要障碍者;(3)严重颅内高压;(4)脊柱手术禁忌证者;(5)原发性脑积水病史;(6)梗阻性脑积水;(7)既往神经系统疾病史。按随机数字表法将300例患者随机分为研究组与对照组各150例,其中研究组男88例,女62

例,年龄 28~70(52.15±9.28)岁;格拉斯哥昏迷评分(GCS)3~5 分 65 例,6~8 分 51 例,9~15 例 34 例;原发病:脑外伤 61 例,动脉瘤破裂蛛网膜下腔出血 37 例,颅内占位病变 16 例,其他 36 例;糖尿病 55 例,高血压 78 例,吸烟 24 例,喝酒 30 例。对照组男 81 例,女 69 例,年龄 27~71(52.66±9.41)岁;GCS 评分 3~5 分 62 例,6~8 分 55 例,9~15 例 33 例;原发病:脑外伤 58 例,动脉瘤破裂蛛网膜下腔出血 38 例,颅内占位病变 17 例,其他 37 例;糖尿病 55 例,高血压 79 例,吸烟 28 例,喝酒 30 例。2 组一般资料差异无统计学意义($P>0.05$),具有可比性。本研究取得伦理委员会审查审批同意。

1.2 方法 术前处理:颅脑 CT 检查、气管插管、维持电解质平衡,常规消毒,全身麻醉等。

对照组行 VPS 术治疗:患者持仰卧位并于左侧侧脑室枕角穿刺,流出脑脊液后将导丝退出(入侧脑室长度维持在 4.5 cm)。于耳后皮下固定分流关阀门,并连接分流管,经头颈胸皮下至肋弓下缘与同侧锁骨中线皮下交点,保留腹腔端 30 cm 游离,置入腹腔髂窝方向。

研究组行 LPS 术治疗:患者左侧卧、右下肢伸直、曲颈左下肢屈膝,纵向穿刺于 L3~L4 或 L4~L5 椎间隙(切口穿刺点 5 mm),针头斜面向上经专用穿刺点垂直刺入背部,有落空感后将针芯退出,顺穿刺针套管,再于椎管腰大池 4~5 cm 置入分流管,渗出脑脊液后退出穿刺针,建立皮下隧道 3 cm 切口于腰部穿刺点,在髂后上棘安置阀门于储液囊,切口为左下腹髂前上棘于肚脐连线中外约 1/3 位置,逐层分开皮肤,暴露腹膜,通条作切小口在皮下联连通髂棘于腰部位置,置入 20 cm 长度末端分流管于盆腔中,将分流管与分流阀门连接结扎,将多余分流管固定并剪除,选用可调压分流阀门,逐层缝合切口。术后 2 组患者均常规抗感染治疗。

1.3 观察指标 (1)疗效:于术后 6 个月进行复查时评估疗效。治疗后临床症状明显改善,经头颅 MRI/CT 检查显示脑室系统明显缩小,且少量或无硬膜下积液视为优;治疗后临床症状有改善,脑室系统有缩小,且脑积水处存在脑组织腹胀视为良;治疗后临床症状与脑室系统无改善视为一般。(2)治疗前后各评分比较:采用加拿大神经病学量表(CNS)评估患者神经功能缺损情况,包括 9 项内容,总分 0~12 分,分数越高,神经功能越好;采用改良 Rankin 量表(mRS)评估患者日常生活能力,总分 0~6 分,分数越高,神经功能越差。分别于治疗前与治疗 6 个月进行评估。

(3)治疗前后指标比较:采集 5 mL 外周静脉血,应用全自动生化分析仪(山东博科生物产业有限公司, BK-280)检测红细胞分布宽度(red blood cell volume distribution width, RDW),ELISA 检测中枢神经特异性蛋白(S100B)水平,转化生长因子- $\beta 1$ (transforming growth factor- $\beta 1$, TGF- $\beta 1$)水平。试剂盒来自武汉艾迪抗生物科技有限公司。于术前与术后 1 周进行检测。(4)并发症:比较 2 组患者术后并发症发生情况,包括感染、癫痫、引流管外露、堵管、DICH 与总并发症发生率。(5)收集患者一般资料,包括年龄、性别、原发病、吸烟(吸烟定义为:每天抽烟 ≥ 1 支,连续吸烟时间 > 6 月)、饮酒、糖尿病、高血压、术后 2 周内调节分流管阀门、术后穿刺道水肿、术后硬膜下有积液。通过二元 Logistic 回归分析 DICH 发生影响因素。

1.4 统计学处理 通过 SPSS 22.0 对数据进行分析。计数资料以率(%)表示,行 χ^2 检验;正态分布的计量资料以均数 $\pm$ 标准差($\bar{x}\pm s$)表示,组间比较分别行独立样本 t 检验、组内比较配对样本 t 检验,采用重复测量方差分析不同时间的计量资料,采用 Logistic 回归分析影响因素。 $P<0.05$ 代表差异具有统计学意义。

2 结果

2.1 2 组疗效比较 2 组治疗疗效存在明显差异,研究组疗效较对照组更高($P<0.05$)。见表 1。

表 1 2 组疗效比较 [例(%)]

Table 1 Comparison of curative effects between the two groups [n(%)]

组别	<i>n</i>	优	良	一般	优良率
研究组	150	85(56.67)	55(36.67)	10(6.67)	140(93.33)
对照组	150	69(46)	56(37.33)	25(16.67)	125(83.33)
t/χ^2 值		3.416	0.014	7.278	7.278
<i>P</i> 值		0.065	0.905	0.007	0.007

2.2 2 组治疗前后各评分比较 治疗前,2 组 CNS 评分、mRS 评分比较无明显差异($P>0.05$)。治疗后,2 组较治疗前的 CNS 评分均显著升高,mRS 评分均显著降低($P<0.05$),且研究组 CNS 评分高于对照组,mRS 评分均低于对照组($P<0.05$)。见表 2。

2.3 2 组治疗前后 s100B、RDW、TGF- $\beta 1$ 比较 治疗前,2 组 s100B、RDW、TGF- $\beta 1$ 比较差异无统计学意义($P>0.05$),治疗后研究组 s100B、RDW、TGF- $\beta 1$ 均低于对照组($P<0.05$)。组内比较,与治疗前相比,2 组患者治疗后的 s100B、RDW、TGF- $\beta 1$ 水平均显著降低($P<0.05$)。见表 3。

表 2 2 组治疗前后各评分比较 (分, $\bar{x} \pm s$)Table 2 Comparison of scores before and after treatment in the two groups (score, $\bar{x} \pm s$)

组别	n	时点	CNS 评分	mRS 评分
研究组	150	治疗前	5.06±0.56	4.07±0.65
		治疗后	7.96±0.81	2.03±0.42
t 值			16.213	32.285
P 值			<0.001	<0.001
对照组	150	治疗前	5.05±0.65	3.98±0.55
		治疗后	7.01±0.69	2.85±0.39
t 值			11.353	9.281
P 值			<0.001	<0.001
t 值(2 组治疗前比较)			0.143	1.295
P 值(2 组治疗前比较)			0.887	0.196
t 值(2 组治疗后比较)			10.935	17.522
P 值(2 组治疗后比较)			<0.001	<0.001

表 3 2 组治疗前后 s100B、RDW、TGF-β1 比较 ($\bar{x} \pm s$)Table 3 Comparison of s100B, RDW and TGF-β1 between the two groups before and after treatment ($\bar{x} \pm s$)

指标	组别	n	治疗前	治疗后	F 值	P 值
s100B/(μg/L)	研究组	150	2.21±0.31	1.28±0.27	$F_{\text{时点}}=505.692$	$P_{\text{时点}}<0.001$
	对照组	150	2.22±0.34	1.73±0.32	$F_{\text{组间}}=3.742$	$P_{\text{组间}}=0.054$
	t 值		0.266	13.163	$F_{\text{交互}}=12.702$	$P_{\text{交互}}<0.001$
	P 值		0.790	<0.001		
RDW/%	研究组	150	16.35±2.34	12.58±1.58	$F_{\text{时点}}=226.347$	$P_{\text{时点}}<0.001$
	对照组	150	16.87±2.26	14.28±1.55	$F_{\text{组间}}=3.989$	$P_{\text{组间}}=0.047$
	t 值		1.958	9.407	$F_{\text{交互}}=0.477$	$P_{\text{交互}}=0.490$
	P 值		0.051	<0.001		
TGF-β1/(ng/L)	研究组	150	2718.50±703.58	1664.76±625.59	$F_{\text{时点}}=136.811$	$P_{\text{时点}}<0.001$
	对照组	150	2798.08±729.76	2304.26±692.44	$F_{\text{组间}}=3.053$	$P_{\text{组间}}=0.082$
	t 值		0.961	8.393	$F_{\text{交互}}=4.795$	$P_{\text{交互}}=0.029$
	P 值		0.337	<0.001		

表 4 2 组术后并发症比较 [例(%)]

Table 4 Comparison of postoperative complications between the two groups [n(%)]

组别	n	感染	癫痫	引流管外露	堵管	DICH	总并发症发生率
研究组	150	4(2.67)	5(3.33)	5(3.33)	3(2.00)	8(5.33)	25(16.67)
对照组	150	9(6.00)	12(8.00)	7(4.67)	8(5.33)	18(12.00)	54(36.00)
χ ² 值		2.01	3.055	0.347	2.359	4.211	14.451
P 值		0.156	0.08	0.556	0.125	0.040	<0.001

3 讨论

交通性脑积水是神经外科临床较常见疾病^[7-10], 临床治疗多采用腹腔分流术治疗^[11-12], 主要为 LPS 术和 VPS 术。本研究通过对 2 组术式进行对比显示, 研究组疗效较对照组更高, 提示可调压分流管 LPS 术治疗交通性脑积水较 VPS 术疗效更好, 其治疗效果更好原因分析为^[13-16]: (1) 可调压分流管 LPS 术通过

2.4 2 组术后并发症比较 研究组患者术后 DICH 与总并发症发生率均低于对照组 ($P<0.05$)。见表 4。

2.5 2 组单因素比较 2 组在性别、原发病、吸烟、饮酒、术后穿刺道水肿比较差异无统计学意义 ($P>0.05$), 但 2 组在年龄、糖尿病、高血压、术后 1 周内调节分流管阀门、术后硬膜下有积液比较差异有统计学意义 ($P<0.05$)。见表 5。

2.6 术后 DICH 发生多因素 Logistic 回归分析 以“是否发生 DICH”为因变量, “年龄、糖尿病、高血压、术后 2 周内调节分流管阀门、术后硬膜下有积液”为自变量 (赋值见表 6), 进行多因素 Logistic 回归分析显示, 年龄、高血压、糖尿病、术后 1 周内调节分流管阀门、术后硬膜下有积液均为术后 DICH 发生的危险因素 ($P<0.05$)。见表 7。

应用组合阀将脑室内压力有效控制, 维持在正常范围。(2) 可调压设计方便有效调节阀性能与压力, 保证引流安全。(3) 交通性脑积水治疗时过低分流管压力会导致发生分流过度, 过高的分流管压力会无法缓解症状, 可调压分流管 LPS 术可根据实际情况进行分流管压力调整。且本研究显示治疗后, 2 组较治疗前的 CNS 评分均显著升高, mRS 评分均显著降低,

表5 DICH组与非DICH组单因素比较
Table 5 Univariate comparison between DICH group and non-DICH group

相关因素	分类	DICH组 (n=26)	非DICH组 (n=274)	t/ χ^2 值	P值
年龄/岁		65.38±6.2	50.11±5.81	9.929	<0.001
性别	男	19(73.08)	150(54.74)	3.244	0.072
	女	7(26.92)	124(45.26)		
原发病	脑外伤	11(42.31)	108(39.42)	1.305	0.253
	动脉瘤破裂蛛网膜下腔出血	9(34.62)	66(24.09)		
	颅内占位病变	2(7.69)	31(11.31)		
	其他	4(15.38)	69(25.18)		
糖尿病	是	20(76.92)	90(32.85)	19.866	<0.001
	否	6(23.08)	184(67.15)		
高血压	是	21(80.77)	136(49.64)	9.228	0.002
	否	5(19.23)	138(50.36)		
吸烟	是	7(26.92)	45(16.42)	1.827	0.176
	否	19(73.08)	229(83.58)		
喝酒	是	5(19.23)	55(20.07)	0.011	0.918
	否	21(80.77)	219(79.93)		
术后1周内调节分流管阀门	是	12(46.15)	50(18.25)	11.279	0.001
	否	14(53.85)	224(81.75)		
术后穿刺道水肿	是	10(38.46)	77(28.1)	1.238	0.266
	否	16(61.54)	197(71.9)		
术后硬膜下有积液	是	9(34.62)	39(14.23)	7.34	0.007
	否	17(65.38)	235(85.77)		

表6 交通性脑积水患者术后DICH发生多因素
Logistic回归分析赋值情况

Table 6 Multivariate Logistic regression analysis
assignment of postoperative DICH in patients
with communicating hydrocephalus

变量	变量名	赋值方法
DICH	Y	是=0, 否=1
年龄	X1	连续变量
糖尿病	X2	是=0, 否=1
高血压	X3	是=0, 否=1
术后1周内调节分流管阀门	X4	是=0, 否=1
术后硬膜下有积液	X5	是=0, 否=1

且研究组CNS评分高于对照组,mRS评分均低于对照组。提示可调压分流管LPS术治疗交通性脑积水较VPS术改善患者神经损伤效果更好,可有效提高日常生活能力。分析为:可调压分流管LPS术中通过调节阀门对患者脑内压力进行控制,使脑脊液分流效果提高,对脑脊液正常生理循环重建具有促进作用,进而使脑内血流微循环改善,脑神经缺血缺氧损伤改善,进而促进患者日常生活功能恢复^[17-18]。进一步证实可调压分流管LPS术治疗交通性脑积水疗效更好。同时本研究结果显示与治疗前相比,2组患者治疗后的s100B、RDW、TGF- β 1水平均显著降低,且治疗后研究组s100B、RDW、TGF- β 1均低于对照

表7 交通性脑积水患者术后DICH发生多因素Logistic回归分析

Table 7 Multivariate Logistic regression analysis of postoperative DICH in patients with communicating hydrocephalus

相关因素	B	S.E.	Wald	P值	Ex(B)	95% EXP(B) 之信赖区间	
						上限	下限
年龄	-0.377	0.059	40.92	<0.001	0.686	0.611	0.770
糖尿病	1.791	0.502	12.722	<0.001	5.995	2.241	16.038
高血压	1.535	0.549	7.825	0.005	4.642	1.583	13.610
术后1周内调节分流管阀门	1.356	0.470	8.331	0.004	3.879	1.545	9.737
术后硬膜下有积液	1.049	0.500	4.394	0.036	2.854	1.071	7.611

组。分析原因:s100B 是评估神经损伤相关因子^[19],如本文上述可调压分流管 LPS 术促进脑神经缺血缺氧损伤改善,则 s100B 释放减少。RDW 是红细胞大小参数反映指标,且既往研究表明,高水平 RDW 是急性脑卒中功能预后不良危险因素,与神经系统疾病预后相关^[20]。且高水平 RDW 代表外周血内未成熟网织红细胞数量增加,且因 RDW 变形性较差,促进血小板聚集,具有较好促栓作用,减少脑血流量,引发脑组织缺血缺氧损伤。另高水平 RDW 代表机体存在炎症状态,炎症状态达到一定水平时,损伤神经细胞,并对内皮细胞与血脑屏障产生破坏,引发神经细胞凋亡,损伤脑组织。而疏通脑脊液循环通路可避免红细胞分解,降低 RDW 水平,进一步证实可调压分流管 LPS 术改善脑内血流微循环效果更好^[21]。TGF- β 1 是细胞生长凋亡调节因子,可以调节炎症反应^[22],参与组织损伤修复,生理状态下少量表达或不表达,脑积水发生后,引发炎症反应,刺激合成分泌 TGF- β 1。TGF- β 1 可趋化炎症因子,加重脑部炎症损伤,且 TGF- β 1 可刺激细胞外基质表达,沉积于脑脊液循环通路,经金属基质蛋白酶途径对细胞外基质降解进行阻碍,加重脑积水病情^[23]。本文研究组 TGF- β 1 低于对照组,提示研究组患者病情缓解程度更好。另研究组患者术后 DICH 与总并发症发生率均低于对照组。分析原因:VPS 术对患者脑室穿刺存在因穿刺位置不当导致的分库管堵塞发生,甚至发生脑组织出血损伤,且 VPS 术操作时间较长,增加感染风险,且因脑室穿刺会损伤大脑皮质,增加癫痫发生的可能^[24]。可调压分流管 LPS 术无需颅内操作,避免不必要损伤,因而术后并发症较少。

交通脑积水脑室腹腔分流术后少见 DICH 发生,DICH 发生多数患者出血量较少,临床无明显症状,但出血量多的患者对分流效果、术后康复于身体健康产生严重影响,受临床神经外科重视。进一步采用多因素 Logistic 回归分析显示,年龄、糖尿病、高血压、术后 1 周内调节分流管阀门、术后硬膜下有积液均为交通性脑积水患者术后 DICH 发生的相关影响因素。分析原因^[7,25-42]:高龄患者多伴有慢性疾病,糖尿病、高血压易导致小动脉玻璃样变性,引发缺血性疾病与脑出血。术后 1 周内调节分流管阀门易导致脑组织发生塌陷,分流管靠近中线部位或位置较深部位更容易发生塌陷,分流管在脑组织移位过程中摩擦皮层血管、脉络丛,从而导致 DICH。而下调分流管阀门压力会时颅内压快速下降,形成硬膜下积液。因而术后需根据患者神经功能改善情况谨慎、缓速下调分流管阀

门压力。并定期复查头颅 CT,发现硬膜下积液需及时调整分流管阀门压力,预防 DICH 发生。

可调压分流管 LPS 术相比 VPS 术治疗交通性脑积水效果更好,可有效改善患者神经损伤情况,降低 RDW、S100B、TGF- β 1 水平,减少术后并发症发生率。且高龄、糖尿病、高血压、术后 1 周内调节分流管阀门、术后硬膜下有积液均为交通性脑积水患者术后 DICH 发生的相关危险因素,临床需针对上述患者加强预防。

4 参考文献

- [1] DUY P Q, KAHLE K T. Intraventricular CSF Turbulence in Pediatric Communicating Hydrocephalus[J]. Neurology, 2021, 97(5): 246-247. DOI: 10.1212/WNL.0000000000012237.
- [2] ZHANG J X, SHI X Y, TANG Z X, et al. Acute communicating hydrocephalus caused by extravasation of digital subtraction angiography contrast medium: a case report and literature review[J]. J Int Med Res, 2020, 48(8): 300060520945504. DOI: 10.1177/0300060520945504.
- [3] PILLAI S V. Techniques and Nuances in Ventriculoperitoneal Shunt Surgery [J]. Neurol India, 2021, 69S471-S475. DOI: 10.4103/0028-3886.332261.
- [4] KIM H K, LEE H S, HEO M H, et al. Ventriculoperitoneal Shunt for CNS Metastasis in Breast Cancer: Clinical Outcomes Based on Intrinsic Subtype [J]. Clin Breast Cancer, 2021, 21(4): e402-e414. DOI: 10.1016/j.clbc.2020.12.013.
- [5] SUN T, YOU C, MA L, et al. Comparison of ventriculoperitoneal shunt to lumboperitoneal shunt in the treatment of posthemorrhagic hydrocephalus: A prospective, monocentric, non-randomized controlled trial[J]. Medicine (Baltimore), 2020, 99(27): e20528. DOI: 10.1097/MD.00000000000020528.
- [6] WANG Z, WANG K, QIAN Z, et al. Lumboperitoneal and Ventriculoperitoneal Shunt Surgery for Posthemorrhagic Communicating Hydrocephalus: A Comparison[J]. World Neurosurg, 2019, 127: e638-e643. DOI: 10.1016/j.wneu.2019.03.235.
- [7] WANG X T, ZHANG L Y, LV H T, et al. Delayed intracerebral hemorrhage after ventriculo-peritoneal shunt procedure: two case reports and a review of literature [J]. Eur Rev Med Pharmacol Sci, 2021, 25(19): 6093-6100. DOI: 10.26355/eurrev_202110_26887.
- [8] USAMI K, ISHISAKA E, OGIWARA H. Endoscopic third ventriculostomy and cerebrospinal fluid shunting for pure communicating hydrocephalus in children[J]. Childs Nerv Syst, 2021, 37(9): 2813-2819. DOI: 10.1007/s00381-021-05242-4.
- [9] ROBLT P, MOLLIER O, OLLIVIER M, et al. Communicating chronic hydrocephalus: A review [J]. Rev Med Intern, 2021, 42(11): 781-788. DOI: 10.1016/j.revmed.2021.05.018.
- [10] ZHANG J X, SHI X Y, TANG Z X, et al. Acute communicating hydrocephalus caused by extravasation of digital subtraction angiography contrast medium: a case report and literature review [J]. J Int Med Res, 2020, 48(8): 300060520945504. DOI: 10.1177/0300060520945504.
- [11] YANAGAWA T, HARADA Y, YAMASHITA K, et al. Development of Valve Reversal After Lumboperitoneal Shunt Construction [J]. World Neurosurg, 2021, 154: e770-e773. DOI: 10.1016/j.wneu.2021.07.139.
- [12] GOTO Y, OKA H, HINO A. Lumboperitoneal Shunt Surgery Using Valve Implantation on the Paravertebral Spinal Muscle [J]. World Neurosurg, 2021, 146: e1092-e1096. DOI: 10.1016/j.

- wneu.2020.11.098.
- [13] SUN T, CUI W, YANG J, et al. Shunting outcomes in communicating hydrocephalus: protocol for a multicentre, open-label, randomised controlled trial [J]. *BMJ Open*, 2021, 11(8): e051127. DOI: 10.1136/bmjopen-2021-051127.
- [14] YANAGAWA T, HARADA Y, YAMASHITA K, et al. Development of Valve Reversal After Lumboperitoneal Shunt Construction [J]. *World Neurosurg*, 2021, 154: e770–e773. DOI: 10.1016/j.wneu.2021.07.139.
- [15] YOUN J, KOVACS G G, KONGKHAM P, et al. Corpus Callosum Hyperintensity in Normal Pressure Hydrocephalus After Ventriculoperitoneal Shunt [J]. *Neurology*, 2021, 96(23): 1096–1097. DOI: 10.1212/WNL.00000000000012041.
- [16] XIE D, CHEN H, GUO X, et al. Comparative study of lumboperitoneal shunt and ventriculoperitoneal shunt in the treatment of idiopathic normal pressure hydrocephalus [J]. *Am J Transl Res*, 2021, 13(10): 11917–11924.
- [17] GOTO Y, OKA H, NISHII S, et al. Lumboperitoneal shunt surgery via lateral abdominal laparotomy [J]. *J Neurosurg Spine*, 2019, 20: 1–6. DOI: 10.3171/2019.10.SPINE19957.
- [18] AZAD T D, ZHANG Y, VARSHNEYA K, et al. Lumboperitoneal and Ventriculoperitoneal Shunting for Idiopathic Intracranial Hypertension Demonstrate Comparable Failure and Complication Rates [J]. *Neurosurgery*, 2020, 86(2): 272–280. DOI: 10.1093/neuros/nyz080.
- [19] SU X, VASILKOVSKA T, FRÖHLICH N, et al. Characterization of cell type-specific S100B expression in the mouse olfactory bulb [J]. *Cell Calcium*, 2021, 94: 102334. DOI: 10.1016/j.ceca.2020.102334.
- [20] 张爱军, 鲁友明, 陈鑫, 等. RDW TGF- β 1 FIB 与创伤性脑损伤后脑积水患者术后神经功能缺损的关系及预测预后的 ROC 分析 [J]. *中国实用神经疾病杂志*, 2021, 24(13): 1117–1123. DOI: 10.12083/SYSJ.2021.14.028.
- [21] AKCAL M A, EKE I. Post-Operative Red Cell Distribution Width Increase May Predict Mortality in Patients Operated for Hip Fracture [J]. *Clin Lab*, 2021, 67(11). DOI: 10.7754/Clin. Lab.2021.210337.
- [22] LODYGA M, HINZ B. TGF- β 1 – A truly transforming growth factor in fibrosis and immunity [J]. *Semin Cell Dev Biol*, 2020, 101: 123–139. DOI: 10.1016/j.semcdb.2019.12.010.
- [23] HE Z, XUE H, LIU P, et al. miR-4286/TGF- β 1/Smad3-Negative Feedback Loop Ameliorated Vascular Endothelial Cell Damage by Attenuating Apoptosis and Inflammatory Response [J]. *J Cardiovasc Pharmacol*, 2020, 75(5): 446–454. DOI: 10.1097/FJC.0000000000000813.
- [24] GARCÍA-MARTÍN A, OTERO-RODRÍGUEZ A, MIRANDA-ZAMBRANO D, et al. Abdominal pseudocysts, an unusual complication of ventriculoperitoneal shunt systems: Literature systematic review [J]. *Neurocirugía (Astur: Engl Ed)*, 2021, 32(2): 69–77. DOI: 10.1016/j.neucir.2020.03.005.
- [25] YANG W S, SHEN Y Q, ZHANG X D, et al. Hydrocephalus Growth: Definition, Prevalence, Association with Poor Outcome in Acute Intracerebral Hemorrhage [J]. *Neurocrit Care*, 2021, 35(1): 62–71. DOI: 10.1007/s12028-020-01140-w.
- [26] 刘强, 钟启胜, 李博. 终板造瘘和腰大池外引流治疗后交通动脉瘤破裂出血的效果 [J]. *中国实用神经疾病杂志*, 2022, 25(1): 53–57. DOI: 10.12083/SYSJ.211754.
- [27] CAO Y, LIU C, LI G, et al. Metformin Alleviates Delayed Hydrocephalus after Intraventricular Hemorrhage by Inhibiting Inflammation and Fibrosis [J]. *Transl Stroke Res*, 2022 Jul 19. DOI: 10.1007/s12975-022-01026-3.
- [28] BARRIT S, EL HADWE S, LUBICZ B, et al. External hydrocephalus associated with dural sigmoid sinus arteriovenous fistula: a case report [J]. *Br J Neurosurg*, 2022: 1–3. DOI: 10.1080/02688697.2022.2101616.
- [29] VITIELLO L, SALERNO G, DE BERNARDO M, et al. Ultrasound Detection of Intracranial Hypertension in Brain Injuries [J]. *Front Med (Lausanne)*, 2022, 9: 870808. DOI: 10.3389/fmed.2022.870808.
- [30] DAWES W. Secondary Brain Injury Following Neonatal Intraventricular Hemorrhage: The Role of the Ciliated Ependyma [J]. *Front Pediatr*, 2022, 10: 887606. DOI: 10.3389/fped. 2022.887606.
- [31] LI M, FU H, LI J, et al. Compound variants of FKTN, POMGNT1, and LAMB1 gene identified by prenatal whole-exome sequencing in three fetuses with congenital hydrocephalus [J]. *J Obstet Gynaecol Res*, 2022 Jul 17. DOI: 10.1111/jog.15358.
- [32] LIDÉN S, FARAHMAND D, LAURELL K. Ventricular volume in relation to lumbar CSF levels of amyloid- β 1-42, tau and phosphorylated tau in iNPH, is there a dilution effect? [J]. *Fluids Barriers CNS*, 2022, 19(1): 59. DOI: 10.1186/s12987-022-00353-9.
- [33] SUN Z, DONG S, FU L, et al. Factors affecting development of infection after implantation of ventriculoperitoneal shunts in patients with post-traumatic hydrocephalus [J]. *World Neurosurg*, 2022: S1878-8750 (22) 00960-3. DOI: 10.1016/j.wneu.2022.07.022.
- [34] WANG Z, XI B, YU B, et al. Prediction of adult post-hemorrhagic hydrocephalus: a risk score based on clinical data [J]. *Sci Rep*, 2022, 12(1): 12213. DOI: 10.1038/s41598-022-16577-6.
- [35] VIGLIOTTI V S, CONCEPCION T, MOHAMED M, et al. Modeling the Scale-up of Surgical Services for Children with Surgically Treatable Congenital Conditions in Somaliland [J]. *World J Surg*, 2022 Jul 15. DOI: 10.1007/s00268-022-06651-5.
- [36] HALLQVIST C, GRÖNSTEDT H, ARVIDSSON L. Gait, falls, cognitive function, and health-related quality of life after shunt-treated idiopathic normal pressure hydrocephalus—a single-center study [J]. *Acta Neurochir (Wien)*, 2022 Jul 13. DOI: 10.1007/s00701-022-05309-4.
- [37] MALIK N, SAMPLES D C, FINNERAN M M, et al. Pediatric pineal region masses: a single-center experience over 25 years [J]. *Childs Nerv Syst*, 2022 Jul 14. DOI: 10.1007/s00381-022-05593-6.
- [38] DVALISHVILI A, KHINIKADZE M, GEGIA G, et al. Neuroendoscopic lavage versus traditional surgical methods for the early management of posthemorrhagic hydrocephalus in neonates [J]. *Childs Nerv Syst*, 2022 Jul 13. DOI: 10.1007/s00381-022-05606-4.
- [39] FLECK S, DAMATY A E, LANGE I, et al. Pineal cysts without hydrocephalus: microsurgical resection via an infratentorial-supracerebellar approach—surgical strategies, complications, and their avoidance [J]. *Neurosurg Rev*, 2022 Jul 12. DOI: 10.1007/s10143-022-01831-2.
- [40] TOMITA T, ALDEN TD, DIPATRI A J. Pediatric pineal region tumors: institutional experience of surgical managements with posterior interhemispheric transtentorial approach [J]. *Childs Nerv Syst*, 2022 Jul 11. DOI: 10.1007/s00381-022-05595-4.
- [41] MOCHIZUKI Y, KODAIRA M, KONDO Y, et al. Delayed Detection of Hydrocephalus following Mildly Traumatic Subarachnoid Hemorrhage in Corticobasal Degeneration: A Case Report [J]. *Case Rep Neurol*, 2022, 14(2): 268–273. DOI: 10.1159/000524794.
- [42] AKIRA M, YUICHI T, TOMOTAKA U, et al. The Outcome of Neurorehabilitation Efficacy and Management of Traumatic Brain Injury [J]. *Front Hum Neurosci*, 2022, 16: 870190. DOI: 10.3389/fnhum.2022.870190.