

doi: 10.13241/j.cnki.pmb.2020.20.011

神经外科手术中大量输血患者红细胞压积及凝血状态研究*

刘敏¹ 石继红² 胡晓龙^{2Δ} 党娥¹ 魏贤¹

(空军军医大学第一附属医院西京医院 1 输血科; 2 烧伤与皮肤外科 陕西 西安 710032)

摘要 目的:探讨神经外科手术中大量输血患者采用不同输血方法对红细胞压积及凝血状态的影响。方法:选择 2017 年 2 月至 2019 年 12 月在本院进行手术的神经外科患者 104 例,根据随机数字表法把患者分为观察组与对照组各 52 例。观察组给予自体输血治疗,对照组给予异体输血治疗,记录和比较患者红细胞压积及凝血状态变化情况。结果:所有患者都完成手术,两组的手术时间、术中输血量与补液量对比差异无统计学意义($P>0.05$)。两组术后 1 d 的红细胞压积低于术前 1 d($P<0.05$),组间手术前后对比差异都无统计学意义($P>0.05$)。两组术后 1 d 的凝血酶原时间 (prothombin time, PT) 与活化部分凝血活酶时间 (activated partial thromboplastin time, APTT) 值高于术前 1 d($P<0.05$),组间手术前后对比差异都无统计学意义($P>0.05$)。观察组输血后 7 d 的感染发生率为 1.9%,显著低于对照组的 15.4%($P<0.05$)。结论:神经外科手术中大量输血中采用自体输血并不会影响患者的红细胞压积与凝血状态,不会增加输血难度与输血量,但能有效减少感染等不良反应。

关键词: 神经外科; 自体输血; 异体输血; 红细胞压积; 凝血功能; 感染

中图分类号: R457.1 **文献标识码:** A **文章编号:** 1673-6273(2020)20-3853-04

A Study on the Hematocrit and Coagulation Status of Patients with Massive Blood Transfusion in Neurosurgery*

LIU Min¹, SHI Ji-hong², HU Xiao-long^{2Δ}, DANG E¹, WEI Xian¹

(1 Department of Transfusion; 2 Burns and Dermatology, The First Affiliated Hospital of Air Force Military Medical University, Xi'an, Shaanxi, 710032, China)

ABSTRACT Objective: To investigate the effects of different blood transfusion methods on the hematocrit and coagulation status of patients undergoing in a large number of blood transfusion during neurosurgery. **Methods:** From February 2017 to December 2019, 104 cases of patients treated by neurosurgery in our hospital were selected and divided into the observation group and control group, according to the random number table method, with 52 cases in each group. The observation group was given autologous blood transfusion therapy, and the control group was given allogeneic blood transfusion therapy. The changes in hematocrit and coagulation status of the patients were compared. **Results:** All patients completed the operation. There was no significant difference in the operation time, intraoperative blood transfusion volume and fluid replacement volume between the two groups ($P>0.05$). The hematocrit at 1 day after operation in both groups were lower than that at 1 day before operation ($P<0.05$), and there was no significant difference between the two groups before and after operation ($P>0.05$). The PT and APTT values at 1d after operation in two groups were higher than those at 1d before operation ($P<0.05$), and there was no significant difference compared between the two groups before and after operation ($P>0.05$). The incidence rates of infection in the observation group at 7 days after blood transfusion was 1.9%, which was significantly lower than that in the control group (15.4%, $P<0.05$). **Conclusion:** Autologous massive transfusion in neurosurgery shows little affect on the hematocrit and coagulation status of patients, it also does not increase the difficulty and volume of blood transfusion, but it can effectively reduce the occurrence of adverse reactions such as infection.

Key words: Neurosurgery; Autologous blood transfusion; Allogeneic blood transfusion; Hematocrit; Coagulation function; Infection

Chinese Library Classification(CLC): R457.1 **Document code:** A

Article ID: 1673-6273(2020)20-3853-04

前言

神经外科术中出血量较大,输血是保障手术顺利进行的重

要措施。但输血可以引起多种不良反应,为此当前多于如何输血引起的广泛关注^[1,2]。传统上多采用异体输血进行处理,但是有时很难完全满足临床外科手术用血的需求,且有可能使肿瘤

* 基金项目:国家自然科学基金项目(81571914)

作者简介:刘敏(1983-),女,大专,初级技师,研究方向:输血检验,电话:19991937863, E-mail: lmlumin163126@163.com

Δ 通讯作者:胡晓龙(1976-),男,博士,副主任医师,研究方向:烧伤、创面愈合、瘢痕形成的分子机制及防治,

电话:18165292166, E-mail: huxl0416@fmmu.edu.cn

(收稿日期:2020-05-06 接受日期:2020-05-30)

患者免疫功能受到抑制可引发不良反应及传播传染病的风险,严重的可导致患者死亡^[3,4]。随着近年来技术和设备的不断改进,自体输血在临床的应用越来越广泛,主要是通过术前采集患者全血或血液成分,进行相应处理后用于患者输血^[5,6]。

自体输血可刺激骨髓造血功能,改善机体功能^[7]。而且自体输血都在短期内回输,血液新鲜,血液中有有效成分损失少,细胞活力好,输血效果更好^[8]。凝血是指使血液由流动状态变成不能流动的凝胶状态的过程,是机体的一项重要生理指标^[9]。有研究显示外科手术中随着出血量的增加,血小板及其他凝血成分丢失增多^[10,11]。而自体血血浆成分较少,主要成分为红细胞,参与机体凝血功能的主要物质大部分存在于血浆中,故而自体输血可能对凝血系统产生一定的不良影响^[12,13]。本研究主要探讨了神经外科手术中大量输血患者采用不同输血方法对红细胞压积及凝血状态的影响,现总结报道如下。

1 资料与方法

1.1 研究对象

选择 2017 年 2 月至 2019 年 12 月在本院进行手术的神经外科患者 104 例,纳入标准:ASA I - II 级;择期行神经外科手术;患者签署了知情同意书;肝肾功能正常,无血液性、内分泌及自身免疫性疾病;年龄 18~65 岁;出血量 ≥ 800 mL;本院伦理委员会批准了此次研究;年龄 20~70 岁;临床资料完整。排除标准:术前服用抗凝药物者;术前有严重凝血功能异常、肝肾功能不良者;脓毒血症、败血症者;血液受污染者。

根据随机数字表法把患者分为观察组与对照组,每组各 52 例。两组患者的 ASA 分级、出血量、体重指数、性别、年龄、手术类型等对比差异均无统计学意义($P>0.05$),具有可比性,见表 1。

表 1 两组一般资料的对比

Table 1 Comparison of the general information between two groups

Groups	n	ASA classification (I / II)	BMI (kg/m ²)	Gender (Male/Female)	Average age (years)	Type of operation (brain tumor/ intracerebral hemorrhage/other)	Aamount of bleeding (mL)
Observation group	52	27/25	22.45 $\pm$ 1.42	28/24	35.14 $\pm$ 1.42	22/18/12	987.21 $\pm$ 23.88
Control group	52	26/26	22.56 $\pm$ 1.11	27/25	35.22 $\pm$ 1.11	24/16/12	989.76 $\pm$ 19.34

1.2 输血方法

观察组:给予自体输血治疗,手术切皮开始应用自体血液回收机(北京利韦新欣医疗器械公司 ZT-2000 型)通过负压将患者术野所有血液吸入贮血器内,同时进行抗凝。血液经多层过滤后进行离心,500 rpm 离心 10 min,去除细胞碎片、抗凝剂、游离的血红蛋白等,将浓缩红细胞置于储血袋内回输给患者。

对照组:给予异体输血治疗,合理选择库存血液样本,不回收获术野血。两组术中补液为乳酸钠林格液和羟乙基淀粉氯化钠注射液,根据术中生命体征调节输液速度。

1.3 观察指标

(1)两组的手术时间、术中输血量与补液量。(2)所有患者在术前 1 d 与术后 1 d 的静脉血,进行抗凝 30 min,1000 rpm 离

心 10 min,取上层血浆,采用全自动生化分析仪测定红细胞压积与 PT 和 APTT。(3)两组在输血后 7 d 发生的感染情况,包括肺部感染、切口感染、泌尿道感染等。

1.4 统计学分析

采用 SPSS18.00 统计软件进行分析,计量资料以均数 $\pm$ 标准差表示,组间对比采用 t 检验;计数数据以百分比表示,组间对比采用卡方 χ^2 检验,以 $P<0.05$ 为差异有统计学意义。

2 结果

2.1 两组输血情况的对比

所有患者都完成手术,两组的手术时间、术中输血量与补液量对比差异无统计学意义($P>0.05$),见表 2。

表 2 两组输血情况的对比

Table 2 Comparison of the blood transfusion between the two groups

Groups	n	Operation time (min)	Intraoperative blood transfusion (mL)	Fluid volume(mL)
Observation group	52	3.65 $\pm$ 0.12	767.87 $\pm$ 45.19	2000.61 $\pm$ 500.44
Control group	52	3.67 $\pm$ 0.15	769.00 $\pm$ 35.72	2009.43 $\pm$ 410.86

2.2 两组术前和术后红细胞压积变化的对比

两组术后 1 d 的红细胞压积显著低于术前 1 d($P<0.05$),组间手术前后对比差异都无统计学意义($P>0.05$),见表 3。

2.3 两组术前和术后凝血功能变化的对比

两组术后 1 d 的 PT 与 APTT 值高于术前 1 d ($P<0.05$),组间手术前后对比差异都无统计学意义($P>0.05$),见表 4。

2.4 两组输血后感染发生情况的对比

观察组输血后 7 d 的感染发生率为 1.9 %,显著低于对照

组(15.4 %, $P<0.05$),见表 5。

3 讨论

神经外科手术患者由于创伤大、出血多,需要输注大量血液制品,以维持循环和内环境稳定^[14,15]。异体输血是临患者床常用的输血方式,但随着血源的日趋紧张与肝炎、艾滋病等经血传播性疾病的发现,异体输血的安全性得到了广泛的质疑,特别是当前异体输血导致的感染等不良反应比较常见^[16]。

表 3 两组手术前后红细胞压积变化对比(例,%)

Table 3 Comparison of the changes in hematocrit before and after surgery between two groups (n,%)

Groups	n	Preoperative 1 d	Postoperative 1 d	t	P
Observation group	52	37.41± 1.44	30.76± 1.32	12.933	0.000
Control group	52	37.98± 1.24	30.66± 1.11	12.001	0.000

表 4 两组手术前后凝血功能变化的对比(s)

Table 4 Comparison of the changes of coagulation function between the two groups before and after surgery (s)

Groups	n	PT		t	P	APTT		t	P
		Preoperative 1 d	Postoperative 1 d			Preoperative 1 d	Postoperative 1 d		
Observation group	52	12.34± 1.11	15.28± 1.73	8.473	0.002	30.23± 2.14	34.20± 1.74	11.093	0.000
Control group	52	12.76± 1.09	15.33± 1.35	8.778	0.001	30.11± 1.77	33.76± 2.11	10.773	0.000

表 5 两组感染情况的对比(例,%)

Table 5 Comparison of the incidence of infection between the two groups (n,%)

Groups	n	Pulmonary infection	Infection of incisional wound	Urinary tract infection	Total
Observation group	52	0	1	0	1(1.9)*
Control group	52	3	3	2	8(15.4)

随着医学技术的发展,自体输血技术得到了广泛应用,包括术前预存式血液回输、术中回收式自体输血、稀释性血液回输等^[17]。其中,术中回收式自体输血尤其适用于神经外科术中大量出血的患者,能快速提供完全相容的同型血液,减缓解血源紧张,降低了异体输血常见的感染不良反应情况^[18]。本研究中,所有患者都完成手术,两组的手术时间、术中输血量与补液量对比差异无统计学意义;观察组输血后 7 d 的感染发生率为 1.9%,显著低于对照组的 15.4%,表明神经外科手术中采用自体输血并不增加手术难度,且能减少不良反应的发生^[19]。当前,也有研究显示在回输的自体血中,红细胞压积高、携氧能力好,避免了异体输血可能引起的酸中毒等不良反应,也保证了重要器官组织氧合。且自体血中可能含有少量的炎性细胞因子,自体血本身可能具有免疫刺激作用,从而达到减轻免疫抑制或增强免疫功能的效果^[20,21]。因此,对于出血量大的患者,术中尽可能收集术野出血、体腔积血并回输给患者对改善患者预后具有重要价值^[22]。

凝血实质就是血浆中的可溶性纤维蛋白原转变不溶性的纤维蛋白的过程,可分为凝血酶原酶复合物的形成、凝血酶原的激活和纤维蛋白生成等步骤^[23]。凝血本身受多种因素的影响,关于自体血与异体血红细胞表面的凝血状态还有待深入分析。术中自体血回输能够迅速提高大出血患者的救治成功率,也完全避免异体输血相关不良反应^[24]。但也有研究表明在自体血回收过程中,为防止血液凝固需要加用肝素抗凝^[25]。本研究显示两组术后 1 d 的 PT 与 APTT 值高于术前 1 d,手术前后组间对比差异都无统计学意义,表明自体输血并不会影响输血患者的凝血功能。也有研究显示回输自体血后可伴随出现血小板数量的减少,且与输血量有显著相关性,但是血小板功能无明显改变。同时,回输血量 <800 mL 对机体凝血功能无明显影响,且能部分改善凝血块的形成过程^[26,27]。

在神经外科手术中,手术输血的目的是保证机体组织充足氧供,补偿丢失的血容量、血细胞,促进患者的康复^[28]。红细胞压积的变化也与凝血改变相关,红细胞压积降低伴随和 / 或不伴随血小板降低都可以减少血小板聚集形成^[29]。还有研究显示红细胞压积的减少了凝血酶产生的总量,延缓了凝血酶的形成^[30]。本研究显示两组术后 1 d 的红细胞压积低于术前 1 d,手术前后组间对比差异都无统计学意义,表明自体输血并不会影响输血患者的红细胞压积状态。也有研究显示在大外科手术中应用自体血液回输技术能及时回收失血,对红细胞功能及血液流变学无明显不良影响,能维持有效循环,有效保护组织代谢^[31]。

总之,神经外科手术中大量输血中采用自体输血并不会影响患者的红细胞压积与凝血状态,不会增加输血难度与输血量,且能有效减少感染等不良反应的发生。本研究也存在一定的不足,如自体输血对于患者的要求比较高,需要多个科室的配合,同时本研究样本数量较少,将在后续研究中深入探讨。

参考文献 (References)

- [1] Bernabei F, Roda M, Buzzi M, et al. Blood-Based Treatments for Severe Dry Eye Disease: The Need of a Consensus[J]. J Clin Med, 2019, 8(9): 99-103
- [2] Bezerra FMP, Nascimento VDD, Dumaresq DMH, et al. lncRNA MALAT1 Accelerates Wound Healing of Diabetic Mice Transfused with Modified Autologous Blood via the HIF-1 α Signaling Pathway [J]. Rev Bras Ortop (Sao Paulo), 2019, 17(13): 504-515
- [3] Bitan ZC, Zhou A, McMahon DJ, et al. Donor Iron Deficiency Study (DIDS): protocol of a study to test whether iron deficiency in blood donors affects red blood cell recovery after transfusion [J]. Korean J Thorac Cardiovasc Surg, 2019, 17(4): 274-280
- [4] Bos-Mikich A, Ferreira MO, De Oliveira R, et al. Platelet-rich plasma or blood-derived products to improve endometrial receptivity? [J]. J

- Assist Reprod Genet, 2019, 36(4): 613-620
- [5] Chang Y, Li J, Wei LN, et al. Autologous platelet-rich plasma infusion improves clinical pregnancy rate in frozen embryo transfer cycles for women with thin endometrium[J]. *Medicine (Baltimore)*, 2019, 98(3): e14062
- [6] Coltoff A, Shreenivas A, Afshar S, et al. A single-institution experience of performing bloodless transplant in Jehovah's Witness patients [J]. *Hematol Oncol Stem Cell Ther*, 2019, 12(1): 44-49
- [7] Craig EK, Yazer MH, Waters JH. Red blood cell salvage analysis from clotted blood[J]. *Blood Transfus*, 2019, 17(2): 146-150
- [8] Crosby AD, Sistino JJ. Impact of Pre-bypass Autologous Blood Collection on Blood Transfusion Rates[J]. *J Extra Corpor Technol*, 2019, 51(3): 140-146
- [9] D'alessandro A, Reisz JA. Effects of aged stored autologous red blood cells on human plasma metabolome [J]. *Blood Adv*, 2019, 3 (6): 884-896
- [10] Dekker NM, Veerhoek D, Koning NJ, et al. Postoperative microcirculatory perfusion and endothelial glycocalyx shedding following cardiac surgery with cardiopulmonary bypass [J]. *Anaesthesia*, 2019, 74 (5): 609-618
- [11] Iwata S, Hirasaki Y, Nomura M, et al. Thromboelastometric evaluation of coagulation profiles of cold-stored autologous whole blood: A prospective observational study [J]. *Medicine (Baltimore)*, 2019, 98 (39): e17357
- [12] Karafin MS, Francis RO. Impact of G6PD status on red cell storage and transfusion outcomes[J]. *Blood Transfus*, 2019, 17(4): 289-295
- [13] Lee S J, Wang H, Ahn SH, et al. Metabolomics Approach Based on Multivariate Techniques for Blood Transfusion Reactions[J]. *Sci Rep*, 2019, 9(1): e1740
- [14] Lim MH, Je HG. Effects of Preoperative Autologous Blood Donation in Patients Undergoing Minimally Invasive Cardiac Surgery[J]. *Korean J Thorac Cardiovasc Surg*, 2019, 52(6): 385-391
- [15] Matsuzawa R, Murata H, Sato M, et al. Autologous Transfusion of Blood Aspirated during Suction Decompression in Clipping of Large or Giant Cerebral Aneurysm [J]. *Sports Med Open*, 2019, 59 (9): 351-356
- [16] Miao Y, Guo W, An L, et al. Postoperative shed autologous blood re-infusion does not decrease the need for allogeneic blood transfusion in unilateral and bilateral total knee arthroplasty[J]. *PLoS One*, 2019, 14(7): e0219406
- [17] Munteanu SE, Menz HB, Bonanno DR, et al. Effectiveness of standardized ultrasound guided percutaneous treatment of lateral epicondylitis with application of autologous blood, dextrose or perforation only on pain: a study protocol for a multi-center, blinded, randomized controlled trial with a 1 year follow up [J]. *BMC Musculoskelet Disord*, 2019, 20(1): e351
- [18] Nunes NG, Oliveira JA. Is Intraoperative Blood Cell Salvage Effective in Hip Surgery?[J]. *Rev Bras Ortop (Sao Paulo)*, 2019, 54(4): 377-381
- [19] Perez A, Bakhtary S, Nedelcu E, et al. Overtransfusion of Autologous Blood Identifies Opportunities for Improving Patient Blood Management[J]. *Blood Adv*, 2019, 11(3): e4202
- [20] Peters AL, Straat M, Vlaar AP, et al. CAR-T Cell Therapy in Diffuse Large B Cell Lymphoma: Hype and Hope[J]. *Transfusion*, 2019, 3(2): e185
- [21] Pinto MA, Chedid MF, Sekine L, et al. Intraoperative cell salvage with autologous transfusion in liver transplantation [J]. *World J Gastrointest Surg*, 2019, 11(1): 11-18
- [22] Ross D, Erkokcak O, Rasouli MR, et al. Operative Time Directly Correlates with Blood Loss and Need for Blood Transfusion in Total Joint Arthroplasty[J]. *Arch Bone Jt Surg*, 2019, 7(3): 229-234
- [23] Solheim SA, Bejder J. Autologous Blood Transfusion Enhances Exercise Performance-Strength of the Evidence and Physiological Mechanisms[J]. *Sports Med Open*, 2019, 5(1): e30
- [24] Song K, Pan P, Yao Y, et al. The incidence and risk factors for allogeneic blood transfusion in total knee and hip arthroplasty[J]. *J Orthop Surg Res*, 2019, 14(1): e273
- [25] Suzuki R, Mikamo A, Matsuno Y, et al. Effect of Autotransfusion Using Intraoperative Predonated Autologous Blood on Coagulopathy during Thoracic Aortic Surgery: A Randomized Controlled Trial[J]. *J Orthop Surg Res*, 2019, 25(6): 311-317
- [26] Thomson J, Hofmann A, Barrett CA, et al. Patient blood management: A solution for South Africa [J]. *S Afr Med J*, 2019, 109 (7): 471-476
- [27] Van Der Merwe M, Lightfoot N J, Munro J T, et al. Intraoperative cell salvage use reduces the rate of perioperative allogeneic blood transfusion in patients undergoing periacetabular osteotomy [J]. *J Hip Preserv Surg*, 2019, 6(3): 277-283
- [28] Van Hezel ME, Boshuizen M. Red blood cell transfusion results in adhesion of neutrophils in human endotoxemia and in critically ill patients with sepsis[J]. *Transfusion*, 2020, 60(2): 294-302
- [29] Wang D, Zhou G, Mao ST, et al. Allogeneic blood transfusion in 163 children with acute lymphocytic leukemia (a STROBE-compliant article)[J]. *Medicine (Baltimore)*, 2019, 98(7): e14518
- [30] Whittaker GA. Corticosteroid injection for plantar heel pain: a systematic review and meta-analysis[J]. *J Clin Med*, 2019, 20(1): e378
- [31] Wu WW, Zhang WY, Zhang WH, et al. Survival analysis of intraoperative blood salvage for patients with malignancy disease: A PRISMA-compliant systematic review and meta-analysis [J]. *Medicine (Baltimore)*, 2019, 98(27): e16040