

doi: 10.13241/j.cnki.pmb.2020.02.028

洗涤红细胞输注在早产儿贫血中的应用价值分析*

唐会珍 屈明利 王 钱 史小莺 张 凡

(西安交通大学附属西北妇女儿童医院输血科 陕西 西安 710061)

摘要 目的:分析洗涤红细胞输注在早产儿贫血中的应用价值。**方法:**选取2015年10月~2017年11月我院需要输血治疗的贫血早产儿107例,均具有《早产儿管理指南》中的输血指征。采用随机数字表法将患儿分为两组,对照组53例输注红细胞悬浮液,观察组54例输注洗涤红细胞。比较两组患儿输血情况、治疗前后血液流变学相关指标、亚硝基硫醇(RSNO)、超氧化物歧化酶(SOD)和苯二醛(MDA)水平的变化及并发症的发生情况。**结果:**两组患儿输血量、输血次数、输血后血细胞压积和输血后血红蛋白水平比较均无统计学差异($P>0.05$)。输血前,两组患儿全血高切黏度、全血低切黏度、血浆黏度、RSNO、SOD和MDA水平比较无统计学差异($P>0.05$);输血后,两组全血高切黏度、全血低切黏度及血浆黏度均较输血前显著下降,且观察组以上指标均显著低于对照组($P<0.05$);对照组患儿RSNO、SOD水平显著下降,MDA水平显著升高($P<0.05$),观察组患儿以上指标均无显著变化($P>0.05$)。观察组患儿呼吸暂停和院内感染的发生率显著低于对照组($P<0.05$),两组脑白质损伤及颅内出血的发生率比较均无统计学差异($P>0.05$)。**结论:**洗涤红细胞输注可显著改善贫血早产儿的血液流变学,降低应激反应及呼吸暂停和院内感染的发生率,且输血量、输血次数、输血后血细胞压积和输血后血红蛋白水平与输注红细胞悬浮液相当。

关键词:洗涤红细胞输注;早产儿;贫血;应用价值

中图分类号:R714.21;R457.1 文献标识码:A 文章编号:1673-6273(2020)02-338-04

Analysis of the Application Value of Washed Red Blood Cell Transfusion for the Anemia of Premature Infants*

TANG Hui-zhen, QU Ming-li, WANG Qian, SHI Xiao-ying, ZHANG Fan

(Department of blood transfusion,

Northwest women's and Children's Hospital affiliated to Xi'an Jiaotong University, Xi'an, Shaanxi, 710061, China)

ABSTRACT Objective: To analyze the application value of washed red blood cell transfusion for the premature infant anemia.

Methods: 107 cases of anaemic premature infants needing blood transfusion in our hospital were selected from October 2015 to November 2017. The children were divided into two groups by the random number table method. 53 cases in the control group were given erythrocyte suspension, and 54 cases in the observation group were given erythrocyte washing. The changes of blood rheology, nitrite mercaptanol (RSNO), superoxide dismutase (SOD) and phenylaldehyde (MDA) levels before and after blood transfusion, and the incidence of complications were compared between the two groups. **Results:** There was no statistically significant difference in the blood transfusion volume, times of blood transfusion, hematocrit after blood transfusion and hemoglobin level after blood transfusion between the two groups ($P>0.05$). Before transfusion, there was no statistically significant difference in the whole blood high tangential viscosity, whole blood low tangential viscosity, plasma viscosity, RSNO, SOD and MDA levels between the two groups ($P>0.05$). After blood transfusion, the whole blood high tangential viscosity, whole blood low tangential viscosity and plasma viscosity of both groups were significantly lower than those before blood transfusion, and the above indicators in the observation group were significantly lower than those in the control group ($P<0.05$). The levels of RSNO and SOD in the control group were significantly decreased, while the levels of MDA were significantly increased ($P<0.05$), the above indicators showed no significant difference in the observation group ($P>0.05$). The incidence of apnea and nosocomial infection in the observation group was significantly lower than that in the control group ($P<0.05$), and there was no statistical difference in the incidence of white matter injury and intracranial hemorrhage between the two groups ($P>0.05$). **Conclusion:** Washing red blood cell infusion can significantly improve the hemorheology of premature infants with anemia, reduce the incidence of stress reaction, apnea and nosocomial infection, and the blood transfusion volume, times, hematocrit after blood transfusion and the hemoglobin level after blood transfusion are equivalent to that of the transfusion of red blood cell suspension.

Key words: Washed red blood cell transfusion; Premature infants; Anemia; Application value

Chinese Library Classification(CLC): R714.21; R457.1 **Document code:** A

Article ID: 1673-6273(2020)02-338-04

* 基金项目:陕西省自然科学基金研究计划项目(2017JM7897)

作者简介:唐会珍(1986-),女,本科,主管技师,研究方向:临床输血,E-mail:tanghuiizhen25754@163.com

(收稿日期:2019-04-27 接受日期:2019-05-22)

前言

目前,随着我国围产医学的不断发展,早产儿的出生率和存活率显著升高^[1-2]。与足月儿相比,早产儿各器官功能发育不成熟,适应能够较弱,易发生各种并发症,其中贫血是早产儿常见的问题之一^[3-5]。有研究显示我国住院早产儿贫血的发生率约为38.1%,28~31周胎龄早产儿贫血发生率高达71.43%,严重影响患儿的生长发育、免疫系统、血流动力学指标及生存质量,甚至危及患儿的生命^[6]。目前,对于早产儿贫血的治疗主要包括输血、补充维生素和铁剂以及肌肉注射促红细胞生成素等,其中输血仍是临床常用的有效治疗手段^[7-9]。

早产儿是一个特殊的群体,对血液制品的要求比较复杂,成分输血具有不良反应少、节约血源、易于保存、血液成分浓度高等特点,提高了治疗效果的同时降低了疾病传播的风险,是输血现代化的标志,使得输血更加科学化^[10-12]。成分输血的种类包括红细胞悬浮液、洗涤红细胞、浓缩红细胞、机采血小板、新鲜冷冻血浆等,是用化学或物理的方法将全血分离制备成容量小、浓度高的血液成分,然后根据患者的需要进行输注^[13-15]。目前关于早产儿贫血不同成分输血的方式的效果比较研究较少。因此,本研究对比分析了洗涤红细胞和浓缩红细胞输注用于新生儿贫血的临床效果,以期临床早产儿贫血输血方法的选择提供更多的参考依据。

1 资料与方法

1.1 一般资料

选取2015年10月~2017年11月在我院需要输血治疗的贫血早产儿107例,均具有《早产儿管理指南》中的输血指征。纳入标准:①符合《实用新生儿学》中早产儿贫血的诊断标准;②胎龄29~36周;③患儿家属签署知情同意书。排除标准:①先天性心脏病;②急性失血、染色体异常;③有先天性缺陷需外科手术治疗者。采用随机数字表法将患儿分为两组,对照组53例,男25例,女28例;胎龄30~36周,平均30.58±2.01周;出生体重1100~2450g,平均1725.51±214.32g;年龄1~7d,平均

4.85±1.02d。观察组54例,男26例,女28例;胎龄29~35周,平均39.96±1.85周;出生体重1200~2510g,平均1786.37±220.16g;年龄2~7d,平均4.93±1.05d。两组患儿一般资料比较无统计学差异($P>0.05$),具有可比性。

1.2 治疗方法

两组患儿均给予心电监护,监测血氧饱和度,纠正水电解质平衡、酸中毒等常规治疗,同时进行呼吸道管理和血糖水平控制,一次配血后分次进行输注。对照组患儿输注红细胞悬浮液。观察组患儿输注洗涤红细胞。输注量均为10~15 mL/kg/次,2~4h左右完成输注,期间检测患儿的血压、血糖、心率、肤色等,调整输注量和输注速度。

1.3 观察指标

①比较两组患儿的输血情况,包括输血量、输血次数、输血后血细胞压积和输血后血红蛋白水平。②比较两组患儿输血前后的RSNO、SOD和MDA水平。分别于输血前和输血后6h采集两组患儿的静脉血1 mL,离心后分离上清液,采用硝酸盐还原酶法测定RSNO水平,硫代巴比妥酸法测定MDA水平,黄嘌呤氧化酶法测定SOD水平,试剂盒均由上海将来实业股份有限公司提供,所有检测均严格按照说明书进行操作。③比较两组患儿输血前后的血液流变学相关指标,分别于输血前和输血后6h两组患儿静脉血,采用全自动血液流变仪测定两组患儿的全血高切黏度、全血低切黏度及血浆黏度。④比较两组患儿并发症的发生情况。

1.4 统计学方法

采用SPSS16.0进行数据分析,计数资料以率(%)表示,组间比较行卡方检验,计量资料以($\bar{x}\pm s$)表示,组间比较行t检验,以 $P<0.05$ 为差异有统计学意义。

2 结果

2.1 两组患儿输血情况的比较

两组患儿输血量、输血次数、输血后血细胞压积和输血后血红蛋白水平比较无统计学差异($P>0.05$),见表1。

表1 两组患儿输血情况比较($\bar{x}\pm s$)
Table 1 Comparison of the blood transfusion between two groups($\bar{x}\pm s$)

Group	n	Blood transfusion volume(mL)	Number of blood transfusion	Hemoglobin (g/L)	PCV (%)
Control group	53	43.85±11.12	2.02±0.51	118.95±35.12	36.98±10.12
Observation group	54	44.21±12.57	2.12±0.67	120.31±37.52	37.12±10.57
t	-	-0.157	-0.868	-0.193	-0.070
P	-	0.876	0.386	0.847	0.944

2.2 两组患儿输血前后RSNO、SOD和MDA水平比较

输血前两组患儿RSNO、SOD和MDA水平比较无统计学差异($P>0.05$);输血后,对照组患儿RSNO、SOD水平显著下降,MDA水平显著升高($P<0.05$),观察组患儿以上指标均无显著变化($P>0.05$),见表2。

2.3 两组患儿输血前后血液流变学相关指标比较

输血前,两组患儿全血高切黏度、全血低切黏度及血浆黏

度比较均无统计学差异($P>0.05$);输血后,两组以上指标均较治疗前显著下降,且观察组以上指标均显著低于对照组($P<0.05$),见表3。

2.4 两组患儿的并发症发生情况比较

观察组患儿呼吸暂停和院内感染的发生率显著低于对照组($P<0.05$),两组脑白质损伤及颅内出血的发生率比较均无统计学差异($P>0.05$),见表4。

表 2 两组患儿输血前后 RSNO、SOD 和 MDA 水平的比较($\bar{x} \pm s$)Table 2 Comparison of the levels of RSNO、SOD and MDA between two groups before and after blood transfusion($\bar{x} \pm s$)

Indicator	Control group(n=53)		Observation group(n=54)	
	Before blood transfusion	After blood transfusion	Before blood transfusion	After blood transfusion
RSNO(nmol/mL)	31.25± 8.13	21.03± 5.34*	30.58± 8.87	28.57± 7.12
SOD(U/mL)	28.33± 6.98	19.33± 5.22*	28.94± 7.01	27.12± 6.87
MDA(nmol/mL)	34.89± 5.33	46.32± 10.02*	35.12± 5.76	36.57± 6.11

注:与输血前相比,* $P < 0.05$ 。

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

表 3 两组患儿输血前后血液流变学相关指标的比较($\bar{x} \pm s$)Table 3 Comparison of indicators related to hemorheology between two groups before and after blood transfusion($\bar{x} \pm s$)

Indicator	Control group(n=53)		Observation group(n=54)	
	Before blood transfusion	After blood transfusion	Before blood transfusion	After blood transfusion
High cutting viscosity	6.32± 1.95	5.03± 1.56*	6.21± 1.78	4.12± 1.03**
Low cutting viscosity	12.31± 3.85	9.85± 2.56*	11.89± 3.24	7.51± 2.11**
plasma viscosity	2.33± 0.65	1.63± 0.43*	2.41± 0.71	1.11± 0.31**

注:与输血前相比,* $P < 0.05$;与对照组比较,** $P < 0.05$ 。

Note: Compared with before blood transfusion, * $P < 0.05$; Compared with control group, ** $P < 0.05$.

表 4 两组患儿的并发症发生情况的比较[例(%)]

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

Group	n	Apnea	White matter damage	Nosocomial infection	Intracranial hemorrhage
Control group	53	40(75.47)	2(3.77)	26(39.62)	13(24.53)
Observation group	54	30(55.56)	0(0.00)	14(48.15)	10(9.26)
χ^2	-	4.690	2.077	6.114	0.572
P	-	0.030	0.243	0.013	0.449

3 讨论

早产儿因医源性失血和促红细胞生成素不足而引发贫血,且相对于足月儿其贫血出现的更早且更严重^[16,17]。早产儿的红细胞寿命更短、生长较快血容量扩大引起血液稀释、促红细胞生成素不足、疾病原因及营养不足等,临床主要表现为呼吸暂停、体重不增、气促、喂养困难等,出生体重越低、胎龄越小,贫血出现的越早、越严重、持续时间越长,严重影响患儿的生长发育,影响病情的恢复,甚至危及生命^[18-20]。因此,及早进行预防和治疗是关键,成分输血是目前治疗该病最直接有效的手段^[21,22]。红细胞悬浮液是将采集到的全血去除大部分血浆,并加入红细胞添加剂制成^[23,24]。洗涤红细胞将全血采用物理方法去除血浆后经过 3~6 次生理盐水反复洗涤后制备成的一种成分血,可降低血浆蛋白、白细胞、大量的补体进入患儿体内,较少输血反应的发生率^[25,26]。

RSNO 是 NO 的主要储存载体,NO 对红细胞的变形性和氧携带能力具有重要作用^[27]。SOD 是清除自由基的主要催化酶,可促进机体的氧化和抗氧化平衡,保护细胞免受损伤^[28]。MDA 水平与机体内脂质过氧化程度呈显著的正相关,可反映细胞脂质过氧化的程度^[29]。有研究显示^[30]输血可引起机体强烈

的炎症反应,从而加重患者的器官损伤。本研究结果显示对照组患儿输血后 RSNO、SOD 水平显著下降,MDA 水平显著升高,而观察组无明显变化,说明红细胞悬浮液输注可加重贫血早产儿体内的应激反应,降低 NO 水平,而洗涤红细胞不增加患儿的应激反应,对患儿的损伤较小。观察组患儿全血高切黏度、全血低切黏度及血浆黏度的改善情况显著优于对照组,说明洗涤红细胞输注可显著纠正微循环障碍,改善患儿的组织细胞供氧。此外,两组患儿的输血量、输血次数、输血后血细胞压积和输血后血红蛋白水平比较无统计学差异,说明红细胞悬浮液输注和洗涤红细胞输注均能够显著改善患儿的贫血状态,纠正血细胞比容。在并发症方面,由于早产儿的免疫系统发育不成熟,输血后可能会产生血源性感染、代谢性酸中毒等并发症。本研究中,观察组的呼吸暂停和院内感染的发生率显著低于对照组,说明洗涤红细胞输注可显著降低并发症的发生,这可能与该方法降低血浆蛋白、白细胞大量的补体进入患儿体内有关。

综上所述,洗涤红细胞输注可显著改善贫血早产儿的血液流变学,降低应激反应及呼吸暂停和院内感染的发生率,且输血量、输血次数、输血后血细胞压积和输血后血红蛋白水平与输注红细胞悬浮液相当。

参 考 文 献(References)

- [1] Joshi S, Mulinge I, Kamat M. An Extremely Premature Neonate with Severe Anemia[J]. *Journal of Neonatal Surgery*, 2017, 6(2): 33
- [2] Özdemir Z, Törer B, Hanta D, et al. Determination of tissue hypoxia by physicochemical approach in premature anemia [J]. *Pediatrics & Neonatology*, 2017, 58(5): 425-429
- [3] Hasanbegovic E, Cengic N, Hasanbegovic S, et al. Evaluation and Treatment of Anemia in Premature Infants [J]. *Medical Archives*, 2016, 70(6):408-412
- [4] Colombatti R, Sainati L, Trevisanuto D. Anemia and transfusion in the neonate[J]. *Seminars in Fetal & Neonatal Medicine*, 2016, 21(1): 2-9
- [5] Bissinger R, Schumacher C, Qadri S M, et al. Enhanced eryptosis contributes to anemia in lung cancer patients [J]. *Oncotarget*, 2016, 7 (12): 14002-14014
- [6] Jiang P, Bian M, Ma W, et al. Eryptosis as an Underlying Mechanism in Systemic Lupus Erythematosus-Related Anemia [J]. *Cell Physiol Biochem*, 2016, 40(6): 1391-1400
- [7] Muzamil J, Shiekh A A, Bhat G M, et al. Thymoma masquerading as transfusion dependent anemia[J]. *Indian J Med Paediatr Oncol*, 2016, 37(4): 296-299
- [8] İnce C. Blood Transfusions Correct Anemia and Improve Tissue Oxygenation in Surgical and Critically ill Patients[J]. *Turkish Journal of Anaesthesiology & Reanimation*, 2017, 45(3): 119-121
- [9] López-Catzin JF, Bolado-García PB, Gamboa-López GJ, et al. Decreased transfusions in preterm infants with anemia treated with erythropoietin [J]. *Rev Med Inst Mex Seguro Soc*, 2016, 54 (5): 576-580
- [10] Kane L C, Woodward C S, Husain S A, et al. Thromboelastography--does it impact blood component transfusion in pediatric heart surgery [J]. *Journal of Surgical Research*, 2016, 200(1): 21-27
- [11] Sun G, Liu X, Liu Z, et al. A multicenter study of blood component transfusion in patients with liver cirrhosis in China: Patient characteristics, transfusion practice, and outcomes [J]. *Digestive & Liver Disease*, 2016, 48(12): 1478-1484
- [12] Mays J A, Hess J R. Modelling the effects of blood component storage lesions on the quality of haemostatic resuscitation in massive transfusion for trauma[J]. *Blood Transfus*, 2017, 15(2): 153-157
- [13] Dunbar N M, Olson N J, Szczepiorkowski Z M, et al. Blood component transfusion and wastage rates in the setting of massive transfusion in three regional trauma centers[J]. *Transfusion*, 2016, 57 (1):45-52
- [14] Han S, Kwon J H, Jung S H, et al. Perioperative Fresh Red Blood Cell Transfusion May Negatively Affect Recipient Survival After Liver Transplantation[J]. *Annals of Surgery*, 2016, 267(2): 346-351
- [15] Jones A. Safe transfusion of blood components[J]. *Nurs Stand*, 2018, 32(25): 50-63
- [16] Andrade E, Araujo E, Rolo L C, et al. Risk factors for cerebral palsy in premature infants identified during the pre and perinatal periods: a case-control study[J]. *Minerva Ginecol*, 2016, 68(1): 29-36
- [17] Chagas D F B A, Moreira L L, Lopes M M E, et al. Micronutrient supplementation adherence and influence on the prevalences of anemia and iron, zinc and vitamin A deficiencies in preemies with a corrected age of six months[J]. *Clinics*, 2016, 71(8): 440-448
- [18] Siwaponanan P, Fucharoen S, Sirankapracha P, et al. Elevated levels of miR-210 correlate with anemia in β -thalassemia/HbE patients[J]. *International Journal of Hematology*, 2016, 104(3): 338-343
- [19] Pinho-Pompeu M, Surita F G, Pastore D A, et al. Anemia in pregnant adolescents: impact of treatment on perinatal outcomes[J]. *Journal of Maternal-Fetal Medicine*, 2016, 30(10): 1158-1162
- [20] Lee M L, Yen H J, Chen S J, et al. Juvenile Myelomonocytic Leukemia in a Premature Neonate Mimicking Neonatal Sepsis [J]. *Pediatrics & Neonatology*, 2016, 57(2): 149-152
- [21] Peng T, Wang L M, Wu J X, et al. Effects of perioperative transfusion of blood components on the long-term prognosis of hepatocellular carcinoma[J]. *Zhonghua Yi Xue Za Zhi*, 2017, 97(14): 1079-1083
- [22] Feng S, Machina M, Beattie W S. Influence of anaemia and red blood cell transfusion on mortality in high cardiac risk patients undergoing major non-cardiac surgery: a retrospective cohort study [J]. *British Journal of Anaesthesia*, 2017, 118(6): 843-851
- [23] Li P, Zheng L, Zhang D, et al. Investigation of High Speed Erythrocyte Flow and Erythrocyte Wall Impact in a Lab on a Chip[J]. *Artificial Organs*, 2016, 40(11): E203-E218
- [24] Zemlianskykh N G, Babichuk L A. The changes in erythrocyte Ca^{2+} -ATPase activity induced by PEG-1500 and low temperatures[J]. *Cell & Tissue Biology*, 2017, 11(2): 104-110
- [25] Burlaka Y B, Sukhoveev O V, Grin N V, et al. EPR spectroscopy studies of changes in erythrocyte membranes in patients with laryngeal cancer[J]. *Experimental Oncology*, 2017, 39(1): 49-52
- [26] Akbudak I H, Kucukatay V, Kilic-Erkek O, et al. Investigation of the effects of major ozone autohemotherapy application on erythrocyte deformability and aggregation [J]. *Clinical Hemorheology & Microcirculation*, 2018, 13(6): 1362
- [27] Shao Q, Fallica J, Casin K M, et al. Characterization of the sex-dependent myocardial S-nitrosothiol proteome [J]. *Am J Physiol Heart Circ Physiol*, 2016, 310(4): H505-H515
- [28] Broxton C N, Culotta V C. SOD Enzymes and Microbial Pathogens: Surviving the Oxidative Storm of Infection [J]. *Plos Pathogens*, 2016, 12(1): e1005295
- [29] Zhou Y H, Yu J P, Liu Y F, et al. Effects of Ginkgo biloba Extract on Inflammatory Mediators (SOD, MDA, TNF- α , NF-KappaBp65, IL-6) in TNBS-Induced Colitis in Rats[J]. *Mediators of Inflammation*, 2017, 2006(5): 1-9
- [30] Ki K K, Faddy H M, Flower R L, et al. Packed Red Blood Cell Transfusion Modulates Myeloid Dendritic Cell Activation and Inflammatory Response In Vitro [J]. *Journal of Interferon & Cytokine Research*, 2018, 38(3): 111-121