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先天性心脏病患儿围术期输血与术后肺损伤的相关性研究 *

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摘要 目的:研究先天性心脏病患儿围术期输血与术后发生肺损伤的相关性。**方法:**选择我院诊治的 120 例先天性心脏病患儿,均在体外循环下进行手术矫治。根据患儿术后是否出现肺损伤分为无肺损伤组(n=97 例)与肺损伤组(n=23 例)。比较两组一般资料,比较不同围术期输血浆量及输血量患儿的术后肺损伤发病率;采用多因素 logistic 回归对术后肺损伤与围术期输血浆量、围术期输血量、最低红细胞压积(>30%)、体外循环时间(>80 min)、年龄(≤ 1 岁)以及最低温度之间的相关性进行分析。**结果:**无肺损伤组与肺损伤组患儿性别间无显著差异(*P>0.05*);肺损伤组患儿年龄、体质量均显著低于无肺损伤组患儿(*P<0.05*),而围术期输血浆量、围术期输血量、最低血红积压、体外循环时间均显著高于无肺损伤组患儿(*P<0.05*)。随着患儿围术期输血浆量及输血量的增加,患儿术后肺损伤的发病率越高(*P<0.05*);多因素 logistic 回归分析显示围术期输血浆量、围术期输血量、最低红细胞压积(>30%)、体外循环时间(>80 min)以及年龄(≤ 1 岁)是患儿发生术后肺损伤的独立危险因素(*P<0.05*)。**结论:**围术期输血浆量以及输血量与先天性心脏病患儿术后肺损伤的发生紧密相关,围术期输血浆量以及输血量越多,肺损伤的发生风险就越高,建议临床上开展多种节约用血措施。

关键词:先天性心脏病;围术期输血;术后肺损伤;相关性

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Correlation between of Perioperative Blood Transfusion and Postoperative Lung Injury in Children with Congenital Heart Disease*

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ABSTRACT Objective: To explore the correlation between perioperative blood transfusion and postoperative lung injury in children with congenital heart disease. **Methods:** 120 cases of congenital heart disease in our hospital were selected and undergone surgical correction under cardiopulmonary bypass. According to whether there was postoperative lung injury in children with no lung injury group (n=97 cases) and lung injury group (n=23 cases). The general information of two groups was compared. To observe the incidence of postoperative lung injury in children with different perioperative blood transfusion volume and transfusion volume. Multivariate logistic regression was used to evaluate the postoperative lung injury and perioperative blood transfusion volume, perioperative blood transfusion volume, minimum hematocrit (>30%), cardiopulmonary bypass time (>80 min), age (≤ 1 year old). The correlation between the lowest temperature was analyzed. **Results:** There was no significant difference in sex between children without lung injury and those with lung injury (*P>0.05*). The age and body weight of children with lung injury were significantly lower than those without lung injury (*P<0.05*) Blood transfusion volume, perioperative blood transfusion volume, minimum red blood pressure, and cardiopulmonary bypass time were significantly higher than those without lung injury (*P<0.05*). With the perioperative blood transfusion volume and blood transfusion increased, the incidence of postoperative lung injury in children was higher (*P<0.05*). Multivariate logistic regression analysis showed that perioperative blood transfusion volume, perioperative blood transfusion, minimum hematocrit (>30%), cardiopulmonary bypass time (>80 min) and age Indirect risk factors for lung injury (*P<0.05*). **Conclusions:** Perioperative blood transfusion volume and blood transfusion are closely related to the occurrence of postoperative lung injury in children with congenital heart disease. Perioperative blood transfusion and the amount of blood transfusion, the higher the risk of lung injury. Proposed to carry out a variety of clinical blood conservation measures.

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前言

先天性心脏病是临床上最为常见的一种先天性畸形，约占各种先天性畸形的 28 %，由于胚胎发育过程中心脏及大血管形成障碍或发育异常引起解剖结构异常，或出生后本应自动关闭的通道未能闭合的情形[1,2]。一般认为妊娠 5-8 w 是胎儿心脏发育最重要的时期，先天性心脏病发病原因很多，药物、感染病毒、环境污染、射线辐射等环境因素占 92%[3,4]。先天性心脏病患者常同时合并多种畸形，症状各有不同，按病理生理变化及血液动力学结构可分为发绀型或者非发绀型，按有无分流可分为无分流类、左至右分流类、右至左分流类[5,6]。

近年来，我国先天性心脏病的发生率逐年升高，大部分患者均需开展手术治疗，术后呼吸功能低下是婴幼儿先天性心脏病术后常见处理困难的问题 [7,8]。随着体外循环技术的不断发展，外科矫治手术治疗先天性心脏病的安全性逐渐升高，患儿的预后情况得到了显著的改善，但体外循环术后患儿常发生重度肺损伤，严重者甚至发生呼吸窘迫综合征[9,10]。目前临床上关于体外循环术后肺损伤的研究主要为动物和成人实验，对于婴幼儿只集中于复杂体外循环术的深低温停循环以及深低温低流量所引起的肺损伤方面。因此，本研究对先天性心脏病患儿围术期输血与术后肺损伤之间的相关性进行了探讨，现报道如下。

1 资料与方法

1.1 一般资料

选择 2012 年 3 月～2017 年 3 月在我院进行诊治的 120 例先天性心脏病患儿，所有患儿均在体外循环下进行手术矫治。根据患儿术后是否出现肺损伤分为无肺损伤组(n=97 例)以及肺损伤组(n=23 例)。所有患儿的家属均签署知情同意书，本研究已通过我院伦理委员会审批。

1.2 方法

按照两组患儿围术期输血浆量的差异，分为：>100 mL/kg、80~100 mL/kg、60~80 mL/kg、40~60 mL/kg、≤ 40 mL/kg，按照两组患儿围术期输血量的差异，分为：>150 mL/kg、120~150 mL/kg、90~120 mL/kg、60~90 mL/kg、≤ 60 mL/kg。观察不同围术期输血浆量以及输血量患儿的术后肺损伤发病率；采用多因素 logistic 回归对术后肺损伤与围术期输血浆量、围术期输血量、最低红细胞压积(>30%)、体外循环时间(>80 min)、年龄(≤ 1 岁)以及最低温度之间的相关性进行分析。

1.3 统计学分析

采用 SPSS 15.00 软件，所有资料采取正态分布检验。非正态分布资料用中位数(四分位数间距)表示，正态分布资料采用($\bar{x}\pm s$)表示。非正态分布计量资料用 Mann-Whiteey U 检验；正态分布计量资料用 t 检验；计数资料采用 x^2 检验。多组间比较采用方差分析，使用多因素 logistic 回归分析对术后肺损伤和各因素之间的相关性进行分析，以 *P<0.05* 表明差异有统计学意义。

2 结果

2.1 两组一般资料比较

无肺损伤组与肺损伤组患儿性别间无显著差异 (*P>0.05*)；肺损伤组患儿年龄、体质量均显著低于无肺损伤组患儿 (*P<0.05*)，而围术期输血浆量、围术期输血量、最低血红胞压积、体外循环时间均显著高于无肺损伤组患儿(*P<0.05*)，见表 1。

表 1 两组一般资料比较 (n, $\bar{x}\pm s$)

Table 1 Comparison of general information between two groups (n, $\bar{x}\pm s$)

Groups	Gender (male/female)	Age (months)	Body weight (kg)	perioperative plasma volume(ml)	perioperative blood transfusion (ml)	The lowest red blood cell backlog (%)	cardiopulmonary bypass time(min)
Non-lung injury group(n=97)	41/56	19.45± 11.37	9.58± 1.24	42.51± 5.74	55.72± 6.58	28.43± 3.79	55.35± 6.31
Lung injury group(n=23)	9/14	16.13± 0.75	6.78 ± 1.32	73.21± 6.54	105.28± 7.93	31.28± 3.94	80.35± 8.46
P	>0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

2.2 围术期输血浆量以及输血量与术后肺损伤的关系

随着先天性心脏病患儿围术期输血浆量以及输血量的增加，患儿术后肺损伤的发病率逐渐升高(*P<0.05*)，见表 2。

2.3 先天性心脏病围术期输血患儿发生术后肺损伤的影响因素分析

多因素 logistic 回归分析显示围术期输血浆量、围术期输血量、最低红细胞压积(>30%)、体外循环时间(>80 min)以及年龄(≤ 1 岁)是先天性心脏病围术期输血患儿发生术后肺损伤的独立危险因素(*P<0.05*)，见表 3。

3 讨论

婴幼儿先天性心脏病体外循环术后最为常见的危重急症为急性肺损伤[11,12]，临床上表现主要包括呼吸窘迫以及进行性低氧血症，影像学表现为肺部出现非均一性的渗出性病变，是造成先天性心脏病患儿体外循环术后死亡的常见因素[13-15]。体外循环术引发肺损伤的具体机制目前尚未完全阐明，有多数学者认为体外循环术引起的全身炎性反应综合征是造成体外循环术后肺损伤的主要原因。而引发全身炎性反应的因素包括缺

表 2 围术期输血浆量以及输血量与术后肺损伤发生率的关系

Table 2 The correlation of perioperative plasma volume, blood transfusion with the incidence of postoperative lung injury in Children with Congenital Heart Disease

Groups	n	Perioperative plasma volume (ml/kg)					Perioperative blood transfusion (ml/kg)				
		>100	80-100	60-80	40-60	≤ 40	>150	120-150	90-120	60-90	≤ 60
Non-lung injury group	97	7	9	12	30	39	6	8	11	28	44
Lung injury group	23	5	4	3	5	6	4	4	3	6	6
Morbidity		41.67	30.77	20.00	14.71	13.33	40.00	33.33	21.43	17.65	12.00
P				<0.05					<0.05		

表 3 先天性心脏病围术期输血患儿发生术后肺损伤的影响因素分析

Table 3 Analysis of the risk factors of the postoperative lung injury in Children with Congenital Heart Disease

	P	OR	95%CI
Perioperative plasma volume	0.037	1.02	1.002~1.019
Perioperative blood transfusion	0.031	1.03	1.004~1.025
Lowest hematocrit (>30%)	0.015	2.69	1.237~5.938
Extracorporeal circulation time (>80 min)	0.023	2.46	1.352~7.954
Age (≤ 1 year)	0.009	4.93	1.437~12.534
Minimum temperature	0.512	-	-

血 - 再灌注损伤、肺血流中断以及血液成分与体外循环术的人工管道相接触[16-18]。近年来，输血的风险受到临床上的广泛关注，当外源血液以及自身血液与异物进行接触后，均会导致全身免疫反应，从而对先天性心脏病患儿心脏手术的预后情况造成直接或间接的影响[19,20]。

合理的输血具有改善组织代谢，增加血液的携氧能力，增强凝血功能以及免疫功能的效果。Clifford L 等[21]研究发现输血会使患者术后的并发症发生率以及病死率升高。本研究结果发现，随着先天性心脏病患儿围术期输血浆量以及输血量的增加，患儿术后肺损伤的发病率逐渐升高，提示围术期输血浆量以及输血量与先天性心脏病患儿术后肺损伤的发生密切相关。围术期输血浆量以及输血量越多，肺损伤的发生风险越高。经多因素 logistic 回归分析结果显示围术期输血浆量、围术期输血量、最低红细胞压积(>30%)、体外循环时间(>80 min)以及年龄(≤ 1 岁)是患儿发生术后肺损伤的独立危险因素。分析其原因为婴幼儿的肺脏结构以及肺功能均未发育成熟，代偿功能相对较弱，极易出现肺损伤，患儿的年龄越小，术后肺损伤的发生率就越高，因而我们建议对于年龄较小的婴儿，必须尤其加强围术期的肺保护以及护理，以预防术后肺损伤的发生[22]。建立体外循环后肺动脉的血流遭受阻断，肺组织仅可依靠侧支循环以及支气管动脉进行灌注，因此体外循环建立的时间越长，患儿术后肺损伤的发病率就越高[23-25]。

输血导致肺损伤的具体发病机制目前尚未完全阐明，一般认为由于供血者血浆中有白细胞抗体，包括针对人类白细胞抗原 - Ⅰ、中性粒细胞特异性抗原(尤其是人类粒细胞抗原 -32)以及人类白细胞抗原 - Ⅱ的抗体是常见的原因[26,27]。供血者血液中的白细胞抗体会引发抗原 - 抗体反应使肺中的补体得以激活，造成中性粒细胞向肺组织发生聚集以及活化，并且释放出活性物质，最终引发肺组织损伤[28-30]。

综上所述，围术期输血浆量以及输血量与先天性心脏病患儿术后肺损伤的发生紧密相关；围术期输血浆量以及输血量越多，肺损伤的发生风险就越高。

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