Clin. Lab. 2024;70:XXX-XXX

ORIGINAL ARTICLE

Development of a Risk Assessment Model for Predicting Red Blood Cell Transfusion in Neonatal Patients

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SUMMARY

Background: **The goal was to develop a risk assessment model for predicting red blood cell (RBC) transfusion in neonatal patients to assist hospital blood supply departments in providing small portions of RBCs to those requiring RBC transfusion on time.**
Methods: **Clinical information was collected from 1,201 children admitted to the neonatal unit. Clinical factors associated with predicting RBC transfusion were screened, and prediction models were developed using stepwise and multifactorial logistic regression analyses, followed by the evaluation of prediction models using receiver operating characteristic curves, calibration curves, and decision curve analysis (DCA).**
Results: **Overall, 81 neonatal patients were transfused with RBCs, and the variables of gestational age at birth, age < 1 month, receipt of mechanical ventilation, and infant anemia were included in the final prediction model. The area under the curve of the prediction model was 0.936 (0.921 - 0.949), which was significantly higher than that of the individual indicators of gestational age at birth, age at admission < 1 month, receipt of mechanical ventilation, and infant anemia ($p < 0.001$). DCA showed a standardized net benefit for the possible risk of infant RBC transfusion at 0.1 - 1.0.**
Conclusions: **We developed a risk assessment model to predict the risk of RBC transfusion in neonatal patients that can effectively assess the risk of RBC transfusion in children.**
(Clin. Lab. 2024;70:xx-xx. DOI: 10.7754/Clin.Lab.2023.230933)

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Manuscript accepted November 13, 2023

Supplementary Data

Table S1. Statistical table of clinical information of mothers of patients between the transfusion and no transfusion groups.

	Total (n = 1,201)	No Transfusion (n = 1,120)	Transfusion (n = 81)	p-value
Age	29.00 (26.00 - 32.00）	29.00 (26.00 - 32.00)	30.00 (26.00 - 34.00)	0.067
Number of births	1.76 ± 0.80	1.74 ± 0.02	2.03 ± 0.11	0.003
Number of pregnancies	2.45 ± 1.44	2.44 ± 0.43	2.73 ± 0.56	0.104
History of Prevent Miscarriage				
No	854	814	40	< 0.001
Yes	346	305	41	
History of abnormal pregnancy				
No	703	658	45	0.548
Yes	494	458	36	
Pre-eclampsia				
No	1,169	1,098	71	< 0.001
Yes	32	22	10	
Placenta previa				
No	1,161	1,086	75	0.072
Yes	40	34	6	
Perinatal cardiomyopathy				
No	1,186	1,105	81	0.617
Yes	15	15	0	
Gestational diabetes mellitus				
No	1,069	997	72	0.971
Yes	132	123	9	
Hypertension				
No	1,127	1,056	71	0.028
Yes	73	63	10	
Hypothyroidism				
No	1,169	1,091	78	0.807
Yes	32	29	3	
Hyperthyroidism				
No	1,190	1,111	79	0.167
Yes	11	9	2	
Anaemia				
No	1,178	1,098	80	0.966
Yes	23	22	1	
Intrahepatic cholestasis of pregnancy				
No	1,185	1,105	80	1.000
Yes	16	15	1	
Antiphospholipid				
No	1,182	1,104	78	0.261
Yes	19	16	3	

Table S1. Statistical table of clinical information of mothers of patients between the transfusion and no transfusion groups (continued).

	Total (n = 1,201)	No Transfusion (n = 1,120)	Transfusion (n = 81)	p-value
Premature rupture of membranes				
No	**1,004**	**949**	**55**	**< 0.001**
Yes	**196**	**170**	**26**	
Mode of delivery				
Easy Delivery	**345**	**334**	**11**	**0.002**
Caesarean Section	**856**	**786**	**70**	
***In vitro* fertilisation**				
No	**1,135**	**1,062**	**73**	**0.124**
Yes	**66**	**58**	**8**	
Multiple pregnancy				
No	**1,092**	**1,025**	**67**	**0.008**
Yes	**109**	**95**	**14**	

Table S2. Statistical table of clinical information of patients between the transfusion group and the no transfusion group.

	Total (n = 1,201)	No Transfusion (n = 1,120)	Transfusion (n = 81)	p-value
Gestational Age	**37.01 ± 0.08**	**37.32 ± 0.07**	**32.63 ± 0.38**	**< 0.001**
Birth Weight	**2.95 ± 0.94**	**3.02 ± 0.03**	**1.87 ± 0.08**	**< 0.001**
Apgar score (1 minute)	**8.71 ± 1.04**	**8.79 ± 0.29**	**7.68 ± 0.16**	**< 0.001**
Gender				
Female	**465**	**432**	**33**	**0.699**
Male	**736**	**688**	**48**	
ABO blood group				
A	**375**	**354**	**21**	**0.235**
B	**331**	**305**	**26**	
O	**397**	**366**	**31**	
AB	**98**	**95**	**3**	
RhD blood group				
Positive	**1,197**	**1,117**	**80**	**0.244**
Negative	**4**	**3**	**1**	
Asphyxia				
No	**1,175**	**1,100**	**75**	**0.030**
Yes	**26**	**20**	**6**	
Mechanical ventilation				
No	**948**	**888**	**60**	**< 0.001**
Yes	**253**	**232**	**21**	
Oxygen therapy				
No	**929**	**873**	**56**	**< 0.001**
Yes	**272**	**247**	**25**	

Table S2. Statistical table of clinical information of patients between the transfusion group and the no transfusion group (continued).

	Total (n = 1,201)	No Transfusion (n = 1,120)	Transfusion (n = 81)	p-value
Fetal distress				
No	**1,159**	**1,082**	**77**	**0.676**
Yes	**42**	**38**	**4**	
Neonatal respiratory distress syndrome				
No	**1,137**	**1,067**	**70**	**0.020**
Yes	**64**	**53**	**11**	
Neonatal pneumonia				
No	**947**	**876**	**71**	**0.045**
Yes	**254**	**244**	**10**	
Anaemia				
No	**1,018**	**953**	**65**	**< 0.001**
Yes	**183**	**167**	**16**	
Age				
> 1 month	**66**	**61**	**5**	**0.980**
< 1 month	**1,135**	**1,059**	**76**	