Effect of Blood Component Transfusion on Coagulation Function in Postpartum Haemorrhage

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ABSTRACT

Postpartum haemorrhage (PPH) is a serious complication of pregnancy. In this study, patients with PPH were treated with blood component transfusion, and the effectiveness of blood component transfusion and its influence on coagulation function were analysed. This retrospective randomised controlled study evaluated the clinical data of patients with PPH who were admitted to the Department of Blood Transfusion at the First Affiliated Hospital of Xiamen University, from January 2021 to December 2021. In 2021, 84 patients received treatment at this hospital. Patients transfused with a 1:1 ratio of red blood cells (RBC) to cryoprecipitate showed a significant improvement in coagulation levels compared to pretreatment. The combination of RBC, plasma, and cryoprecipitate in a reasonable proportion effectively improves coagulation function in haemorrhage puerperae, showing a good clinical treatment effect. It is worth promoting.

Key Words: *Postpartum, Blood component transfusion, Coagulation, Resuscitation rate.*

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With China's opening up and the implementation of two-child policy, pregnancy and childbirth rates have increased significantly, however, the likelihood of postpartum haemorrhage (PPH) has also increased.[1] Childbirth can lead to potential complications, and PPH is one such serious complication. It is defined as a total blood loss exceeding 500 mL within 24 hours after delivery.[2,3] PPH is an important factor contributing to maternal mortality. The key to treating PPH is controlling the bleeding and transfusing patients. Traditional treatment mainly used whole blood transfusion to restore blood volume. However, this approach neglected platelet activation, resulting in excessive platelet dilution that could impact coagulation function and haemoglobin levels, leading to various adverse reactions. Compared with whole blood transfusion, blood component transfusion considers patients' specific needs and extracts high-purity blood components through physical or chemical processing. Therefore, it has replaced whole blood transfusion in clinical applications.

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It has been reported that early transfusion of plasma and red blood cells (RBC) in a 1:1 ratio effectively improves patients' coagulation function.[4] Therefore, this study evaluated two-component transfusion regimens for treating patients with PPH.

This study was conducted at the Blood Transfusion Department of the First Affiliated Hospital of Xiamen University after obtaining approval by the Hospital's Ethics Committee. By maintaining a 95% confidence interval, a 5% acceptable margin of error, and an expected 20% improvement rate in the coagulation function, the sample size was determined to be 84. The included cases met the diagnostic criteria for PPH as defined by the Chinese Obstetrics and Gynaecology Guidelines, and had normal coagulation function and good compliance. Patients with serious disorders in vital organs and a history of psychiatric disorders were excluded. Based on different ratios of fresh frozen plasma (FFP) and RBC, 84 patients were divided into Group A and Group B. The ratio of RBC to cryoprecipitate was 1:1 in Group A (40 cases) and 1:0.5 in Group B (44 cases). Patients in both groups were immediately treated with haemostasis, blood supplementation, correction of temperature and acidosis, and prevention of infection. Coagulation function and blood routine indicators were tested every 1 to 2 hours to adjust the treatment plan reasonably. Activated partial thromboplastin time (APTT), prothrombin time (PT), and FIB were measured using a Sysmex CA-7000 fully automated coagulation analyzer.

Table I: Comparison of the coagulation level ($\bar{x}\pm s$).

Group	Number of cases	APTT (s)		PT (s)		FIB (g/L)	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Group A	40	59.77 ± 5.83	33.65 ± 6.04*	21.75 ± 1.45	12.68 ± 2.31*	1.47 ± 0.72	2.85 ± 0.85*
Group B	44	59.13 ± 5.92	50.69 ± 8.22	21.67 ± 1.44	32.98 ± 3.53	1.54 ± 0.75	1.13 ± 0.37
t		0.241	7.969	0.517	21.158	0.714	8.304
p (SPSS 22.0)		>0.05	<0.001	>0.05	<0.001	>0.05	<0.001

*Note: *: Compared with pre-treatment using the t-test, p <0.05.*

Table II: Comparison of Hb, PLT, and D-dimer levels ($\bar{x}\pm s$).

Group	Number of cases	Hb (g/L)		PLT ($\times10^9$/L)		D-dimer (mg/L)	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Group A	40	70.66 ± 15.25	83.24 ± 11.57	105.27 ± 22.12	83.86 ± 10.53	3.72 ± 2.42	4.66 ± 1.31
Group B	44	70.35 ± 15.57	66.33 ± 7.87	103.34 ± 21.75	68.65 ± 8.33*	3.57 ± 2.32	3.06 ± 0.71
t		0.061	5.596	0.039	5.274	0.458	7.931
p (SPSS 22.0)		>0.05	<0.001	>0.05	<0.001	>0.05	<0.001

*Note: *: Compared with pre-treatment using the t-test, p <0.05.*

The SPSS 22.0 was used for processing data. The measurement data were expressed by ($\bar{x}\pm s$), all conforming to normal distribution; the t-test was used for comparing the measurement data. The count data were expressed as n (%) and compared using the χ^2 test. A value of $p < 0.05$ meant a statistically significant difference. The results showed no significant differences in coagulation function levels between the two groups before treatment ($p > 0.05$, Table I). After treatment, Group A demonstrated a significant improvement in coagulation function, while Group B showed no improvement ($p > 0.05$, Table I). Additionally, APTT and PT levels were significantly higher in Group A than in Group B, and the FIB level was lower in Group A with statistical significance ($p < 0.001$, Table I).

The differences in the Hb, PLT, and D-dimer levels between the two groups were not statistically significant before treatment ($p > 0.05$). After treatment, Group A had an improvement in the Hb level, an insignificant decline in the PLT ($p > 0.05$), and no significant increase in the D-dimer level ($p > 0.05$); the Hb, PLT, and D-dimer levels in Group B decreased and were statistically different from those in Group A ($p < 0.001$, Table II).

This study analysed data from PPH patients in 2021. Patients in Group A showed a significant improvement in coagulation function after component transfusion, suggesting its effectiveness. Patients in Group B, who received a transfusion ratio of 1:0.5, had significantly higher APTT and PT levels compared to Group A, which received a 1:1 transfusion ratio, while their FIB level was lower. These results suggested that a 1:0.5 ratio of RBC to cryoprecipitate was ineffective in improving maternal coagulation, similar to the results of a previous study.[5,6] Patients with PPH lose a large amount of blood, and transfusion therapy is limited to the transfusion of plasma and RBC. Delayed supplementation of cold-precipitated coagulation factors can lead to abnormal coagulation function. Replenishing the lost coagulation factors through a proper ratio of cryoprecipitate, plasma, and RBC transfusion helps maintain normal coagulation function and reduces the risk of rebleeding.

Hb, PLT, and D-dimer detection have a high predictive value for PPH, and a sustained decrease in Hb and PLT levels and an increase in D-dimer levels indicate the possibility of sustained bleeding. The present study found that transfusion with a 1:1 ratio of RBC to cryoprecipitate resulted in a good Hb elevation, an insignificant decrease in PLT, and no significant increase in D-dimer levels. It is concluded that this transfusion ratio is effective and facilitates recovery.

However, this study has some shortcomings. It was a single-centred retrospective cohort study, so the case source was single, and the sample size needs to be improved. The paper did not provide information on underlying diseases such as hypertension, diabetes, coronary heart disease, or chronic obstructive pulmonary disease, which could potentially impact the prognosis.

In conclusion, patients with PPH should receive timely blood component transfusion, and the best effect is achieved when the ratio of RBC to FFP is 1:1. This regimen improves coagulation function and facilitates patient recovery, making it valuable for promotion and application.

ETHICAL APPROVAL:

The study protocol was approved by the Ethics Committee of the First Affiliated Hospital of Xiamen University and conducted in accordance with the Declaration of Helsinki.

PATIENTS' CONSENT:

Written informed consent was obtained from all study participants.

COMPETING INTEREST:

The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:

TY, HX, FL: Study design, data collection, and analysis.
FL, BZ, QH, YW: Manuscript preparation, drafting, and revising.
TY, HX: Review and agreement to be accountable for all aspects of the work.
All authors approved the final version of the manuscript to be published.

REFERENCES

1. Yu S, Cheng Y, Tse WT, Sahota DS, Chung MY, Wong SSM, *et al*. Perioperative prophylactic internal iliac artery balloon occlusion in the prevention of postpartum hemorrhage in placenta previa: A randomised controlled trial. *Obstet Anesth Digest* 2021; **41(2)**:76-7. doi: 10.1097/01.aoa.0000744108.27892.08.
2. Elmas B, Simsek S, Dincgez B, Ozceltik G, Urun C, Akin HY. Could birth weight to placental weight ratio predict postpartum haemorrhage and neonatal intensive care unit admission? *J Coll Physicians Surg Pak* 2022; **32(12)**:1557-62. doi: 10.29271/jcpsp.2022.12.1557.
3. Haq G, Tayyab S. Control of postpartum and post abortal haemorrhage with uterine packing. *J Pak Med Assoc* 2005; **55(9)**:369-71.
4. Feng LJ. Effect of plasma and erythrocytes cell ratio on coagulation function in postpartum hemorrhage patients treated with massive blood transfusion. *J Med Forum* 2019; **40(12)**: 80-2.
5. Yang JH, Zhou Y, Zhang SW, Fu JM, Qiu YJ, Xu B, *et al*. Pilot study on the changes of suspended erythrocytes cells and plasma quality prepared from material whole blood stored at 30℃ for 24 hours. *Chin J Blood Trans* 2019; **32(2)**:150-3. doi: 10.13303/j.cjbt.issn.1004-549x.2019.02.013.
6. Sangerman MA, Pomares H, Alonso E, Grau J, Galiano M, Encuentra M, *et al*. Impact of erythrocytes cell transfusion burden status in patients with lower-risk myelodysplastic Syndromes. *Blood* 2019; **134(S1)**:3013. doi: 10.1182/blood-2019-127486.