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The Effect of the Direct Anti-Human Globulin Test on the Clinical Outcome of Patients Receiving Blood Transfusion

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Abstract: *Objective:* To study the effect of the direct anti-human globulin test on the clinical efficacy of blood transfusion patients. *Methods:* 52 transfused patients were selected for this study, of which 26 cases with positive direct anti-human globulin tests were included in the positive group, and another 26 cases with negative direct anti-human globulin tests were included in the negative group. The apparent efficacy of the patients in the two groups after blood transfusion was compared. *Results:* After blood transfusion, the apparent efficacy of the negative group was significantly higher, $P < 0.05$; in the positive group, the proportion of the predominantly multi-antibody group was the highest; after blood transfusion, the post-transfusion apparent efficacy of the simple IgG group was higher than that of the multi-antibody group, $P < 0.05$; comparing the intensity of the different antibodies resulted in the 1+ group, and the 3+ to 4+ groups were significantly lower after blood transfusion, $P < 0.05$. *Conclusion:* The use of the direct antiglobulin test in transfused patients showed that patients with positive results would have better clinical efficacy. Direct anti-human globulin tests will have an impact on the clinical efficacy of blood transfusion in patients with positive results, so it is very important to carry out a direct anti-human globulin test on blood transfusion patients.

Keywords: Direct anti-human globulin test; Blood transfusion; Clinical efficacy

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1. Introduction

Clinical study of direct anti-human globulin test, a type of classical test, suggests positivity if immune complexes or autoantibodies adhere to red blood cell membranes, and can be used to detect blood disorders, autoimmune hemolytic anemia, and other diseases that require the use of red blood cell transfusions in clinical treatment [1]. Clinical analysis of positive results of direct anti-human globulin tests suggests that the patient's immune factors influence the state of anemia. In this paper, 52 patients were selected for this study to investigate the effect of the use of a direct anti-human globulin test on the clinical outcome of patients receiving blood transfusion.

2. General information and methods

2.1. General information

52 transfused patients were selected for this study from January to December 2023, out of which 26 cases with positive direct anti-human globulin test were included in the positive group, with 10 males and 16 females, aged 55–78 (60.66 ± 6.55) years old, and another 26 cases with negative direct anti-human globulin test were included in the negative group, with 11 males and 15 females, aged 52–77 (60.61 ± 6.55) years old.

2.2. Methods

The XE-5000 hemocyte analyzer of Japan Sysmex company and related reagents were used for testing. For the blood transfusion treatment, 2U leukocyte-reduced red blood cell suspension was transfused each time, and blood specimens were collected before and 24 hours after blood transfusion for hemoglobin (Hb) testing. For patients with a positive result, 3–6 times saline washing of red blood cells was performed, followed by preparation of red blood cell suspension 0.8–1.0% using LISS liquid, adding 50 μl to the microcolumn gel antibody typing card. Centrifugation treatment was done for 10 minutes to obtain the results.

2.3. Judgment criteria

(1) Significantly effective: Compared with the expected (90% of the value of the donor Hb multiplied by the input volume/patient body weight multiplied by 0.085), Hb increased by more than 80% after treatment;

(2) Effective: After treatment, Hb increased by 50–80% compared with the expected;

(3) Ineffective: Other conditions.

2.4. Statistical analysis

SPSS25.0 software was used for calculation, expressed as rate (%) and mean ± standard deviation (SD), χ^2 test and *t*-test were implemented, and $P < 0.05$ was statistically significant.

3. Results

After transfusion, the apparent efficacy of the negative group was significantly higher, $P < 0.05$, the specific data are shown in **Table 1**; among the positive groups, the highest percentage was dominated by the multiple antibody group, the specific data are shown in **Table 2**; after transfusion, the post-transfusion apparent efficacy of the simple IgG group was significantly higher than that of the multiple antibody group, χ^2 value = 6.4549, $P < 0.05$, the specific data are presented in **Table 3**; comparing the different antibody strengths to the 1+ group, the 3+ to 4 + group were significantly lower in post-transfusion, χ^2 value = 4.3815, 5.2381, $P < 0.05$, as presented in **Table 4**.

Table 1. Efficacy of transfusion therapy comparing positive and negative groups (%)

Group	Number of cases	Significantly effective	Effective	Ineffective	Apparent efficacy
Positive group	26	6 (23.07)	10 (38.46)	10 (38.46)	23.07
Negative group	26	19 (73.07)	4 (15.38)	3 (11.53)	73.07
χ^2 value	-	-	-	-	13.0193
P value	-	-	-	-	< 0.05

Table 2. Classification of positivity and agglutination intensity

Classification	Number of cases	4+	3+	2+	1+
IgG/C3d	7	2	2	2	1
Single IgG	5	0	2	1	2
Single C3d	5	0	0	2	3
IgG/IgM/C3d	4	2	1	1	0
IgG/C3d/IgA/IgM	2	1	0	1	0
IgG/IgM/C3d/C3c	2	0	1	1	0
IgG/C3d/C3c/IgA/IgM	1	1	0	0	0

Table 3. Comparison of the therapeutic efficacy (%) of the three groups after red blood cell suspension infusion ($n = 26$)

Group	Number of cases	Significantly effective	Effective	Ineffective
Multiple antibody groups	16 cases	2 (12.50)	10 (62.50)	4 (25.00)
IgG group	6 cases	4 (66.66)	1 (16.66)	1 (16.66)
C3d group	4 cases	2 (50.00)	2 (50.00)	0

Table 4. Comparison of therapeutic efficacy (%) of different antibody strengths after red blood cell suspension infusion

Group	Significantly effective	Effective	Ineffective
4+	0	2 (40.00)	3 (60.00)
3+	1 (12.50)	5 (62.50)	2 (25.00)
2+	2 (28.57)	3 (42.85)	2 (28.57)
1+	4 (66.66)	2 (33.33)	0

4. Discussion

A positive direct anti-human globulin test indicates the body's hematopoietic rate is slower than the rate of destroying red blood cells, which will lead to anemia in patients, and a blood transfusion given to the patients will lead to hypoxia in the body, and the clinical efficacy of red blood cell transfusion can be evaluated by the increase of Hb after the patients received the blood transfusion. In this paper, it was concluded that most of the positive patients did not have good transfusion results [2], and some of the patients may have serious reactions after the transfusion, which may aggravate the patient's anemia, so the evaluation of transfusion indications should be implemented before transfusion of blood in positive patients.

Clinical analysis of antibodies in direct anti-human globulin tests as well as complement revealed that they correlate with the severity of the patient's disease, the most severe being IgG+C3 hemolysis [3]. In this study, after transfusion, the negative group had a significantly higher apparent efficacy, $P < 0.05$; among the positive groups, the highest percentage was mainly in the multiple antibody group; after transfusion, the simple IgG group had a significantly higher apparent efficacy than the multiple antibody group, $P < 0.05$; comparing the different antibody strengths to the 1+ group, the 3+ to 4+ groups were significantly lower after transfusion, $P < 0.05$. Analyzing the above, it was concluded that in the multiple antibody group, because of the "adhesion" effect of C3d, it quickly destroys the infused red blood cells as well as the body's own erythrocytes, and the anemia symptoms of the patients could not be significantly improved. The analysis shows that the effect of red blood cell infusion in

the multi-antibody group is poor because the destruction of red blood cells and IgM activation of complement are stronger than IgG, and generally due to secondary factors that lead to the emergence of simple IgG type, the absorption and dispersion test is implemented, which can be used to effectively remove the interference of autoantibodies, and significant blood transfusion efficiency can be achieved [4-6]. In the C3d-positive group, it is mainly agglutination, and factors that affect the patient's immune status include the destruction of red blood cells, therefore, in this paper, C3d-positive patients had good blood transfusion [7-9]. In addition, for positive patients, the antibody intensity is enhanced, with reduced transfusion efficacy [10].

5. Conclusion

To summarize, direct anti-human globulin tests will have an impact on the clinical efficacy of blood transfusion in patients with positive results, so it is very important to carry out direct anti-human globulin tests.

Disclosure statement

The authors declare no conflict of interest.

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