



Analysis of Adverse Reactions of Blood Transfusion and Discussion of Influencing Factors in Linyi Area from 2013 To 2020

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Abstract

Background: We aimed to explore the influencing factors of clinical adverse blood transfusion reactions, to provide theoretical basis and support for clinical safe blood transfusion, and to minimize the occurrence of adverse blood transfusion reactions.

Methods: The method was to retrospectively analyze the report of adverse blood transfusion reports from 6 hospitals in Linyi area, Shandong, China to the blood station in Linyi City center from 2013 to 2020. We aimed to classify factors, analyze the occurrence of adverse transfusion reactions, and discuss the correlation between the occurrence of adverse transfusion reactions and the above factors.

Results: Overall, 248 patients (77.98%) had a history of blood transfusion. The difference between this group and the group with no history was statistically significant ($P < 0.05$). The incidence of adverse transfusion reactions in middle-aged and elderly patients was relatively high, especially for those over 50 yr old, with an adverse reaction of 135, for example, the proportion reached 42.45%. In addition, a retrospective analysis found that the occurrence of adverse transfusion reactions was mostly concentrated from Mar to Sep, a total of 228 cases, accounting for 71.69% of all adverse reactions, which was the highest incidence of adverse transfusion reactions.

Conclusion: The main adverse reactions of transfusion were allergic reactions, followed by non-hemolytic febrile reactions, mainly caused by transfusion of suspended red blood cells.

Keywords: Blood transfusion; Allergic reactions; Fever; Blood products

Introduction

Blood transfusion as an important means of clinical rescue and treatment has greatly improved the survival rate of critically ill patients (1). However, due to the foreign antigenicity of foreign blood components and the degeneration of blood during storage, it is easy to cause non-

hemolytic fever reactions, chills, allergies and so on after entering the body (1).

Although blood safety has made significant progress through various technical measures and blood transfusion reactions have been significantly reduced, there are still potential risks in the transfusion of blood and blood components (2).



Analyzing and summarizing the laws and influencing factors of transfusion-related adverse reactions, can provide theoretical basis and support for clinically safe transfusion and minimize the occurrence of transfusion-related adverse reactions.

To this end, a retrospective analysis of the occurrence of adverse blood transfusion reactions was conducted, reported by six hospitals in Linyi from 2013 to 2020.

Methods

According to the data, the adverse reaction report form of blood transfusion reported by six hospitals in Linyi from 2013 to 2020 was classified according to the variety of blood products, patient gender, age, type of adverse reaction and history of blood transfusion. Among them, 318 patients, 167 males and 151 females, aged from 9 months old to 86 yr old, developed adverse reactions to blood transfusion. All the patients underwent component blood transfusion.

According to clinical blood transfusion (3) and technical specifications for clinical blood transfusion, the adverse reactions of blood transfusion was mainly included:

1) Allergic reactions during or within 24 days after blood transfusion, the patient presents with skin flushing, itching, dyspnea, chest tightness, angioneurotic edema, bronchospasm, anaphylactic shock and other symptoms;

2) Fever reaction: the patient had no fever symptoms before the transfusion, and the body temperature increased more than 1°C during the transfusion or within 1-2 h after the transfusion, and the fever symptoms had nothing to do with the primary disease;

3) Circulatory overload: during the transfusion or within 1h after the transfusion, the patient suddenly had dyspnea, sitting breathing, cough-blood foamy sputum, fidgets, sweating, and both lungs are full of rashes.

SPSS 17.0 statistical software (Chicago, IL, USA) was used for statistical analysis. Counting data was compared using χ^2 test. $P < 0.05$ means the difference was statistically significant.

Results

The occurrence of different types of adverse transfusion reactions

From 2013 to 2020, a total of 318 feedback report forms for adverse reactions of blood transfusion were received. Among them, the incidence of allergic reactions was the highest, accounting for 62.57% (199/318); followed by non-hemolytic fever reactions, accounting for about 33.64% (107/318), others accounted for about 3.77% (12/318). Among the 318 cases, the number of adverse reactions of erythrocytes was the largest, which was 138. Among them, suspended erythrocytes were the main occurrence, 135 cases, and only 3 washes of erythrocytes (Table 1).

Table 1: The incidence of adverse transfusion reactions with different blood components [n(%)]

<i>Blood products</i>	<i>Number</i>	<i>Anaphylaxis</i>	<i>Non-hemolytic fever reaction</i>	<i>Other</i>
Suspended red blood cells	135	71 (52.59)	57 (42.22)	7 (5.18)
Ordinary virus inactivated plasma	94	65 (69.14)	28 (29.78)	1 (1.06)
Mechanical platelet collection	75	54 (79.66)	18 (24.00)	3 (4.00)
Cold precipitation	11	8 (72.72)	2 (18.18)	1 (9.09)
red blood cells was washed	3	1(33.33)	2 (66.67)	0
Total	318	199 (62.57)	107 (33.64)	12 (3.77)

The main time of adverse reactions in blood transfusions occurrence

A retrospective analysis found that the occurrence of adverse reactions in blood transfusions

was mostly concentrated from Mar to Sep, with a total of 228 cases, accounting for 71.69% of all cases of statistical adverse reactions (Table 2).

Table 2: Number of cases of various adverse reactions in different months

Types of adverse reactions	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Anaphylaxis	6	13	23	22	30	18	19	21	17	14	9	7
Fever reaction	7	6	10	13	9	13	10	12	11	6	5	5
Other	1	2	0	2	2	1	1	0	1	1	0	1
Total	14	21	33	37	41	32	30	33	29	21	14	13

Relationship between adverse reactions of blood transfusion and gender, age and history of blood transfusion

From the perspective of the relationship between the adverse reaction of blood transfusion and the patient's gender, age and blood transfusion history, 167 males and 151 females had no significant

difference in the composition ratio; 248 patients (77.98%) had a history of blood transfusion, while 70 patients (22.02%) had no history of blood transfusion. The difference between the two groups was statistically significant ($P < 0.05$) (Table 3 and 4).

Table 3: Comparative analysis of various types of blood transfusion adverse reactions and patients' gender

Gender	Anaphylaxis	Non-hemolytic fever reaction	Other
Male	100	61	6
Female	99	46	6
Total	199	107	12

Note: n is the number of cases of adverse reactions. By Pearson chi-square test, the χ^2 value was 0.483, and the P -value was 0.785, which was greater than 0.05, and the difference was not statistically significant

Table 4: Comparative analysis of various types of blood transfusion adverse reactions and patients' previous blood transfusion history (n)

Blood transfusion history	Anaphylaxis	Non-hemolytic fever reaction	Else
Without	39	28	3
Exist	160	79	9
Total	199	107	12

Note: n is the number of cases of adverse reactions. By Pearson chi-square test, the χ^2 value was 7.140, and the P -value was 0.028, which was less than 0.05, and the difference was statistically significant

Discussion

Although blood undergoes strict procedures such as screening and testing, there is still the possibil-

ity of transfusion-transmitted diseases and other adverse reactions of transfusion (4). Adverse blood transfusion reactions refer to new symptoms or signs that occur in the recipient during

or after the blood transfusion and cannot be explained by the original disease (3). With the development of blood transfusion technology, the rate of adverse reactions of blood transfusion gradually decreased (1), but allergic reactions and non-hemolytic fever are still common reason (5). At the same time, due to the individual differences and specific characteristics of blood transfusion patients, the related risks of blood transfusion are different, and the adverse reactions of blood transfusion caused by different components of blood products are also different.

The results of this survey suggest that in the statistical data of 6 hospitals in Linyi area from 2013 to 2020, the main adverse reactions of blood transfusion were allergic reactions and non-hemolytic fever reactions, of which the highest proportion of allergic reactions was 62.57%, followed by non-hemolytic fever reactions. Accounting for about 33.64%, by analyzing the relationship between allergic reactions and non-hemolytic fever reactions and blood transfusion components, it was found that the adverse reactions were mainly caused by suspended red blood cells and plasma, and no acute hemolytic reaction occurred, consistent with the report in another study (6). This is mainly related to the white blood cells contained in the plasma, the cytokines produced in the blood preservation, the cytokines produced by the activation of the white blood cells in the plasma, and the patient's allergic constitution (7). It may also be because the blood transfused by the patient is a blood donation for a small number of allergic constitutions. It is suggested that the allergic reaction can be caused when contacting the allergen again (8). There was only 1 case of transfusion adverse reaction caused by washing red blood cells. After allergy to patients with suspended red blood cells transfused to wash red blood cells, no allergic reaction occurred again. Therefore, for patients with plasma protein allergies, you can choose to wash to remove plasma components to reduce blood transfusion reactions.

Through the analysis of the influencing factors of adverse transfusion reactions, we can find that there is no difference between male and female

adverse transfusion reactions in the region. The reasons for considering this phenomenon may be: 1) With the increase of age, the immunity of elderly patients continues to decrease, and exposure to external antigens increases the production of antibodies in patients. 2) Repeated blood transfusions cause antibodies in blood components in the body to gradually increase. Therefore, knowing and mastering the patient's age and previous blood transfusion history before transfusion can reasonably and accurately select the blood components to be injected and take preventive and treatment measures in advance, so as to reduce the incidence of adverse reactions to blood transfusion.

In addition, this investigation found that the adverse reactions of blood transfusion are mostly concentrated from Mar to Aug, and the consideration may be related to seasonal factors: 1) With the alternations of spring and summer, external factors such as pollen may cause sensitization, resulting in an intensified antigen-antibody response after transfusion. 2) High temperature and humidity in summer have a greater impact on the preservation of blood components and cold chain transport after blood donation.

The occurrence of transfusion reactions are jointly lead to a variety of factors, both the cause of the blood products itself and the individual differences of patients (9-11).

Conclusion

It is necessary that the medical institutions of medical personnel and blood stations staff should strictly carry out operation procedures, accurately grasp the blood transfusion indications, strict control of blood storage conditions and the cold chain environment, reasonable choose blood components, strengthen blood transfusion the quality control of each process, so as to minimize the occurrence of transfusion reactions.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or fal-

sification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interest.

References

1. Ikebe E, Matsuoka S, Tanaka A, et al (2019). Reduction in adverse transfusion reactions with increased use of washed platelet concentrates in Japan-A retrospective multicenter study. *Transfus Apher Sci*, 58(2): 162-168.
2. Bassi R, Aggarwal S, Bhardwaj K, et al (2017). Patterns of Adverse Transfusion Reactions in a Tertiary Care Centre of North India: A Step Towards Hemovigilance. *Indian J Hematol Blood Transfus*, 33(2):248-253.
3. Philip J, Pawar A, Chatterjee T, et al (2016). Non Infectious Complications Related to Blood Transfusion: An 11 year Retrospective Analysis in a Tertiary Care Hospital. *Indian J Hematol Blood Transfus*, 32(3): 292-298.
4. Perelman I, Khair S, Dermer E, et al (2019). The epidemiology of multicomponent blood transfusion: a systematic review. *Transfus Med*, 29(2): 80-94.
5. Kato H, Nakayama T, Uruma M, et al (2015). A retrospective observational study to assess adverse transfusion reactions of patients with and without prior transfusion history. *Vox Sang*, 108(3): 243-250.
6. De Pascale MR, Belsito A, Sommese L, et al (2019). Blood transfusions and adverse acute events: a retrospective study from 214 transfusion-dependent pediatric patients comparing transfused blood components by apheresis or by whole blood. *Ann Ist Super Sanita*, 55(4): 351 -356.
7. He C, Deng S (2020). Analysis of 79 cases of adverse reactions caused by blood transfusion and its counter measures. *Laboratory Medicine and Clinical*, 15(22): 3339-3341.
8. Daurat G (2010). Reporting and notification of transfusion serious adverse events in France. *Transfus Clin Biol*, 17(5/6): 362-365.
9. Luo B, Li X (2017). Analysis of related factors of transfusion adverse reactions in 15594 blood recipients and preventive measures. *Clinical Transfusion and Examination*, 2017: 36-39.
10. Goel R, Tobian AAR, Shaz BH (2019). Non-infectious transfusion-associated adverse events and their mitigation strategies. *Blood*, 133(17): 1831-1839.
11. Raval JS, Griggs JR, Fleg A (2020). Blood Product Transfusion in Adults: Indications, Adverse Reactions, and Modifications. *Am Fam Physician*, 102(1): 30-38.