

ORIGINAL ARTICLE

Evaluation of Pretransfusion Testing Practices and Their Impact on Patient Safety

DOI: 10.5281/zenodo.17357431

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Received: 29 Sep 2025
Accepted: 9 Oct 2025
Published: 14 Oct 2025

Published by:
Gopalganj Medical College, Gopalganj,
Bangladesh

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ABSTRACT

Background: The safety of blood transfusions critically depends on proper pretransfusion procedures, as errors in sample collection, labeling, crossmatching, and bedside verification can result in the administration of incompatible blood with potentially fatal outcomes. The purpose of the study was to evaluate pretransfusion testing practices and their effect on patient safety. **Aim of the study:** The aim of the study was to assess pretransfusion testing practices and their effect on patient safety. **Methods:** This cross-sectional study was conducted at the Department of Transfusion Medicine, Mugda Medical College and Hospital, National Institute of Burn and Plastic Surgery, Dhaka, Bangladesh, from January to June 2025, including 100 transfusion recipients. Data on demographics, transfusion indications, pretransfusion practices, errors, and clinical outcomes were collected prospectively and analyzed using SPSS version 26. **Results:** Among 100 transfusion recipients (mean age 46.6 ± 14.8 years; 56% male), anemia (40%) was the most common indication. ABO/Rh typing and crossmatch were performed in 100%, clerical checks in 90%, and documentation in 88%. Pretransfusion errors occurred in 25% (most commonly incomplete forms 8%, mislabeling 6%). Transfusions were largely uneventful (93%), with febrile reactions in 3%, allergic/delayed reactions in 2% each. Adverse events were higher in patients with errors (16% vs. 2.7%). **Conclusion:** Strict adherence to pretransfusion testing protocols is essential to minimize errors and ensure patient safety.

Key words: Pretransfusion, Testing, Safety.

(The Insight 2025; 8(2): 242-246)

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INTRODUCTION

The safety of blood transfusions depends partly on the quality of pretransfusion procedures conducted at the bedside. Despite advances in transfusion practices, the occurrence and mortality associated with immunohemolytic reactions remain unacceptably high [1,2]. Ensuring transfusion safety involves a series of steps, beginning with the decision to administer an appropriate blood component, followed by sample collection, labeling, transport, handling, pretransfusion testing, and the actual administration of the blood product to the patient. Mistakes at any stage can result in the patient receiving incompatible blood, potentially causing serious harm [3].

The crossmatch constitutes a key component of standard pretransfusion testing, designed to identify ABO incompatibilities and other clinically significant antibodies. Key control points in pretransfusion testing include accurate

patient identification, proper blood sample collection, careful record review, and donor blood testing within the transfusion service to verify ABO (and Rh, if the donor is Rh negative), recipient ABO and Rh typing, crossmatching, and appropriate component selection. Mistakes at any of these stages can result in transfusion of an incompatible unit, with potentially fatal consequences [4-7]. Ideally, the bedside ABO-compatibility test should prevent such life-threatening errors arising from labeling mistakes, unit mix-ups, or patient misidentification. Despite its straightforward nature, this bedside test must be performed correctly to ensure reliable agglutination results and accurate interpretation [2].

Errors in transfusion are well documented in the literature and are largely preventable if promptly reported and properly analyzed. Haemovigilance programs worldwide indicate that the primary risk to blood transfusion recipients stems from

human error, often resulting in the administration of the wrong blood component. Errors such as improper patient identification or sample labeling can lead to ABO-incompatible transfusions. Errors that occur while collecting a patient's sample for pretransfusion compatibility testing are particularly significant, since they take place at the initial step of the complex transfusion process [8]. There are three main 'zones of error' that compromise transfusion safety: (i) accurate patient identification and correct labeling of the pretransfusion specimen; (ii) appropriate clinical decision-making regarding the use of blood components; and (iii) precise bedside verification to ensure the correct blood is administered to the intended patient [9].

Despite extensive international reporting on pretransfusion errors and haemovigilance, there is limited data on the prevalence and types of pretransfusion testing errors in Bangladesh, particularly regarding the impact of these errors on patient safety. Most available studies focus on individual errors or isolated adverse events, with few comprehensive analyses examining the full spectrum of pretransfusion practices, compliance rates, and their association with transfusion-related complications in local settings. This gap in knowledge highlights the need for systematic evaluation of pretransfusion testing procedures within Bangladeshi healthcare facilities. The purpose of the study was to evaluate pretransfusion testing practices and their effect on patient safety.

Objective

- To assess pretransfusion testing practices and their effect on patient safety.

METHODS & MATERIALS

This cross-sectional observational study was conducted at the Department of Transfusion Medicine, Mugda Medical College and Hospital, National Institute of Burn and Plastic Surgery,

Dhaka, Bangladesh, from January to June 2025. A total of 100 transfusion recipients were included, selected based on predefined inclusion criteria.

Inclusion Criteria:

- All patients above 18 years of age.
- Patients of either gender receiving any blood component (packed red blood cells, fresh frozen plasma, or platelets).

Exclusion Criteria:

- Patients with incomplete medical records.
- Transfusions where the pretransfusion testing was performed at an external facility.

Data were prospectively collected from transfusion records, requisition forms, and laboratory reports, including baseline demographics (age, sex) and indication for transfusion. Pretransfusion testing practices—ABO and Rh typing, major and minor crossmatching, clerical checks for patient identification and labeling, and documentation of consent and transfusion records—were recorded for each patient. Pretransfusion errors were identified and categorized as mislabeling of samples, incomplete requisition forms, wrong blood in tube (WBIT), discrepancies in ABO grouping, and documentation errors, with frequencies and percentages calculated. Clinical outcomes were monitored, including transfusions without adverse events, febrile non-hemolytic reactions, allergic reactions, delayed transfusions due to errors, and the association between pretransfusion errors and adverse events was analyzed. Data were entered into a spreadsheet and analyzed using descriptive statistics with SPSS version 26, with categorical variables expressed as frequencies and percentages, and continuous variables presented as mean $\pm$ standard deviation.

RESULTS

Table – I: Baseline Characteristics of the Study Population (n = 100)

Variable	Frequency (n)	Percentage (%)
Age group (years)	18–30	18.0
	31–45	28.0
	46–60	34.0
	>60	20.0
	Mean $\pm$ SD	46.6 $\pm$ 14.8
Sex	Male	56.0
	Female	44.0
Indication for transfusion	Anemia	40.0
	Surgery/Trauma	25.0
	Obstetric cases	20.0
	Malignancy	15.0

Table I presents the baseline characteristics of transfusion recipients. The mean age was 46.6 $\pm$ 14.8 years, with the majority (34%) falling within the 46–60 years age group. Males constituted 56% of the study population, while females

accounted for 44%. The most common indication for transfusion was anemia (40%), followed by surgery/trauma (25%), obstetric cases (20%), and malignancy (15%).

Table – II: Pretransfusion Testing Practices among Study Patients (n = 100)

Test Performed	Done		Not Done	
	(n)	(%)	(n)	(%)
ABO & Rh typing	100	100.0	0	0.0
Crossmatch (major/minor)	100	100.0	0	0.0
Clerical check (ID, labeling)	90	90.0	10	10.0
Documentation (consent, records)	88	88.0	12	12.0

Table II summarizes the pretransfusion testing practices performed for the study population. ABO and Rh typing, along with crossmatching, were universally carried out in all patients (100%). Clerical checks for patient identification and

labeling were documented in 90%. Additionally, 88% of cases had proper documentation, including consent and transfusion records.

Table – III: Distribution of Pretransfusion Testing Errors (n = 100)

Type of Error	Number of Cases (n)	Percentage (%)
Mislabeling of sample	6	6.0
Incomplete requisition forms	8	8.0
Wrong blood in tube (WBIT)	2	2.0
Discrepancy in ABO grouping	4	4.0
Documentation error	5	5.0
Total events with ≥1 error	25	25.0

Table III presents the types of errors identified during pretransfusion testing. The most frequent error was incomplete requisition forms (8%), followed by mislabeling of

samples (6%) and documentation errors (5%). Discrepancies in ABO grouping were noted in 4% of cases, while wrong blood in tube (WBIT) was observed in 2%.

Table – IV: Transfusion Outcomes and Adverse Events (n = 100)

Outcome	Number of Patients (n)	Percentage (%)
Transfusion without adverse event	93	93.0
Febrile non-hemolytic reaction	3	3.0
Allergic reaction	2	2.0
Delayed transfusion due to error	2	2.0

Table IV summarizes the clinical outcomes following transfusion. The majority of patients (93%) received transfusion without any adverse event. Febrile non-hemolytic

reactions were reported in 3% of cases, while allergic reactions occurred in 2%. Delayed transfusion due to error was observed in 2% of cases.

Table – V: Association Between Pretransfusion Errors and Adverse Events (n = 100)

	Adverse Event (n)	No Adverse Event (n)	Total (n)
Error Present	4	21	25
No Error	2	73	75
Total	6	94	100

Table V shows the relationship between pretransfusion errors and transfusion-related adverse events. Among 25 cases with documented errors, 4 (16%) were associated with adverse events, whereas only 2 (2.7%) of the 75 error-free cases developed adverse events.

DISCUSSION

Pretransfusion testing practices and their impact on patient safety remain critical components of safe transfusion medicine in tertiary care settings. Errors in these practices, including mislabeling, incomplete requisitions, or ABO incompatibility, can lead to serious adverse events such as febrile reactions, hemolytic transfusion reactions, or delays in transfusion. The findings of this study highlight the prevalence and types of pretransfusion errors, the compliance rates with

standard testing procedures, and their direct association with transfusion-related complications. These findings emphasize the importance of rigorous pretransfusion protocols and continuous monitoring to enhance patient safety and optimize transfusion outcomes.

In the present study, the mean age of transfusion recipients was 46.6 ± 14.8 years, with the largest proportion (34%) in the 46–60 years age group, and a slight male predominance (56). These results are consistent with earlier studies, although some variations exist in demographics. For example, Kipkulei et al.[10] described a younger patient population with a median age of 31.5 years, where females comprised 55.2%, predominantly in the reproductive age range. In contrast, Jacques et al.[11] reported a slightly older cohort with a median age of 43 years, consisting of 145 males and 117 females who

received transfusions. Regarding indications, anemia was the most frequent reason for transfusion in our cohort (40%), followed by surgery/trauma (25%), obstetric cases (20%), and malignancy (15%), paralleling the patterns described by Kipkulei et al.^[10], who reported anemia (62.8%) and neoplasms (23.2%) as common indications, and Jacques et al., who highlighted infection/sepsis (36.7%), trauma (23.5%), and cancer (21.6%). Overall, the age, sex distribution, and transfusion indications in our study align well with findings from diverse international settings, suggesting that the demographic and clinical profile of transfusion recipients is broadly consistent across populations, despite regional variations.

In the present study, pretransfusion testing practices showed universally high compliance, with 100% of patients undergoing ABO and Rh typing and crossmatching, and clerical verification (90%), clerical verification (90%), and documentation (88%). These findings align with a large-scale survey by the College of American Pathologists, which found that more than 91% of laboratories performed ABO grouping in 2004, with Rh typing showing comparable levels of compliance^[12]. Crossmatching in all patients mirrors the CAP survey findings that this practice remains a cornerstone of transfusion safety, albeit with variations in technique across centers. The slightly lower rates of clerical checks and documentation in our study highlight ongoing areas for quality improvement, as these non-technical steps are equally critical in preventing transfusion errors.

In the present study, pretransfusion testing revealed a variety of errors, the most frequent being incomplete requisition forms (8%), followed by mislabeling of samples (6%), documentation errors (5%), discrepancies in ABO grouping (4%), and wrong blood in tube (WBIT) incidents (2%), with a total of 25% of cases showing at least one error. These findings are in line with previous reports, although our error rates appear higher. Jain et al.^[13] identified 2.76% of samples with pretransfusion errors, primarily related to incomplete or mismatched requisition details, particularly in emergency and trauma units, underscoring the vulnerability of high-pressure settings to clerical lapses. In a similar study, Quillen et al.^[14] observed minor mislabeling in 0.3% of cases and major mislabeling, including WBIT, in 0.2%, with most critical errors occurring in emergency department settings. The higher proportions observed in our study may be attributed to variations in institutional resources, staffing, and system safeguards; however, the types of errors identified are similar to those reported in previous studies, emphasizing the universal risk of clerical and identification mistakes in the pretransfusion process. These observations underscore that rigorous adherence to pretransfusion testing protocols is essential, as even minor errors can directly compromise patient safety and clinical outcomes.

In the present study, the majority of patients (93%) received transfusions without any adverse events, while febrile non-hemolytic transfusion reactions (FNHTRs) occurred in 3% of cases and allergic reactions in 2%. Delayed transfusions due to error were rare, observed in 2% of patients. These findings are consistent with previously published data. Sidhu et al.^[15]

reported that among 94 transfusion reactions, FNHTRs and allergic reactions were the most prevalent, at 35.5% and 41.5%, respectively, with hemolytic reactions occurring less frequently, highlighting a similar pattern of outcomes. Similarly, Tadasa et al.^[16] found that acute transfusion reactions occurred in 5.7% of patients, with FNHTRs accounting for 63.6% and allergic reactions for 36.4%, further supporting the observation that non-hemolytic reactions are more common than hemolytic ones. Overall, these results indicate that while transfusion is generally safe, FNHTRs and allergic reactions remain the most frequently observed adverse events, reinforcing the importance of careful monitoring and adherence to transfusion protocols to ensure patient safety.

In the present study, adverse events occurred more frequently in cases where pretransfusion errors were present, with 4 out of 25 patients (16%) experiencing an adverse outcome compared to only 2 out of 75 (2.7%) in error-free cases. Overall, six patients experienced transfusion-related adverse events, highlighting the direct impact of pretransfusion errors on patient safety. These findings are consistent with previous literature. Sidhu et al.^[17] identified 2,229 errors in pretransfusion testing over a year, of which 12 (0.26%) resulted in actual harm, emphasizing the critical importance of accurate sample handling and labeling to prevent adverse outcomes. Similarly, Das et al.^[18] reported that 164 errors in pretransfusion testing samples, predominantly clerical and human errors, contributed to adverse events, with a majority occurring during night shifts, suggesting that heightened vigilance and strict adherence to protocols could mitigate patient harm. Collectively, these studies and our findings underscore that even a small number of pretransfusion errors can significantly increase the risk of adverse transfusion outcomes, reinforcing the need for robust quality assurance and monitoring systems in transfusion practice.

Limitations of the study

This study had several limitations:

- Small sample size may limit the generalizability of the findings.
- The study's limited geographic scope may introduce sample bias, potentially affecting the broader applicability of the findings.

CONCLUSION

This study shows that pretransfusion testing practices were generally well adhered to, though errors such as incomplete forms and mislabeling were still observed. Transfusions were largely safe, but adverse events occurred more frequently when pretransfusion errors were present. These findings underscore the importance of strict compliance with testing protocols and meticulous documentation to ensure patient safety.

REFERENCES

1. Sazama K. Reports of 355 transfusion-associated deaths: 1976 through 1985. *Transfusion*. 1990 Sep;30(7):583-90.
2. Ingrand P, Surer-Pierres N, Houssay D, Salmi LR. Reliability of the pretransfusion bedside compatibility test: association with transfusion practice and training. *Transfusion*. 1998 Nov 12;38(11-12):1030-6.
3. Dzik WH, Murphy MF, Andreu G, Heddle N, Hogman C, Kekomaki R, Murphy S, Shimizu M, Smit-Sibinga CT, Biomedical Excellence for Safer Transfusion (BEST) Working Party of the International Society for Blood Transfusion. An international study of the performance of sample collection from patients. *Vox Sanguinis*. 2003 Jul;85(1):40-7.
4. Maffei LM, St J. American Association of Blood Banks Technical Workshop on Pre-transfusion testing: Routine to complex; Current state of the art: The surveys pretransfusion testing; The survey routine and complex problem solving. In: AABB Annual Meeting. 1997.
5. American Association of Blood Banks. Committee on Standards. Standards for blood banks and transfusion services. The Committee; 1984.
6. Shulman IA, Maffei LM, Johnson ST, Steiner EA. Pretransfusion testing practices. *CAP Today*. 1996;10:85-6.
7. Vengelen-Tyler V, editor. Technical manual. 12th ed. Bethesda (MD): American Association of Blood Banks; 1996.
8. Jain A, Kumari S, Marwaha N, Sharma RR. The role of comprehensive check at the blood bank reception on blood requisitions in detecting potential transfusion errors. *Indian Journal of Hematology and Blood Transfusion*. 2015 Jun;31(2):269-74.
9. Dzik WH. New technology for transfusion safety. *British journal of haematology*. 2007 Jan;136(2):181-90.
10. Kipkulei JC, Buziba N, Mining S, Jepngetich H. Demographic and clinical profiles of blood transfusion recipients at a teaching and Referral Hospital in Kenya. *Open Journal of Blood Diseases*. 2019 Mar 13;9(01):30.
11. Jacques FD, Julmisse SC, Laurore AC, Lefruit RM, Chery MJ, Dubique K. Red blood cell transfusion in a tertiary Haitian hospital's emergency department: patient characteristics and availability challenges. *International Journal of Emergency Medicine*. 2024 Sep 27;17(1):128.
12. Shulman IA, Maffei LM, Downes KA. North American pretransfusion testing practices, 2001-2004: results from the College of American Pathologists Interlaboratory Comparison Program survey data, 2001-2004. *Arch Pathol Lab Med*. 2005 Aug;129(8):984-9.
13. Jain A, Kumari S, Marwaha N, Sharma RR. The role of comprehensive check at the blood bank reception on blood requisitions in detecting potential transfusion errors. *Indian J Hematol Blood Transfus*. 2015 Jun;31(2):269-74.
14. Quillen K, Murphy K. Quality improvement to decrease specimen mislabeling in transfusion medicine. *Archives of pathology & laboratory medicine*. 2006 Aug 1;130(8):1196-8.
15. Sidhu M, Meenia R, Yasmeen I, Akhtar N. A study of transfusion related adverse events at a tertiary care centre in North India: an initiative towards hemovigilance. *Int J Adv Med*. 2015 Jul;2(3):206-10.
16. Tadasa E, Adissu W, Bekele M, Arega G, Gedefaw L. Incidence of acute transfusion reactions and associated factors among adult blood-transfused patients at Jimma University Medical Center, southwest Ethiopia: A cross-sectional study. *Medicine*. 2024 Aug 9;103(32):e39137.
17. Sidhu M, Meenia R, Akhter N, Sawhney V, Irm Y. Report on errors in pretransfusion testing from a tertiary care center: A step toward transfusion safety. *Asian J Transfus Sci*. 2016 Jan-Jun;10(1):48-52.
18. Das SS, Chakrabarty R, Zaman RU. Monitoring errors in a blood bank immunohematology laboratory: Implementing strategies for safe blood transfusion. *Global Journal of Transfusion Medicine*. 2017 Jul 1;2(2):118-23.