

ABO blood group discrepancies: Study of prevalence and related factors

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ABSTRACT

Background:

ABO discrepancy is any deviation from the expected pattern of red cell antigen grouping with serum-grouping or when the forward-grouping results do not correlate with reverse-grouping results. This study was done to determine the incidence and causes of ABO discrepancies and to identify the correct blood group for safe blood transfusions.

Methods:

This is a retrospective descriptive study. It was done on 9970 samples collected between June 2017 and May 2018. All ABO typing records kept at the Grande International Hospital (GIH) blood bank laboratory were reviewed.

Results:

During the study period, 9970 blood grouping tests were performed. ABO discrepancies occurred in 26 of them. Discrepancies were more prevalent in the age of 20-30 and 30-40 years. Majority were seen in patients with history of pregnancy/miscarriage (30%) and with any Carcinoma (23%). The most common blood group involved was B with 34% frequency. 96% were reverse discrepancy type, 84% with extra antibody which was resolved by incubating the sample at 37°C for 30 minutes signifying most probably A and B subgroups and auto/allo antibodies.

Conclusion:

This study emphasizes the need of considering ABO discrepancies in blood banks for donors and recipients for safe blood transfusion to avoid any fatal complications. This discrepancy ratio of 1/384 is more than in other studied population of other countries and also higher than ABO mismatched transfusion in standard centers in Nepal. Repeat testing and investigating for ABO subgroups and auto/allo antibodies is important.

Key words: **Discrepancy, ABO/Rh typing, blood transfusion**

Introduction

ABO grouping is a simple, accurate, and precise procedure and for its validity, the results of cell grouping and serum grouping should agree. In ABO blood group system, the sorting of human blood is based on the inherited properties of red blood cells as determined by the occurrence or absence of the antigens A and B, which are carried on the surface of the red cells. Persons may therefore have type A, type B, type O, or type AB blood. Blood containing red cells with type A antigen on their surface has in its serum antibodies against type B red cells¹.

The A, B, and O blood groups were first identified by Austrian immunologist Karl Landsteiner in 1901².

When the red cell antigen grouping (Forward) results do not correlate with serum grouping (Reverse), a discrepancy is said to exist. In such cases, interpretation of the ABO type must be delayed until the discrepancy is resolved³. In a clinical urgency, group O, Rh- compatible RBCs can be transfused until the resolution of discrepancy⁴.

There are four types of ABO discrepancies.

- Group I discrepancies comprise the unexpected reactions in the reverse grouping due to weakly reacting or missing antibodies.
- Group II discrepancies are those from unexpected reactions in forward grouping due to weakly reacting or missing antigen.
- Group III discrepancies occur due to protein or plasma abnormalities, rouleaux formation and pseudo agglutination.
- Group IV discrepancies are of a miscellaneous group and may be due to transfusion of out of group plasma containing component, presence of cold alloantibody, or autoantibody, pH dependent autoantibody, a reagent dependent antibody (e.g. EDTA, paraben) and IVIG therapy (from ABO isoagglutinins). Mix field agglutination with circulating red cell of more than one ABO type and polyagglutination (e.g. T activation) resulting from inherited or acquire. The abnormalities of red cell membrane also constitute group IV discrepancies.

ABO and Rh blood group discrepancies account for a considerable number of reported transfusion associated reactions⁵. Human errors are a major contribution to blood grouping discrepancies but

some errors are not unavoidable^{6,7}, but luckily, most of these errors do not lead to a critically adverse effects. Since blood transfusion is an extended and complex process linking many steps and individuals, there is possibility for a high rate of error. ABO and Rh discrepancy can thus occur^{6,7,8,9}. Most of the ABO discrepancies are due to the technical error, errors in collection, errors in documentation and registration, phlebotomy errors and occasionally due to physiological problems of the patients.

Objectives

The aim of this study was to assess the ABO discrepancies which occurred during the 1 year study period and how they were handled. To the best of our knowledge, Blood types errors found on different techniques have not been published, or the subject addressed from Nepal.

Materials & Methods

All blood bank ABO typing records kept at the GIH blood bank laboratory between June 2017 to May 2018 were reviewed. The following steps were followed:

- ABO and Rh typing was done which included forward cell grouping and reverse serum grouping by 2 methods i.e. tube method and gel card method done through standard operating procedure. (Grande-BB-SOP-01, page 3,4,6 & 8)
- For forward grouping reagents used were as follows:
 - Anti-A and Anti B - IgM monoclonal antibody (ABO grouping)
 - Anti D - IgM monoclonal antibody (Rh typing)
- For reverse grouping, reagents used were as follows:
 - Pooled known A, B, O cells
 - Other reagents: 6 % Albumin, Auto control (own cells and own serum)
- For A subgroup anti-A lectin was used which reacts directly with A1 and A1B but not A2 or A2B red cells.
- Ortho Bio Vue system Anti-A/Anti- B/ Anti-D Control Reverse diluents gel card for gel card grouping

- All technical errors, errors in sampling, reagent errors were excluded.
- Discrepancies were solved according to discrepancy type protocol.
- Results of work-up were interpreted using a table (Grande-BB-SOP-01, page5)

Results

During 1 year, 9970 blood grouping tests were performed at Grande International Hospital (GIH). ABO discrepancies occurred 26 times with a frequency of 0.26% (1 per 384 samples). Male to female ratio was 42 to 58. The discrepancies were found to be more prevalent in the child bearing age of 20-30 years (38%) and age 30-40 (26%). Discrepancies were most commonly found in patients with a history of pregnancy/miscarriage (30%), history of carcinoma (23%), and without any significant clinical history (23 %).

Table 1: History of patient with ABO discrepancy

| Patient's history | Frequency | Percent |
|---|-----------|---------|
| Transfusion 3 months previously | 1 | 3.8 |
| Second trimester pregnancy, Transfusion history | 1 | 3.8 |
| Acute renal failure | 1 | 3.8 |
| Bone marrow transplant | 1 | 3.8 |
| Carcinoma of breast | 1 | 3.8 |
| Carcinoma of esophagus | 1 | 3.8 |
| Carcinoma of pancreas/TB | 1 | 3.8 |
| Chronic liver disease | 2 | 7.7 |
| Sarcoma | 1 | 3.8 |
| Lymphoma | 1 | 3.8 |
| Lymphoma under chemotherapy | 1 | 3.8 |
| Nothing Significant | 6 | 23.1 |
| Pregnancy | 5 | 19.2 |
| Pregnancy/ Hyperthyroidism | 1 | 3.8 |
| Pregnancy/ Miscarriage before | 1 | 3.8 |
| Transfusion history | 1 | 3.8 |
| Total | 26 | 100.0 |

The most common blood group involved was B (34%), followed by A (26%), AB (23%) & O (17%).

Table 2: Frequency of ABO discrepancy

| Blood Group | Frequency | Percent |
|-------------|-----------|---------|
| A positive | 7 | 26.9 |
| B Positive | 7 | 26.9 |
| B Negative | 2 | 7.7 |
| AB Positive | 4 | 15.4 |
| AB Negative | 2 | 7.7 |
| O Positive | 4 | 15.4 |
| Total | 26 | 100.0 |

Reverse discrepancy type i.e. 96% with 84 % extra antibody was resolved by incubating the sample at 37°C for 30-60 minutes respectively signifying most probably A and B subgroups and auto/allo antibodies.

Table 3: Methods of resolving the discrepancy

| Resolved by | Frequency | Percent |
|---|-----------|---------|
| Room temperature for 30 minutes | 1 | 3.8 |
| At 4°C for 30 minutes | 3 | 11.5 |
| At 37°C for 30 minutes | 10 | 38.5 |
| At 37°C for 30 minutes | 5 | 19.2 |
| At 37°C for 1 hour | 5 | 19.2 |
| tested with A2 cell and tested at 37°C for 1 hour | 2 | 7.7 |
| Total | 26 | 100.0 |

Discussion

The study on analysis of ABO discrepancies in 35 French hospitals showed the incidence of ABO discrepancies of 1 per 3400, most of which were due to phlebotomy errors, collection from wrong patient and clerical errors – in descending order¹⁰. Similar study done at a University hospital in Saudi Arabia showed 261 discrepancies in 549229 samples. The most common causes were errors of blood collection during phlebotomy and clerical errors¹¹.

Another genomic study on 324 clinical samples showed that the number of definable alleles associated with ABO subgroups has increased from 14 to 29 from the earlier study¹².

Clerical errors are common and are responsible for one third of transfusion related deaths. Mix-up sample, phlebotomy errors, misidentification and the technical errors were found to be common in all other studied done previously. We have excluded all these errors in this study.

Conclusion

1 per 384 discrepancies in this study emphasizes the need of considering ABO discrepancies in blood banks for donors and recipients for safe blood transfusion to avoid any fatal complications. This discrepancy ratio is more than in other studied population of other countries. This incidence is also higher than ABO mismatched transfusions at standard centers in Nepal. Repeat testing and investigating for ABO subgroups and auto/allo antibodies is important in patients with clinical significance or without any medical history.

References

1. Daniels G. Human blood groups. John Wiley & Sons. 2008.
2. Giangrande PL. The history of blood transfusion. *Br J Haematol.* 2000;110(4):758-67.
3. Arumugam P, Hamsavardhini S, Ravishankar J, Bharath RR. Resolving ABO discrepancies by serological workup-an analysis of few cases. *Int J Res Med Sci.* 2017; 5(3):893-900.
4. Chapman JF, Elliott C, Knowles SM, Milkins CE, Poole GD et al. Guidelines for compatibility procedures in blood transfusion laboratories. *Transfus Med.* 2004; 14(1):59-73.
5. Cangialosi TJ, Riolo ML, Owens S, Dykhouse VJ, Moffitt AH, Grubb JE et al. The ABO discrepancy index: a measure of case complexity. *Am J Orthod Dentofacial Orthop.* 2004; 125(3): 270-78.
6. Khan MN, Khan TA, Ahmed Z. Discrepancy in ABO Blood Grouping. *J Coll Physicians Surg Pak.* 2013; 23(8): 590-92.
7. Jawitz OK, G Jawitz N, Yuh DD, Bonde P. Impact of ABO compatibility on outcomes Dier heart transplantation in a national cohort during the past decade. *J HorDc Cardiovasc Surg.* 2013;146: 1239-12946.
8. Milkins C, Berryman J, Cantwell C, Elliott C, Haggas R, et al. Guidelines for pretransfusion compatibility procedures in blood transfusion laboratories. *Transfus Med.* 2013; 23(1): 3-35.
9. Ansari S, Szallasi A. 'Wrong blood in tube': Solutions for a persistent problem. *Vox Sang.* 2011;100(3): 298-302.
10. Chiaroni J, Legrand D, Dettori I, Ferrera V. Analysis of ABO discrepancies occurring in 35 French hospitals. *Transfusion.* 2004;44(6):860-4.
11. Qutub H, ABIM A. Analysis of ABO Discrepancies Occurring at a University Hospital, Al-khobar, Saudi Arabia. *Bahrain Med Bull.* 2009;31(4).
12. Olsson ML, Irshaid NM, Hosseini-Maaf B, Hellberg Å, Moulds MK, Sareneva H, Chester MA. Genomic analysis of clinical samples with serologic ABO blood grouping discrepancies: identification of 15 novel A and B subgroup alleles. *Blood.* 2001;98(5):1585-93.