INDONESIAN JOURNAL OF
CLINICAL PATHOLOGY AND MEDICAL LABORATORY
Majalah Patologi Klinik Indonesia dan Laboratorium Medik

PAGE 117
2024 March; 30 (2): 117-121
p-ISSN 0854-4263 e-ISSN 2477-4685
Available at www.indonesianjournalofclinicalpathology.org

Analysis of Blood Group Discrepancy at Dr. Wahidin Sudirohusodo Hospital's Blood Transfusion Unit Makassar

Erdayanti[1], Rachmawati Muhiddin[1], Mansyur Arif[1,2,3]

[1] Department of Clinical Pathology, Faculty of Medicine, Hasanuddin University/Dr. Wahidin Sudirohusodo Hospital, Makassar, Indonesia. E-mail: erdarzl@gmail.com
[2] Hasanuddin University Hospital, Makassar, Indonesia
[3] Dr. Tadjuddin Chalid Hospital, Makassar, Indonesia

ABSTRACT

Discrepancy is a lack of compatibility of blood group tests between forward grouping and reverse grouping. Based on the cause, discrepancies are divided into four groups as follows: group I discrepancies, which occur due to weak or missing antibodies, group II discrepancies, which occur due to weak or missing antigens, group III discrepancies, which result in the formation of rouleaux, and group IV discrepancies, which are caused by other problems. A retrospective study was carried out by using ABO blood group data, which were analyzed by the automatic gel test method with the IH-1000 device. Data from January 2019 to December 2021 was collected at the Blood Transfusion Unit, Dr. Wahidin Sudirohusodo Hospital of Makassar, and the data were grouped using SPSS version 22. A total of 21.742 samples were tested. The number of detected ABO blood group discrepancies was 127 (0.58%). There were 68 (51.3%) males and 59 (46.5%) females with an age range divided into toddler (38.6%), child (2.4%), adolescent (13.4%), adult (8.7%), pre-elderly (17.3%), and elderly (6.3 %). Based on the disease, discrepancies were categorized into samples with infectious disease (33.9%), autoimmune disease (3.9%), malignancy (23.6%), chronic disease (11%), and others (27.6%). The discrepancies consisted of group I (70.9%), group II (0%), group III (0.8%), and group IV (28.3%). There was a significant correlation between age and blood group discrepancy with $p < 0.001$ and moderate correlation strength (0.54). The prevalence of discrepancy in this study was 0.58%. Discrepancies must be resolved before they are reported to minimize transfusion reactions.

Keywords: Discrepancy, blood group, forward grouping, reverse grouping

INTRODUCTION

Discrepancies are a lack of compatibility in blood group testing results between forward grouping (cell typing) and reverse grouping (serum typing/back typing).[1] Cell classification is a blood group test to detect the presence of antigens on the surface of the erythrocyte membrane by reacting these erythrocytes with antisera anti-A and anti-B, whereas serum classification is a blood group test to detect antibodies in serum or plasma, which is reacted with a suspension of erythrocytes type A, B and O from healthy individuals whose blood type is known (as a negative comparison) and auto-control by using their erythrocytes.[2,3]

A study by Sahu *et al*. found 15 discrepancies in 12.715 samples (0.12%).[4] Similar studies done by Makroo N *et al*. and Jain A *et al*. have shown that the prevalence of ABO discrepancy ranges from 0.02 to 0.064%.[5,6] The discrepancy is mostly caused by technical errors including administration errors and sample identification. Problems arise when there are complaints, blood transfusion reactions, doubts in the interpretation of agglutination, and difficulties in determining blood type. Misinterpretation due to discrepancies can threaten the patient's life. This can occur due to technical errors and various clinical conditions or diseases. Therefore, it is necessary to remove all factors of technical errors possibly leading to discrepancies. Technical errors that can cause discrepancies are labeling errors, contaminated reagents, over-centrifugation or lack of centrifugation, incorrect incubation temperature, and misinterpretation or error in recording the results.[7,8] After eliminating technical faults, it is necessary to find out explanations related to the patient's status (age, disease diagnosis, history of blood transfusion and medication, and pregnancy) and the presence of diseases or abnormalities. Based on the cause, discrepancies can be divided into four groups, such as:[9,10] Group I discrepancy, which occurs in serum classification due to weak or missing antibodies. This condition can be found in newborns, the elderly, patients with leukemia, those who use

immune-suppressing drugs, people with congenital agammaglobulinemia and those who have undergone post-bone marrow transplants; Group II discrepancy, which occurs in serum classification due to weak or missing antigen. This can occur in people with Hodgkin's disease or people with persistent diseases such as leukemia or pancreatic Ca; Group III discrepancy, which occurs in the classification of cells and serum due to protein or plasma abnormalities, resulting in unexpected antigen reactions which lead to the formation of rouleaux. This discrepancy occurs in multiple myeloma, an increase in the amount of fibrinogen, and plasma expanders (dextran). Other diseases such as Waldenstrom macroglobulinemia, plasma dyscrasias, and others can also cause this type of discrepancy; Group IV discrepancy, which occurs in the classification of cells and serum due to a problem in the antibody. This usually occurs in cold reaction autoantibodies in which erythrocytes coated with antibodies will agglutinate directly or cause unexpected isoagglutination and others.[11-13]

Based on the findings above, the authors aimed to research the discrepancies in the Blood Transfusion Unit at Dr. Wahidin Sudirohusodo (UTD-RSWS) Hospital, Makassar.

METHODS

A retrospective study with a cross-sectional study method was carried out using data from the UTD Hospital Information System at Dr. Wahidin Sudirohusodo Hospital, Makassar with a recommendation for ethical approval with number: LB.02.04/2.2 /11823/2022.

Data of ABO blood groups from January 2019 to December 2021 were used. A blood group test was carried out using the microplate gel test method with an IH 1000 analyzer.

The study sample was an accessible population, which met the inclusion criteria, namely patients with blood group discrepancy results on pre-transfusion blood group screening tests. A total of 21,742 blood group test results from January 2019 to December 2021 showed 127 discrepancies.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 22. Descriptive statistical calculations with Gamma and Somers D correlation tests were used for statistical analysis. Ethical eligibility approval was obtained from the Health Research Ethics Commission, Faculty of Medicine, Hasanuddin University, Dr. Wahidin Sudirohusodo Hospital. The research was conducted based on ethical clearance recommendations obtained from the Hasanuddin University Research Ethics Committee (KEP) number: 434/UN4.6.4.5.31/ PP36/2022.

RESULTS AND DISCUSSIONS

The study used a cross-sectional design using 21,742 data of blood group tests from January to December 2021 at the Blood Transfusion Unit at Dr. Wahidin Sudirohusodo (UTD-RSWS) Hospital and 127 (0.58%) data of blood group discrepancies. Characteristics of research subjects with blood test discrepancies can be seen in Table 1.

Table 1. Characteristics of research subjects

Criteria	n (%)
Gender	
Male	68 (53.5)
Female	59 (46.5)
Age	
Toddler (0 – 5 years)	66 (52.0)
Child (6 – 11 years)	3 (2.4)
Adolescent (12 – 25 years)	17 (13.4)
Adult (26 – 45 years)	11 (8.7)
Pre-elderly (46 – 65 years)	22 (17.3)
Elderly (> 65 years)	8 (6.3)
Disease	
Infection	43 (33.9)
Autoimmune	5 (3.9)
Malignancy	30 (23.6)
Chronic	14 (11)
Others	35 (27.6)
Discrepancy of blood group test	
Missing/weak antibody	90 (70.9)
Missing/weak antigen	0 (0)
Extra antibody	36 (28.3)
Extra antigen	1 (0 8)

From the data in Table 1, it was known that the majority of the research subjects were male with 68 (53.5%) samples and female with 59 (46.5%) samples. The age range with the highest discrepancies was toddlers (0-5 years) with 66 (52.0%) samples, then pre-elderly (46-65 years) with 22 (17.3%) samples, teenagers (12-25 years) with 17 (13.4%) samples, adults (26-45 years) with 11 (8.7%) samples, elderly (> 65 years) with 8 (6.3%) samples and children (6-11 years) with 3 (2.4%) samples.

The disease category with the highest discrepancies was infectious disease with 43 (33.9%) samples, other diseases with 35 (27.6%) samples, malignancy with 30 (23.6%) samples, chronic diseases with 14 (11%) samples, and autoimmune diseases with 5 (3.9%) samples.

Table 2. Correlation between gender and blood group discrepancy

Gender	Discrepancy			Total	P	R
	Weak Ab	Extra Ag	Extra Ab			
Male	50	18	0	68	0.446	0.147
Female	40	18	1	59		
Total	90	36	1	127		

Table 3. Correlation between age and blood group discrepancy

Age	Discrepancy			Total	P	R
	Weak Antibody	Extra Antibody	Extra Antigen			
Toddler	57	9	0	66	< 0.001	0.544
Child	3	0	0	3		
Adolescent	9	8	0	17		
Adult	5	6	0	11		
Pre-elderly	13	8	1	22		
Elderly	3	5	0	8		
Total	90	36	1	127		

Table 4. Correlation between disease and blood group discrepancy

Diagnosis	Discrepancy			Total	P	R
	Weak Antibody	Extra Antibody	Extra Antigen			
Infectious disease	35	8	0	43	0.797	0.033
Autoimmune disease	1	4	0	5		
Malignancy	15	15	0	30		
Chronic disease	10	3	1	14		
Other diseases	29	6	0	35		
Total	90	36	1	127		

Based on Table 2, it was shown that Gamma and Somers'D correlation tests found no significant correlation between gender and blood group test discrepancy with a p-value of 0.446 (p > 0.05).

Based on Table 3, it was shown that Gamma and Somers'D correlation tests found a significant correlation between age and blood group discrepancy with a p-value of <0.001 (p > 0.05) and a correlation strength of 0.544 (moderate correlation).

Based on Table 4, it was shown that Gamma and Somers'D correlation tests found no significant correlation between the disease and the blood group test discrepancy with a p-value of 0.797 (p > 0.05).

A retrospective study with a cross-sectional design using 21,742 blood group test data from January 2019 to December 2021 at the Blood Transfusion Unit of Dr. Wahidin Sudirohusodo Hospital found that there were 127 (0.58%) data with blood group discrepancies. This finding was relatively high compared to studies conducted by other authors from various countries (Table 5), which showed that the prevalence of ABO blood group discrepancy ranged from 0.02 to 0.24%.[8,14]

Table 5. Prevalence of discrepancy in some countries[13]

Authors	Year	Total Data	Discrepancy
Thakral *et al.*	2005	86,687	None
Sharma *et al.*	2013	104,010	51 (0.04%)
Kaur *et al.*	2013	44,425	28 (0.06%)
Makroo *et al.*	2019	62,080	14 (0.02%)
Jain *et al.*	2018	144,279	93 (0.064%)
Heo *et al.*	2019	552,959	1334 (0.24%)

The prevalence rate of ABO blood group discrepancy in this study was higher than in other studies. This was due to genetic diversity and demographic variation. The relatively smaller population sample size in this study might also be another reason for the higher prevalence rate. Young Heo *et al.* demonstrated that donor-based studies had lower rates than those conducted on patients.[8]

Table 1 shows a higher number of male (53.5%) compared to female subjects (46.5%). This was similar to a study conducted by Sahu *et al.* in India in 2022, which found a higher percentage of males (98.6%) in blood group discrepancy.[4]

Table 6. Comparison of discrepancy criteria in several studies[16]

Study	Group I %	Group II %	Group III %	Group IV %
Arumugam *et al.*	1 (4.76)	2 (9.53)	1 (4.76)	15 (71.42)
Shanti *et al.*	0	1,089 (81.81)	0	246 (18.46)
Heo *et al.*	8 (14.55)	17 (30.90)	0	38 (69.18)
Esmaili *et al.*	82 (82.00)	2 (2.00)	10 (10.00)	6 (6.00)
Sharma *et al.*	30 (58.82)	12 (23.53)	0	6 (11.76)
Rahgozar *et al.*	17 (41.46)	14 (34.16)	0	5 (12.19)

Most of the research subjects were toddlers aged 0-5 years with 66 (52.0%) patients, while the age group with the lowest percentage was children aged 6-11 years with 3 (2.4%) patients. Subjects in this study were categorized based on age group according to WHO. A theory by Seimalhdarh suggests that weak antibody cases can occur at the age of < 6 months and at an advanced age of > 65 years, making age one of the causes of discrepancy. There were 48 subjects under the age range of 6 months and 8 subjects > 65 years old in this study.

Table 1 shows that the highest number of diseases found in the subjects with blood group discrepancy was 43 (33.9%) infectious diseases, and the least disease was 5 (3.9%) autoimmune diseases. There were around 40 more diagnoses found in the data we have collected. Because the diagnoses were very diverse, a general classification of diseases was then used.

Table 1 also shows that samples with group 1 discrepancies with weak/missing antibodies had the highest prevalence of 90 (70.9%) cases. A recent study by Jain *et al.*, and a study by Sharma *et al.*, Esmaily *et al.*, and Nathani *et al.* observed that the ABO type I discrepancy was the most common type of discrepancy (Table 6).[15-17] This weak reaction or loss of antibodies occurs because the patient has problems producing antibodies or inability to produce ABO antibodies. This type of discrepancy can occur in newborns, elderly patients, patients with lymphoma, patients taking immunosuppressive drugs, patients with immunodeficiency diseases, and bone marrow transplants.[18-20] However, this theory was contradictory to the theory by Arumugam and Heo *et al.* suggesting that the most common discrepancy is group IV.[8,21]

Based on Table 2, it was shown that the Gamma and Somers'D correlation tests found no significant correlation between gender and blood group test discrepancy with a p-value of 0.446 (p > 0.05).

Based on Table 3, it was shown that the Gamma and Somers'D correlation tests found a significant correlation between age and blood group test discrepancy with a p-value of <0.001 (p > 0.05) and a correlation strength of 0.544 (moderate correlation).

Based on Table 4, it was shown that the Gamma and Somers'D correlation tests found no significant correlation between type of disease and blood group test discrepancy with a p-value of 0.797 (p > 0.05).

The use of secondary data, limited information from SIRS, and the inability to assess other factors such as history of transfusion and history of drug use, etc., which might influence discrepancy events remained the limitations of this study.

CONCLUSIONS AND SUGGESTIONS

The incidence of discrepancies found in this study was relatively higher compared to other countries. The most common ABO blood group discrepancy found in this study was group I (weak/missing antibody). There was a significant correlation between age and blood type discrepancy with p <0.001 and medium correlation strength (0.54).

By considering many cases of discrepancy, it was expected that all personnel be more careful before giving blood for transfusions to avoid unwanted events. Further research was needed to analyze other factors such as the history of transfusion and history of drug use, which might influence the discrepancy.

REFERENCES

1. Desai P, Navkudkar A, Rajadhyaksha S. ABO blood group discrepancies in blood donor and patient samples at a tertiary care oncology centre: Analysis and serological resolution. Hematol Transfus Cell Ther [published online ahead of print, 2023 Sep 6], 2023; S2531-1379(23)00168-2.
2. Irawaty I, AM R, Arif M. Characteristics of crossmatch types in compatibility testing on diagnosis and blood types using gel method. Indonesian J. Clin. Pathol. Med. Lab. [Internet]. 2018; 23(1): 36-41. Available from: https://www.indonesianjournalofclinicalpathology.org/index.php/patologi/article/view/1182 (accessed Nov 3, 2023).
3. Mujahid A, Dickert FL. Blood group typing: From classical strategies to the application of synthetic

antibodies generated by molecular imprinting. Sensors (Basel), 2015; 16(1): 51.
4. Sahu A, Prakash S, Das N, Routray SS, Naik A, Mukherjee S. Analysis of blood group discrepancy in healthy blood donors at a tertiary care referral hospital from Eastern India: A retrospective study. J Lab Physicians, 2022; 14(3): 247-252.
5. Makroo RN, Kakkar B, Agrawal S, Chowdhry M, Prakash B, Karna P. Retrospective analysis of forward and reverse ABO typing discrepancies among patients and blood donors in a tertiary care hospital. Transfus Med, 2019; 29(02): 103–109.
6. Jain A, Garg S, Marwaha N, Sharma RR. ABO blood grouping discrepancies in the donor population. ISBT Sci Ser, 2020; 15(02): 281–285.
7. Javadzadeh Shahshahani H, Hayati A. Blood group discrepancies at a Regional Blood Center. Int J Hematol Oncol Stem Cell Res, 2020; 14(1): 38-44.
8. Heo WY, Chung YN, Kim TY, Yu HB, Bae JC, *et al.* Analysis of ABO grouping discrepancies among patients from a tertiary hospital in Korea. Transfus Apher Sci, 2021;60(6): 103230.
9. Meny GM. Recognizing and resolving ABO discrepancies. Immunohematology, 2017; 33(2): 76-81.
10. Harmening DM. The ABO blood group system. Modern blood banking and transfusion practices. 5th Ed., USA, Davis Company, 2015; 109–128.
11. Chaitanya Kumar IS, Babu B. Suresh, Arun R, Sreedhar Babu KV, Praveen MD, *et al.* Blood group discrepancy: Is it group I or group III? Journal of Clinical and Scientific Research, 2019; 8(1): 42-43.
12. Mishra D, Parida P, Mahapatra S, Sahoo BB. Resolving blood group discrepancy in patients of the tertiary care centre in Odisha, India. Int J Res Med Sci, 2018; 6(7): 2348-53. Available from: https://www.msjonline.org/index.php/ijrms/article/view/4964 (accessed Nov 3, 2023).
13. Miah SS, Islam A, Linia MS. A close aspect of recognizing and resolving blood group discrepancy carried in a tertiary hospital, Bangladesh. Int J Blood Transfus Immunohematol, 2021; 11: 100056Z02SM2021.
14. Moghaddam, Esmaeil Sanei, Sohaila Khosravi, Akbar Dorgalaleh. Discrepancies in ABO and Rh grouping in Southeast Iran, an analysis of 3 years' experience. Journal of Blood Disorders and Transfusion, 2016; 7: 1-3.
15. Sharma T, Garg N, Singh B. ABO blood group discrepancies among blood donors in Regional Blood Transfusion Centre GTB Hospital, Delhi, India. Transfus Apher Sci, 2014; 50(1): 75-80.
16. Esmaili HA, Taghipour H, Talghini S, Mohammadhoseyni B. An analysis of discrepancies between forward and reverse ABO blood grouping. Res J Pharm Bio Chem Sci, 2014; 5(3): 1360-6.
17. Nathani KJ, Patel JN, Patel KA, Wardhani SJ. Study of discrepancies in ABO blood grouping: Experience of a tertiary health-care center. International Journal of Research in Medical Sciences, 2021; 9(12): 3621-3626.
18. Wasnik M, Lahare S, Jagzape T, Chandrakar RK. Blood group discrepancy in mixed-type autoimmune hemolytic anemia in a pediatric patient. Asian J Transfus Sci, 2021; 15(2): 247-249.
19. Fathima S, Killeen RB. ABO Typing discrepancies. In: StatPearls. StatPearls Publishing, Treasure Island (FL), 2022; PMID: 36251843.
20. Mu S, Sha C, Ren S, Xiang D. Clinical characteristics and influence factor analysis of ABO typing discrepancy among patients in a tertiary hospital. Clin Lab, 2021; 67(11): PMID: 34758226.
21. 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-