ORIGINAL ARTICLE

ABO Discrepancies & Errors in A Routine Blood Bank

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ABSTRACT

Objective: To identify the incidence & type of ABO discrepancies and errors leading to wrong results

Place & Duration: Retrospective study conducted in the EIBDK institute of hematology, Dow University of health sciences, Karachi, Pakistan. From June 2012 till June 2013

Material & Methods: All the data of ABO grouping during study period was collected. ABO discrepancies, pre-analytical, analytical& post –analytical errors in routine blood grouping were noted and recorded on a proforma designed for the study and results were tabulated.

Results: 30 discrepancies (0.3 %), 18 (0.18 %) pre & post analytic errors were identified from a total of 10,000 blood group tests performed during the study period. The commonest of all was ABO discrepancy due to sub-groups n 26 (86.6 %) followed by auto-antibodies n 4 (13.3 %).

Conclusion: ABO discrepancy is not an infrequent finding in routine blood banking while pre-analytical, analytical and post analytical errors are also seen in routine practice and are small but very important source of mistakes which can lead to serious hazards of transfusion. Measures should be taken to identify and resolve these discrepancies while ensuring proper collection, labeling, analysis and reporting of results for safe blood transfusion.

Key words: ABO group, Discrepancy, Mislabeling, Pre-analytical errors, Alloantibody, Analytical errors

INTRODUCTION

Safe blood transfusion practice is of crucial importance during patient's care and can be ensured by setting down and strictly following appropriate and recommended SOPs. Accurate blood grouping of both donor and recipient is the first major step in this practice. It has been seen that in USA about 37 % of transfusion related problems are due to pre-analytical and clerical errors[1].

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ABO discrepancies arise when unexpected reactions occur in cell and serum grouping and confirmed after excluding all the possibilities of technical errors. There are four types of discrepancies from I to IV[2]. Type I is when unexpected reactions occur in reverse grouping usually due to weak or missing antibodies while in group II, unexpected reactions occur in cell or forward grouping usually due to missing or weak antigens. On the other hand group III discrepancy occurs due to a protein or plasma abnormalities and result in rouleoux formation or pseudo-agglutination while group IV occur due to miscellaneous problems especially due to cold antibodies, unexpected ABO and non-ABO alloantibodies as seen in stem cell transplant and other multitransfused patients. It is also important to know the patients' age, diagnosis, medications, history of transfusion and in case of females their pregnancy status. Once the discrepancy has been identified, it should be recorded and results of blood

group with held till it has been resolved. If there is an urgent need of blood transfusion on a background of blood group discrepancy then group"O" Rh compatible RBCs can be given before the discrepancy has been resolved. Since the advent of technology, improving knowhow and rapid updates on blood banking, major emphasis is being thrown on prevention of transmission of blood borne diseases but one should not forget the chances of mistakes by human handling which could be very harmful[3]. The sources of error can occur at multiple points as it involves many people right from identification of donor/recipient, collection, labeling, and dispatch, receiving and numbering in blood bank till the execution and reporting of blood group. Stress should be emphasized at each step especially the process of blood grouping with adequate, appropriate and properly stored anti-seras, known cells and gel cards. Samples should be stored for at least few days, in case re-grouping is desired[4].

It is well known that inappropriate labeling of samples is quiet a frequent finding and has been estimated in one study to be 6.45 % [4,5]. In addition sampling from a different patient and labeling it with different patient, can sometimes occur particularly by a over worked phlebotomist or nurse especially in emergency situations and overcrowded hospitals, is one of the common cause and has been shown in a multinational study involving 62 hospitals to be 0.09 % of all samples collected[6].

To the best of our knowledge enough work, regarding this aspect has not been done in this part of world. The purpose of our study is to be aware of the frequency and types of ABO discrepancies and other errors due to pre-analytical, analytical and post analytical factors leading to erroneous results.

METHOD AND MATERIAL

The blood bank register for ABO grouping and cross match was reviewed from June 2012 till June 2013.The samples were taken in EDTA (ethylene di-amine tetra acetic acid) and plain tube from a peripheral vein and were immediately dispatched to the blood bank.

Adequate sample quantity was taken from both the vials for forward and reverse grouping. Forward grouping was done with 3 % red cell suspension with anti A, B and AB seras. Reverse or serum grouping was done from the sample serum with 3 % known cell suspension of A, B and O groups. An auto tube was also set containing same sample cells and serum. All the tubes were centrifuged for 20 seconds and noted for agglutination. For "A & AB" subgroups, A1 lectin was used for the detection of A2 & A2B sub-groups. A1 lectin is an extract of Dolichus biflorus that reacts with A1 and A1B cells but not with A2 or A2B cells. If the cells react then it is A1 or AIB sub-group, otherwise most probably it is A2 or A2B subgroup.

In cases where the previous record of group was available then it was also compared with the results of latest sample for the precision of results.

Discrepancies due to missing antibodies were resolved by incubating the samples and then mixing them with known cells at 4 C for 15 minutes while discrepancy due to cold antibodies was resolved by incubating the sample at 37 C for 15-30 minutes and then mixing it with known cells.

RESULTS

We were able to detect 30 ABO discrepancies & 28 errors of sampling and analysis. The number and frequency of involvement of major blood groups "A", "B", "AB" and "O" was 9(30%), 10(33.3%), 6(20%) and 5(16.7%) respectively. Females were 17 (56.7%) while males were 13(43.3%). The age range was between 12 and 60 years. The frequency of Type I, II & IV discrepancies was n 03 (11.53%), 01(3.84%) and 26(86.7%) respectively while we did not detect any Type III discrepancy. Type I & II discrepancies involved only O group while Type IV involved all the groups. There were 4 cases of auto antibodies including 2 males and 2 females. Incorrect labelling was identified in 15 (53.6%), expired known cells in 05 (17.8%). and wrong transcription of results was seen in 08 (28.6%) of all pre and post analytical errors.

Table 1.1. Various factors resulting in ABO blood group discrepancies/ erroneous results

Frequency of Discrepancies in Different Major Blood Groups							
	Blood Group		Frequency				Percent
1	A Positive		9				30
2	B Positive		8				26.66
3	B negative		2				6.66
4	AB Positive		4				13.33
5	AB Negative		2				6.66
6	O Positive		5				16.66
	Total		30				100
Type of ABO Discrepancies							
	Type	Description	n (%)	Blood Group	Male n	Female n	Total n (%)
1	Type I	Missing Antibody	03 (10)	O	02	01	
2	Type II	Extra Antigen	01 (3.3)	A	01	00	
3	Type III	Nil	00		00	00	
4	Type IV	Extra Antibody	26 (86.6) (n 4: auto-Ab)	A	04	05	09 (34.6)
				B	04	06	10 (38.4)
				AB	02	05	07 (26.9)
	Total ABO Discrepancies		30		13(43.3)	17 (56.6)	
	Sampling, Labeling & Errors of Analysis						
1	Wrong Labelling		15 (53.6)	Pre-analytical error			
2	Expired Known Cells		05 (17.8)	Analytical error			
3	Transcription Errors		08 (28.6)	Post-analytical error			
	Total Analytical Errors		28				

DISCUSSION

As it is mentioned in literature and few research papers, the sub-groups for ABO system are a significant cause of ABO discrepancy[7]. Table 1.1 shows that the frequency of these discrepancies is nearly the same in all blood groups but significantly less in O group. Table 1.2 shows different types of discrepancies. Type 1 discrepancy was due to absence of corresponding anti body, which is usually seen in neonates, old people and patients on chemotherapy. In our case there was no above mentioned reason and all were group "O" adult samples. In addition there was no significant difference in sex ratio and these were resolved by incubating at 4°C for about 15 minutes, as these give them more contact period at an optimum temperature. Type II was very negligible and occurred in a lady of group "O", who had a history of transfusion and this was resolved with incubation at 37°C. We were not able to see any type III discrepancy while there was a significant percentage of type IV discrepancy, in which we usually detect unexpected alloantibodies, sub-groups and auto-antibodies. Majority of ABO discrepancies were found in reverse grouping due to A 2 & A2B subgroups while few were due to cold reactive alloantibody. All the discrepancies were in reverse grouping and resolved on performing the group after incubation at 37°C, signifying the "cold" nature of these extra antibodies. Females had significantly more type IV discrepancies as compared to males and this may relate to their multi-parous history. Group A2 & A2B were detected in ABO discrepancy by detecting antibody to A1 subgroup and positive reaction of A cells with A1 lectin while some A2 & A2B did not show any extra antibody. Amongst them, quiet a significant number of cases had malignancies, which required frequent transfusions. It appeared that these were minor subgroups and developed alloantibodies subsequent to transfusions. Development of alloantibodies is not an infrequent finding in routine grouping and is usually found in multitransfused

Table 1.2. Details of ABO Discrepancies

Discrepancy	Blood group	Sex	Age	Antibody	History	Resolution
Type 1: Missing Ab n = 03 (10 %)	O	M	32	Anti B	Nil	Incubation at 4 C for 15 minutes
		M	50	Anti B	Nil	
		F	23	Anti B	Pregnancy	
Type 11: Extra antigen n =1 (3.3 %)	O	M	50	Antigen A & B, Anti A & B	H/O Tx	Incubation: 37 C for 30 minutes
Type 1V: Extra Ab n = 26 (86.7%)	A	M	34	Anti A	Tx 3 months ago	Incubation: 37 C for 30 & 60 minutes
		M	45	Anti A	Nil	
		M	38	Anti A	Nil	
		M	44	Autoantibody	Anemia	
		F	33	Anti A	CLD	
		F	45	Anti H & Anti A	Nil	
		F	12	Anti H & Anti A	Ewing's sarcoma	
		F	50	Anti H & Anti A	ARF	
		F	23	Autoantibody	Pregnancy	
	B	M	60	Anti H & Anti B	Tx	
		M	23	Anti H & Anti B	Ca esophagus	
		M	25	Anti H & Anti B	CLD	
		M	55	Autoantibody	Anemia	
		F	35	Autoantibody	Anemia & pregnancy	
		F	25	Anti B	Nil	
		F	21	Anti H & Anti B	Lymphoma	
		F	19	Anti H & Anti B	Pregnancy & hyperthyroidism	
		F	35	Anti H	Lymphoma on chemotherapy	
		F	55	Anti H	Ca breast	
	AB	M	35	Anti H	Nil	Incubation: 37 C for 30 minutes
		M	45	Anti B	Ca pancreas & TB	
		F	27	Anti A	Post BMT	
		F	27	Anti H & B	Ac renal failure	
		F	22	Anti H & B	Pregnant	
		F	26	Anti A & B	Pregnant	
	O	F	33	Autoantibody	Anemia	No resolution

their identification and supply of the corresponding antigen negative blood but unfortunately we had no facility of antibody identification at that time. Supply of appropriate blood group compatible in the presence of alloantibodies is quiet cumbersome and most of the time it is difficult to find a compatible blood[9]. This problem can be overcome by a regular donor pool with their sub-groups known.

Sub-groups can sometimes present a problem especially if the A2 or A2B recipient has developed anti A1 or A1B antibodies warm antibodies, which can sometimes proceed to a hemolytic reaction[10]. In our practice, as a routine we test all A & AB groups with A1 Lectin so as to identify the sub-groups and monitor the patient for development of immune antibodies.

Few cases also occurred due to the absence of corresponding antibody in reverse grouping. This can happen in neonates, old people and those who received chemotherapy[11].

Misidentification of samples can result in ABO incompatible transfusions resulting in death. It is reported that two dozen patients die every year in USA because of this problem [12].

Mislabeled samples creates a problem in grouping when cross checked in record register otherwise may result in wrong grouping of that particular patient resulting in transfusion of wrong blood group. In addition a person labelled with wrong blood group on his identification card can be in a very dangerous situation if he/she requires blood transfusion in case of extreme emergency, when transfusion becomes necessary without waiting for the grouping and cross match results. This problem was seen in 1:600000 in USA from

1990 to 1991[13]. This error can be abolished by avoiding rush or overcrowding situations, supply of enough phlebotomists and confirming the particulars with the identity card of patient. This problem can be minimized by checking the previous records, appropriate history and repetition with a freshly drawn sample.

Quality control is of utmost importance in blood banking[14], proper checking for the storage and expiry of known cells& anti-sera should be done at least twice a day and documented clearly on a chart visible to every body[15].

Use of mobile phones has revolutionized the life style but it can create problems by using it during working hours especially when involved in grouping and cross matching. For investigation of wrong results when we investigated retrospectively next day, we found that the technician was busy on the phone call/messaging and the same time was entering the results in the recording register. This problem can be overcome by making a policy for not using mobile phones during work.

Most of the time the pre-analytical errors are a major source of nuisance and more strict emphasis should be laid down on them[16].

The importance of record keeping should not be forgotten as they are useful to trace back in case of legal cases and when there is problem in investigation of transfusion transmitted diseases[17].

It is worth mentioning to regard errors and omissions as opportunities to improve the system instead of human failures. These measures include sustained efforts for strict compliance with phlebotomy procedures, careful patient identification and accurate & precise technical procedures in the blood bank. New technologies to increase safety and efficiency of blood transfusions, i.e. bar code and radiofrequency technologies should be adopted[18].

CONCLUSION

ABO discrepancies between forward and reverse grouping are frequently seen and the laboratory should resolve the problem before issuing the results. The nature of antibody should be accurately identified and blood issued accordingly, especially in cases of sub-groups of major blood groups. Cold antibodies should be confirmed as they may cause unnecessary avoidance of blood transfusion. Repeating the samples with discrepancies and sometimes re-collection of sample can provide accurate reporting and help prevent mistakes. Stress should also be laid on proper technique and the involvement of a trained and qualified technician. Distraction is an important cause of wrong transcription of results. We encountered three examples of erroneous transcription of results due to simultaneous use of mobile phone by the technologist.. We recommend limited use of mobile phones during working of medical technologist.

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