

Blood Type Distribution in Patients Attending the Laboratory of Yalgado Ouedraogo University Hospital, in Ouagadougou, Burkina Faso

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Abstract

Introduction: Determining erythrocyte antigens is a crucial and preventive procedure in case of any immunohematology accident.

Objectives: The purpose of the present study was to evaluate the frequency of erythrocyte antigens of both blood group systems (ABO and Rhesus) in our patients. We also aimed to identify the sociological and demographic characteristics in these patients.

Patients and methods: We conducted a retrospective, descriptive study on the determination of blood groups (A, B, O, and Rhesus) in patients attending the Hematology Laboratory of Yalgado OUEDRAOGO University Hospital in Ouagadougou, Burkina Faso from 2012 to 2017. The sampling was extensive. The determination of blood groups was performed through the technique of agglutination on an opal glass plate using the Beth Vincent method.

Results: From January 2012 to December 2017, 104,301 blood group tests were performed, a frequency of 17,383.5 blood group tests per year. 20% of the examinations performed in the hematology laboratory were blood group tests. The sex ratio was 0.56 with female sex predominance at 64% (66,753 cases/ 104,301). The 16-31 years age group (60,286 cases/ 104,301) predominated with 57.8%. The main departments that prescribed blood group tests were: gynecology-obstetrics with 34,419/104,301 (33%), pediatrics with 15,019 tests/104,301 (14.4%) and emergency with 14,289 tests/104,301 (13.7%). Group O was the most frequent with 41.5%; (B: 28.5%; A: 23.4%; AB: 7%). The D antigen was predominant with 93% (97,000 cases/ 104,301). Infection workup (154 indications/ 328) was the most frequent indication with a predominance of 46.9%. D antigen predominated in all groups A B O without significant difference between these groups ($p > 0.05$). The gender differences were not statistically significant ($p > 0.05$); regardless of sex, blood group O was the most prevalent in the ABO system. The D antigen was prevalent in both sexes and was 96.3% in females and 92.8% in males; this difference was not statistically significant ($p > 0.05$).

Conclusion: Our sample consisted mainly of women. The prevalent age group was 16 to 45 years. The frequency of ABO and Rhesus blood groups is similar to that of several West African countries with a clear predominance of O and Rhesus positive blood groups.

Keywords: ABO Blood Group; D Antigen; Beth Vincent Test; Burkina Faso

Introduction

The red blood cell or erythrocyte represents a variety of very complex antigens corresponding to the genetic makeup of a subject. There are currently more than twenty independent known human blood group systems. Since the work of Landsteiner (1900), blood groups are categories in which all individuals have been classified according to the variety of agglutinogens (erythrocyte antigens) and agglutinins (serum antibodies: hemo-agglutinins) possessed by their red blood cells and sera [1]. Transfusion safety aims to meet both

quantitative demand through the availability of blood products and qualitative demand by preventing the transmission of infection through blood and immunological responses [2]. The ABO and Rhesus systems are the two most commonly used compatibility systems for blood transfusion. While the ABO system includes two major antigens A and B, the Rhesus system is more complex with multiple antigens. The common antigens are D, C, E, c, and e, each with varying degrees of immunogenicity.

When introduced into an organism that recognizes them as foreign, these antigens can be the target of natural or immune serum antibodies responsible for cell lysis, which can be severe or even fatal [2]. However, these risks remain poorly assessed in our countries and are not always avoided, especially when the transfusion is intended for a polytransfused patient. A multicenter study was carried out in 1996 by the French Blood Transfusion Society and the National Institute of Blood Transfusion which identified 61 cases of accidents related to red cell incompatibility, 21 cases involved ABO incompatibility, 35 cases involved alloantibody incompatibility of systems other than the ABO system [3]. Understanding the prevalence of the most immunogenic antigens improves donor selection and increases the availability of labile blood products (LBP) not only for the rarer antigens but also for polytransfused subjects.

Apart from voluntary donors or cases of illness, few people in Burkina Faso undergo blood typing while it could save their lives in the event of an emergency in serious hemorrhagic accidents.

In Burkina Faso, there are few studies on ABO blood groups and Rhesus D phenotypes. One of the earliest studies in West Africa was conducted in Burkina Faso (formerly Upper Volta), Liberia, and Côte d'Ivoire in the 1950s, where O, A, B, and AB phenotypes were 42%, 19%, 31% and 8% respectively [4].

Most studies carried out in Burkina Faso on the distribution of standard A, B, O, and Rhesus D blood groups have involved voluntary blood donors. Our study aims to study the distribution of blood groups in patients attending the hematology laboratory of the major hospital in Burkina Faso, namely the Yalgado OUEDRAOGO University Hospital Centre in Ouagadougou from 2012 to 2017. Through the study, we should be able to better assess the transfusion needs (demand) to adapt the supply (donors) to the demand.

Patients and Methods

We conducted a retrospective and register-based descriptive study from 1 January 2012 to 31 December 2017 in the hematology laboratory of the YALGADO OUEDRAOGO University Hospital in Ouagadougou in BURKINA FASO. All outpatients and/or hospitalized patients who underwent blood grouping A, B, O, and Rhesus D during the study period were included. All patients whose blood grouping was not usable (unconfirmed blood grouping, incomplete socio-demographic information, etc.) were not included.

The ABO and Rhesus D phenotypes of the patients included in this study were determined by the Beth Vincent method on an opal glass plate, using monoclonal test sera. The blood grouping determination was based on the principle of testing by an agglutination technique of the antigens present on the red blood cells using test sera (antiserum) of known anti-A, anti-B, anti-AB, anti-D specificities. The procedure consisted of:

Placing four (4) drops of blood to be tested separately on an opal glass plate;

- Adding one drop of anti-A, anti-B, anti-AB, anti-D antibodies respectively to each drop of red blood cell to be tested; Mixing with the bottom of a hemolysis tube;
- Shaking the plate with oscillating movements; Reading and noting down the reactions.

Was considered to be:

- Positive: The presence of agglutination indicates that the sample tested has the corresponding antigen.
- Negative: The absence of agglutination indicates that the test sample lacks the corresponding antigen.

Sampling was extensive:

Socio-demographic (age, sex, outpatient or inpatient), clinical (blood grouping indications), and biological (blood grouping phenotypes A, B, O, and Rhesus D) parameters were collected.

The data collected was recorded on a microcomputer equipped with the software Epi info version 7. The statistical significance level (p) used was 5%.

During the study, the identity of the patients in the records was kept confidential. They will not be identified in scientific publications or presentations related to this study.

Results

Prevalence of blood groupings

One hundred four thousand three hundred one (104,301) blood groupings were performed from January 2012 to December 2017, i.e. a prevalence of 17,383.5 groupings per year. The blood grouping accounted for 20% of the tests carried out at the hematology laboratory of YALGADO OUEDRAOGO University Hospital.

Socio-demographic data

Female sex predominated with 64% with 66,753 cases compared to 37,548 cases for males, hence a sex ratio of 0.56. The 16-31 age group was the most affected, as shown in Table 1.

Age (year)	Total	Percentage
0-15	12 829	12.3%
16-31	60 286	57.8%
32-48	17 627	16.9%
>49	13 559	13%
Total	104 301	100%

Table1: Distribution of patients according to age groups

The main departments prescribing blood grouping were the obstetrics-gynecology department, followed by the emergency department (related to medical, trauma, and visceral) with 30.6% (Table 2).

Department	Total	Frequency
Gynecology and Obstetrics	34 419	33%
Pediatrics	15019	14.4%
Medical Emergency	14289	13.7%
Trauma Emergency	9179	8.8%
Visceral emergency	8448	8.1%
Internal Medicine	3338	3.2%
External	3129	3%
Dermatology	2712	2.6
Cardiology	2190	2.1
Resuscitation	1982	1.9
Ophthalmologic hospitalization	1773	1.7
Hepato-Gastroenterology	1773	1.7
Neurosurgery	1565	1.5
Maxillofacial surgery	1460	1.4
ENT	1252	1.2
Urology	1043	1
Orthopedics	730	0.7
Total	104 301	100%

Table2: Distribution of patients according to the departments prescribing blood grouping

Distribution of patients by the ABO group

The characteristics of the distribution of patients according to the ABO group are detailed in Figure 1. Group O subjects (who have neither A nor B antigen) were dominant in our sample with 43,337 patients/104,301 i.e. 41.55%.

Distribution of Patients by rhesus system

We found 97,000 patients/ 104,301 (93%) who were Rhesus D positive compared with 7301 patients/ 104,301 who were Rhesus D negative which is 7%.

Distribution of patients according to the descriptions on the laboratory requisition form

Infectious workup was the most frequent descriptions during our study with a higher prevalence as shown in Table 3.

Patient distribution according to the ABO system associated with Rhesus

The differences observed between different blood groups were not statistically significant ($p > 0.05$). The D antigen dominated regardless of the ABO group as shown in Table 4.

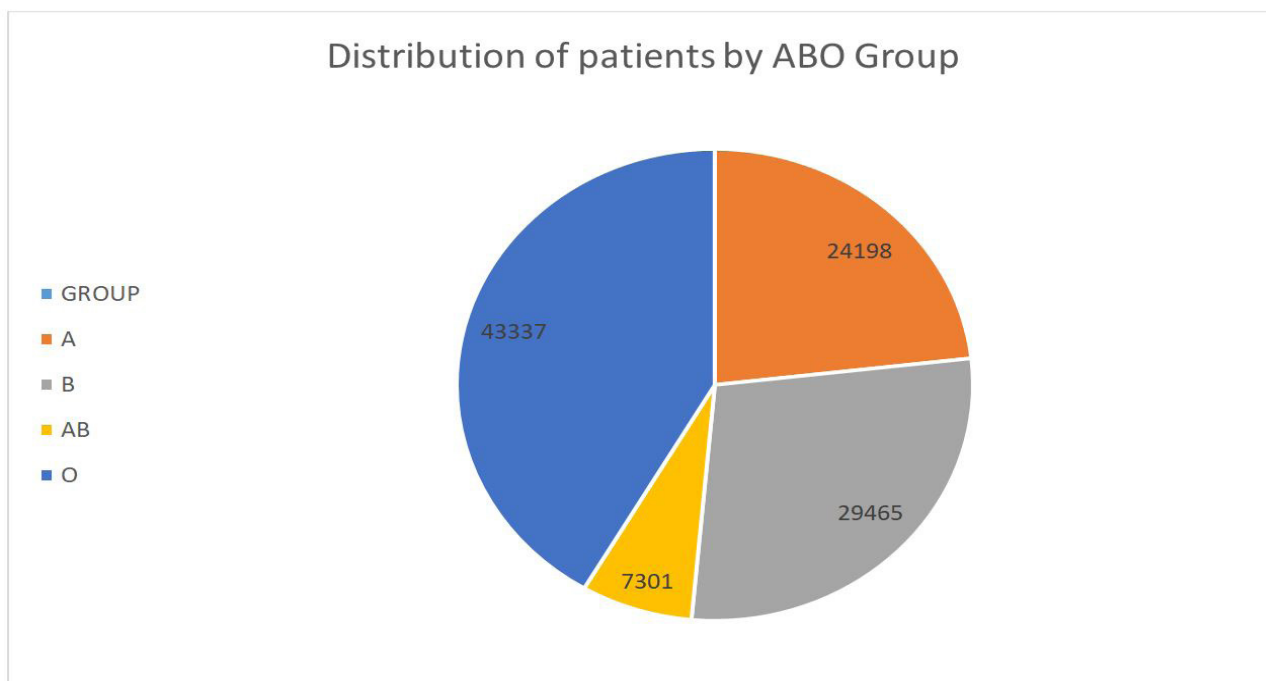


Figure 1: Distribution of patients by ABO group

Description	Total	Frequency
Infectious workup	154	47%
Prenatal checkup	76	23%
Paleness	62	19%
Transfusion	16	5%
Connective Icterus	10	3%
Preoperative assessment	4	1.2%
Hemorrhage	3	0.8%
Diarrhoea	2	0.6%
Suffering of a newborn of a A+ mother	1	0.4%
Total	328	100%

Table 3: Distribution of patients according to the descriptions on the laboratory requisition form

ABO System		Rhesus	
Total		Frequencies	
		Rh+	Rh-
A	24 198	91.9%	8.1%
B	29 465	93.5%	6.5%
AB	7 301	90.7%	9.3%
O	43 337	93.9%	6.1%

Table 4: Patient distribution according to the ABO system associated with standard Rhesus

Patient distribution in the ABO system according to sex

The differences between sexes were not statistically significant ($p > 0.05$). Regardless of sex, Group O was dominant as shown in Table 5.

Distribution of patients in the Rhesus system by sex

Both sexes were comparable ($p > 0.05$). D antigen dominated in both sexes with a prevalence of 96.3% in females (93,411/97,000) and 92.8% in males (90,016/97,000).

Phenotype		Frequencies		
Total		Overall	Male	Female
A	24 198	23.4%	29%	21%
B	29 465	28.5%	27%	30%
AB	7 301	7%	5%	8%
O	43 337	41.1%	39%	41%
Total	104 301	100%	100%	100%

Table 5: Distribution of patients in the ABO system by sex

Discussions

Limitations of our study

Some medical records were not found and those found were sometimes partially filled out, leading to selection bias.

The risk of error was also increased because the blood grouping had been performed by a single technician without the Simonin test.

Socio-demographic data

Gender: There was a clear predominance of females over males (sex ratio=0.56). The reason might be that in the population of Burkina Faso, there are more women than men, and also that the demand for blood grouping by the obstetrics-gynecology department is higher. Indeed, A, B, O, and Rhesus D blood grouping is systematically requested during the prenatal check-up.

Age: The majority of patients were in the 16-31 years age group, 57.8%. This result was similar to that observed by Sékou Fanta *et al.* [2] in Mali with an age range of 16 to 45 years and a frequency of 62.5%. This predominance can be explained on the one hand by the predominantly young population in Burkina Faso and Mali and on the other hand by the high concentration of women of childbearing age.

Department: Blood grouping requests from the obstetrics and gynecology department predominated with 33%. This could be explained on the one hand by the high concentration of women of childbearing age in Burkina Faso and on the other hand by the vulnerability of pregnant women to malaria infections. In our study, the emergency department (medical, trauma, and visceral) with 30.6% were the second department to prescribe blood grouping, which leads us to deduce that it was acute anemia in fine because chronic anemia sometimes resolves into acute anemia. Also, the clinical departments (clinical hematology, pediatric oncology) practice little highly myelosuppressive chemotherapy that requires a lot of labile blood products

Patients in the ABO system

We found a predominance of group O with a frequency of 41.55%. The other antigens were distributed in the following order: B = 28.25%; A = 23.2%; AB = 7%.

In Africa, Dieng [5] in Senegal reported a predominance of O (51.93%), followed by B (22.62%): A (19.65%), and AB (5.80%). Cabannes [6] in Côte d'Ivoire reported findings with the same order of predominance of ABO antigens. The same was true for Broussal *et al.* [7] who in 1979, in Burkina Faso gave the following theoretical average numbers: O = 13,125 B = 8,059 A = 6,984 AB = 1,619.

The same was observed in 1998 by TAITA.M [8] in Burkina Faso with the following frequencies: O = 51% B = 23% A = 19% AB = 7%. In many studies carried out in Africa, similar observations have been reported:

Seka *et al.* [9] had found the following frequencies in Côte d'Ivoire: O = 49.43% B = 23.13% A = 22.54% AB = 4.90%. The frequencies of phenotypic blood groups A, B, O, and AB were 22.54%, 28.56%, 43.30%, and 5.60% respectively and RhD positive was 92.24% in the study of Sawadogo S [10] in Burkina Faso on blood donors from 2011 to 2013.

In Tunisia in 1994, Hmida *et al.* [11] found the following frequencies: O = 68.6% A = 19.2% B = 12.2%. Blood group AB had the lowest frequency. These studies, like ours, showed that group O was always predominant, followed by group B (unlike in the white race), then group A, and finally group AB. Although these figures differ slightly, probably because sample characteristics, we can nevertheless see a similarity in these results. These findings generally show the similar distribution of ABO phenotypes in the Black African population.

Patients in the rhesus system

All but 7% of the study population had the D antigen in our series. Landsteiner and Wiener [8] reported a frequency of 85% Rh+ versus 15% Rh- in the white race. In Africa, Dieng *et al.* [5], Cabannes R *et al.*, [6] Seka *et al.* [9], Taita *et al.* [8], reported respectively 91 to 98%; 80 to 90%; 94.7%, 92.43%; and 90% Rh+. This shows the predominance of Rh+ over Rh- both in the world and Africa in general, and in Burkina Faso in particular.

Descriptions for patient blood grouping requests

The majority of the descriptions were for infection control, 47%. This result was different from that of Keita [12] in Mali, who found a predominance of prenatal checkups with 65.1%. These findings of our study could be explained by the fact that the majority of requests for blood grouping were most often associated with a request for a blood test. The reason for this is the high prevalence of infectious diseases in Burkina Faso, especially malaria, which remains the leading cause of mortality and morbidity in our country.

Patients with the ABO system associated with Rhesus

In our study, the D antigen dominated regardless of the ABO system. The distribution of D antigen is consistent with the literature [5,6,8-10].

Patients in the ABO system by gender

In our study, group O dominated regardless of gender with a prevalence of 39% in men and 41% in women and a predominance of group A (29%) over group B (27%) only in men but further studies are needed to confirm the findings. Keita *et al.* [12] in Mali also found a predominance of group O in both genders with 41.3% in women and 43.9% in men.

Patients in the rhesus system by gender

In our study, we observed that the D antigen dominated in both sexes with a prevalence of 96.3% in women and 92.8% in men. Keita *et al.* [12] in Mali had reported a prevalence of 93.48% in women and 95.6% in men. Thus, the distribution of D antigen is similar in both sexes.

Conclusion

We had a predominantly female sample. The age range from 16 to 45 years of age was predominant. The results showed that the patients were predominantly group O, followed by B, A, and AB, with a predominance of Rhesus-positive consistent with the literature.

These findings should be taken into consideration when planning the collection of rare blood groups (O Rh-negative, B Rh-negative) to be kept in the blood bank in iso-group and iso-Rhesus transfusion safety settings. For rare blood groups (especially Rhesus negative), it is necessary to identify the addresses of potential donors.

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