

EVALUATION OF THE MICROBIOLOGICAL QUALIFICATION OF BLOOD DONATION AT THE AVICENNE MILITARY HOSPITAL IN MARRAKECH

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ABSTRACT

Introduction: The microbiological qualification of blood donations has made great progress in terms of infectious risk.

The use of new technologies and methods in transfusion has been an element of reflection as a new approach to search for viruses in blood donations, which has contributed to the improvement of the quality of screening and transfusion safety.

The objective of our work was to evaluate the microbiological qualification techniques of blood donation at the Blood Transfusion Center (BTC) of the Avicenne Military Hospital of Marrakech (AMH) in comparison with what is done nationally and internationally.

Materiels and Methods: We conducted a retrospective descriptive, comparative and evaluative study of 8221 blood donations collected at the BTC (old and new) of the AMH of Marrakesh, carried out over a five-year period from January 1, 2016 to December 31, 2020.

Results: The prevalence of serological markers of hepatitis B is 0.28% that of hepatitis C is 0.17%, that of HIV is 0.09%, and that of syphilis is 0.40%.

The screening of hepatitis B, C and HIV viruses at the BTC of the Avicenne Military Hospital of Marrakech, is carried out by the ELISA technique (enzyme-linked immunosorbent assay) in sandwich and combined of 4th generation, automated on EVOLIS "Twin plus". Syphilis screening is based on the hemagglutination technique by the TPHA test. The control of positive and doubtful cases is carried out using the chemiluminescence technique (CLIA) in the virology department.

Conclusion: The acquisition of new screening techniques in our laboratory has become a necessity due to the development of new screening methods in recent years that are more sensitive and specific, such as the introduction of viral genomic screening (VGS) into the routine of viral screening tests.

INTRODUCTION

The microbiological qualification of blood donation refers to a battery of serological and molecular tests performed on a blood sample taken from a donor in order to

contribute to the transfusion safety of blood products against infectious agents responsible for blood-borne diseases [1]. It obeys legal texts, therefore any post-transfusion incident is medico-legal.

The use of new technologies and methods in transfusion has been an element of reflection as a new approach to search for viruses on blood donations, which has contributed to the improvement of the quality of screening and transfusion safety.

The objective of our work is to:

- Evaluate the microbiological qualification techniques of blood donation in the military hospital of Marrakech compared to what is done nationally and internationally.
- To highlight the level of microbiological qualification of blood donation in the military hospital of Marrakesh.
- To propose recommendations to improve the level of qualification within the military hospital of Marrakesh.

MATERIELS AND METHODS

This is a retrospective comparative and analytical study of the microbiological qualification of blood donation conducted in the two BTC (old and new) of the Avicenne military hospital of Marrakech, involving 8221 blood donations, carried out over a period of five years from 1 January 2016 to 31 December 2020.

The donors were soldiers from Marrakesh and regions (Benguerir, Ouarzazate, Khouribga, Tadla), whose ages are between 18 and 55 years taken according to the scheduled collections (two to three collections per month) fulfilling the conditions of blood donation.

The techniques used for the microbiological qualification of the blood donation at the BTS of the AMH of Marrakesh were: ELISA 4th generation, hemagglutination and chemiluminiscence CLIA.

The statistical analysis of the results was carried out using the software "Microsoft Office Excel" and "Microsoft Office Word"

which facilitate the management of the data.

RESULTS

During our study period, 8221 donations were studied with an age range between 18 and 55 years. The distribution between male and female was not done, as the vast majority of the donors were male.

In our study, we calculated the prevalence of positive, negative and doubtful cases for the following serological markers: HBsAg, anti-HBcAg, HCVAg and anti-HIVAg1,2. Cases positive for a serological marker were referred to a specialized infectious diseases consultation for further investigation (screening and possible confirmation).

CMV and HTLV I and II serologies are not performed at the BTC of the military hospital in Marrakesh.

Chagas disease and malaria are excluded since we are not in an endemic area, and military personnel returning from malarious areas are excluded from donation.

For covid-19 serology, no screening of BTCdonors at the Marrakesh military hospital was performed during the pandemic.

Negative serological tests were considered negative for the infections screened. In case of doubtful or positive results for serology tests, the bag is systematically discarded and the donor is summoned for another control and a confirmation test.

Concerning the viral hepatitis B virus, out of 8221 donations tested, 23 cases were positive (0.28%), 513 cases were doubtful (6.24%), and 7685 cases were negative (93.48%).

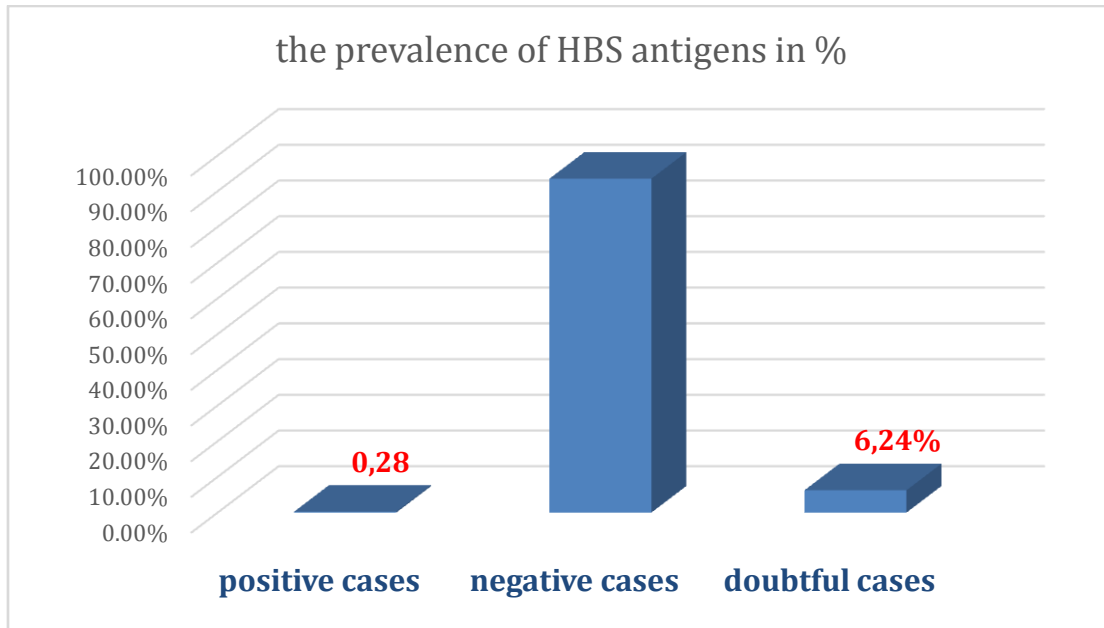


Figure 1: The prevalence of serological markers of the viral hepatitis B in BTC donors at the avicenne military hospital in Marrakesh

Concerning the serological markers of the viral hepatitis C virus, 14 cases were positive (0.17%), 820 cases were doubtful (9.97%), and 7387 cases were negative (89.86%).

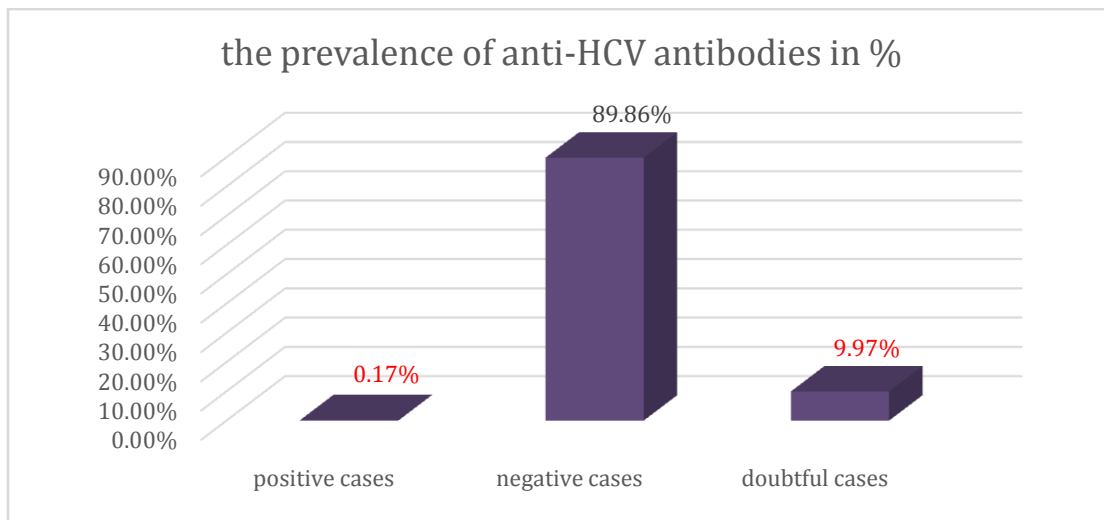


Figure 2: The prevalence of serological markers of the viral hepatitis C in BTC donors at the avicenne military hospital in Marrakesh

The prevalence of HIV was 0.09% (7 positive cases), 408 doubtful cases (4.96%) and 7806 negative cases (94.95%).

	Positive cases	Negatives cases	Doubtful cases
Prevalence of anti-HIV CA 1.2 in %.	0.09%	94.95%	4.96%

The prevalence of serological markers for syphilis (TPHA) was 0.4% or 33 positive cases.

	Positive cases	Negative cases
Prevalence of TPHA in %	0.40%	99.60%

The donor is referred to a specialist in gastroenterology if hepatitis B or C markers are positive and the bag is destroyed.

In the case of a positive serology due to syphilis or HIV virus, the donor is taken in charge by a doctor of an infectious diseases or dermatology department and the bag is destroyed.

DISCUSSION

Transfusion is a specific therapeutic act, which is subject to a precise medical indication and strict regulations, particularly in terms of haemovigilance, which is at the origin of the organization of blood transfusion and good practices, intended to guarantee the safety of transfusion [1].

Each blood donation is tested for the presence of transfusion-transmissible infectious agents. The infectious agents that can be transmitted by transfusion that are tested at the BTC of the HMA of Marrakesh are :

- The detection of HBsAg and anti HBc antibody for the screening of viral hepatitis B.
- The detection of HCV Ag and anti-HCV Ac for the screening of viral hepatitis C.
- The detection of HIV Ag and anti-HIV1 / HIV2 Ac for screening for HIV infection.
- TPHA for screening for latent syphilis.

Screening for hepatitis B, C and HIV viruses is performed by ELISA kits based on the principle of the 4th generation sandwich and combined ELISA technique, automated on EVOLIS "Twin plus". Syphilis screening is based on the hemagglutination technique by the TPHA test.

In our series, we realized 8221 donations during 5 years at a rate of 60 donors per collection respecting the needs of the hospital.

This compares with the regional BTC in Rabat, which makes about 57,711 donations per year [2], and the BTC at the Rabat military hospital with 25,661 donations over about three years [3]. In Canada, approximately 100,000 donations are made each year[4].

Of the 8221 serums tested, 23 cases were positive for the hepatitis B virus, which represents a prevalence of 0.28%, a rate lower than that found in France (5.5%)[5]. For Cameroon, China, Brazil and Sudan, their prevalences remain higher than those of our series with rates of 12.14%, 0.87%, 3%, 6% respectively[6-9]. On the other hand, the prevalence in the United States of America (0.078%) remains significantly lower than ours[10]. As viral genomic screening remains financially and technically inaccessible in most African countries, the most effective means

currently in terms of "transfusion safety" is to increase the effectiveness of medical screening of blood donors to exclude those at risk of carrying a blood-borne infectious agent[11]. The annual prevalence of HIV antibodies found (0.09%) is higher than that of France (0.037%), and the United States of America (0.028%)[10,16]. Contrary to the results obtained in Tunisia, Brazil, China, Sudan and Cameroon (44.4%) where our rate remains lower[6-9,12]. Although blood donations have been biologically qualified by serological techniques (detection of HIV Ag and Ac), the residual risk of transfusion related to this virus persists, due to blood donations collected during the serologically silent window that precedes seroconversion, or due to the false negative result of an incorrectly performed or misinterpreted detection test[13].

Theoretically, the average time between infection with the human immunodeficiency virus and the appearance of the first anti-HIV antibodies that can be detected by the best screening tests is 20 to 30 days: this is the window period.

In order to reduce this delay, various generations of reagents have been developed with performances in terms of sensitivity based on an original principle, the latest generation of tests available allows the combined detection of anti-HIV Ac and p24 Ag[14].

The overall prevalence of HCV markers in our series is low (0.17%) compared to that recorded in Cameroon (14.4%), Sudan, France, China, the United States of America and Tunisia, and higher than that recorded in Brazil (0.05%).

The modes of transmission of HCV infection seem to differ between industrialized countries, where intravenous drug use is dominant, and Africa, where these practices are less common and where the main routes of transmission of the infection remain poorly documented[15].

The lower prevalence of hepatitis C than hepatitis B is related to its main mode of transmission; the percutaneous route[16].

The overall prevalence found in our series is low (0.40%) compared to that recorded in France, China and Sudan (4.5%) and remains higher than that recorded in Brazil (0.08%).

➤ Recommendations (Perspectives):

• Staff:

- Provide ongoing training to staff in screening blood donations according to required standards.

- On-site training of staff by experts.

- Recruit qualified and specialized staff to the laboratory.

- Proper distribution of personnel:

- A serological qualification team

- A team for immuno-hematological qualification

- A team for the separation and preparation of PSL

- A team for on-call duty

- A mobile collar team

• Materials and techniques:

- Provide the CTS of the HMA of Marrakech with automatons and reagents: the use of multiparametric automatons the most credible and effective with more appropriate reagents.

- Improve the techniques of microbiological qualification of blood donation by following the recommendations of the WHO: the sensitivity as well as the specificity must be the highest possible.

- Expand the serology panel: CMV, HTLV ...

- Implementation of the viral genomic screening which has become essential to reduce the serological window.

- Use of automation for syphilis screening.

- Adding other procedures for the treatment of PSL for possible transformation.

- Space :
 - Develop the office space.
 - Create a room for the viral genomic screening
 - Provide an emergency blood transfusion service.
- Archives and computer system:
 - Use of the computer systems developed to archive the results collected.
 - Provide the service with a qualified secretary capable of managing the various computer tasks.

CONCLUSION

Transfusion safety is ensured by controlling all stages of the transfusion chain, from blood collection, preparation and biological qualification to the performance of the transfusion procedure and even the follow-up of recipients.

Microbiological qualification techniques for blood donation have been considerably simplified, automated and developed.

The use of molecular biology as a new tool for the virological qualification of donations is perfectly in line with the permanent concern of reinforcing transfusion safety.

Table 1: Comparative table of hepatitis B screening techniques at the CTS of the HMA Marrakech in relation to international standards and WHO recommendations

Countries	Techniques	Who's recommendations
The BTC of the Avicenne military hospital of Marrakech, Maroc	- ELISA Tests - CLIA	To minimize the risk of HBV infection through transfusion: <ol style="list-style-type: none"> 1. Testing for this virus should be performed with a highly sensitive and specific HBS Ag enzyme-linked immunosorbent assay (EIA/CLIA). 2. Screening with a rapid HBS Ag test or particle agglutination test can be performed in low throughput laboratories, remote areas, or in emergency situations. 3. Anti-HBC screening is not recommended on a routine basis. Countries should determine their need for anti-HBC testing based on the prevalence and incidence of HBV infection. 4. ALT testing is not recommended
France	- ELISA Tests - Confirmation by HBsAg neutralization test.	
Canada	- ELISA tests - Nucleic acid amplification tests (NAT)	
United states of america	- ELISA tests - Nucleic acid amplification tests (NAT)	
India	- ELISA tests - Nucleic acid amplification tests (NAT)	
China	- ELISA tests - CLIA - Nucleic acid amplification tests (NAT)	

Table 2: Comparative table of hepatitis C screening techniques at the CTS of the HMA Marrakech in relation to international standards and WHO recommendations

Countries	technics	Who's recommandation
The BTC of the HMA of Marrakech, Morocco	- ELISA tests - CLIA	<p>To minimize the risk of HCV infection through transfusion:</p> <p>1. HCV testing should be performed by immunoassay for HCV antibodies or by a highly sensitive and specific combined antigen-antibody immunoassay (EIA/CLIA). The test used should be capable of detecting country or region specific genotypes.</p> <p>2. Screening with a highly sensitive and specific rapid HCV antibody test can be performed in low throughput laboratories, in remote areas, or in emergency situations.</p>
France	- ELISA test associated with the HCV VDG - Confirmation by Immunoblot	
Canada	- ELISA tests - Nucleic acid amplification tests (NAT) - Confirmation by CLIA	
United states of america	- ELISA tests - Nucleic acid amplification tests (NAT)	
India	- ELISA tests - Nucleic acid amplification tests (NAT)	
China	- ELISA tests - CLIA - Nucleic acid amplification tests (NAT)	

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