Serological ineptitude in blood banks: is there an association with sexually transmitted infections?

Inaptidão sorológica em bancos de sangue: existe associação com infecções sexualmente transmissíveis?

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ABSTRACT

Introduction: Sexually transmitted infections (STIs) are a serious public health problem, and some of these infections are also transmitted through blood transfusions. **Objective:** To identify publications in scientific journals in Brazil and in the world showing if there is an important association between serological inadequacy due to sexually transmitted infections traced in blood and blood products used for medical use. **Methods:** Systematic review of articles published from 2018 to 2023, using the LILACS, SciELO and PubMed databases, with a concomitant approach to the issues of serological disability and STI. Original studies or review articles in Portuguese, English and Spanish with Brazilian and international data were included. Editorial publications, letter to the editor, letter from the editor or comments on the subject were excluded. **Results:** The search found 571 articles, of which 106 (18.40%) met the inclusion criteria, that is, Serological disability and STI. In studies with international data, the prevalence of donors with hepatitis C ranged from 0.12 to 4.8%; with hepatitis B, from 1.3 to 8.2%; with HIV, from 0.0021 to 2.5%; with syphilis, from 1.73 to 2.4%; with HTLV, 0.66%; and with Chagas disease, from 0.017 to 2.76%. Among articles with Brazilian data, the prevalence of donors with seroreactive tests for hepatitis C ranged from 0.18 to 1.76%; with hepatitis B, from 0.05 to 7.9%; with HIV, from 0.03 to 0.82%; with syphilis, from 0.37 to 3.51%; with HTLV, from 0.02 to 0.3%, and with Chagas disease, from 0.8 to 0.5%. **Conclusion:** STIs are rarely discussed in the scientific literature in studies on serological inadequacy. In addition, a minority of articles were with Brazilian data. However, results show that STIs, despite being little discussed in the scientific literature in studies on the subject of serological inadequacy, have statistically significant percentages of seropositivity for STIs. Moreover, hepatitis C and B have a relevant seroprevalence, reaching 8.2% and 4.8%, respectively, in the international scenario. In Brazil, hepatitis B continues to occupy a prominent place with a seroprevalence of up to 7.9%. However, syphilis now holds a very important role, with a maximum percentage of 3.51%. More studies are needed for further reflection: although STIs are little addressed in studies about serological inadequacy in human blood banks, would they contribute to the maintenance and non-reduction of the general frequency of infections transmitted by blood transfusion?

Keywords: Serological disability. Seroprevalence. Hepatitis B. Hepatitis C. HIV. Syphilis. Sexually transmitted infections. Blood.

RESUMO

Introdução: As infecções sexualmente transmissíveis (IST) são um grave problema de saúde pública e algumas dessas infecções, também, transmitidas por intermédio de transfusões de sangue. **Objetivo:** Identificar publicações em periódicos científicos no Brasil e no mundo sobre se existe importante associação entre inaptidão sorológica por infecções sexualmente transmissíveis rastreadas em sangue e hemoderivados usados para uso médico. **Métodos:** Revisão sistemática de artigos publicados no período de 2018 a 2023, usando as bases de dados Literatura Latino-Americana e do Caribe em Ciências da Saúde (Lilacs), Scientific Electronic Library Online (SciELO) e United States National Library of Medicine (PubMed) com abordagem concomitante para os assuntos de inaptidão sorológica e IST. Incluíram-se estudos originais ou artigos de revisão nos idiomas português, inglês e espanhol com dados brasileiros e internacionais. Foram excluídas publicações do tipo editorial, carta ao editor, carta do editor ou comentários sobre o tema. **Resultados:** A busca localizou 571 artigos dos quais 106 (18,40%) se encaixavam nos critérios de inclusão, ou seja, inaptidão sorológica e IST. Em estudos com dados internacionais, a prevalência de doadores com hepatite C variou de 0,12 a 4,8%; com hepatite B de 1,3 a 8,2%; com HIV de 0,0021 a 2,5%; com sífilis de 1,73 a 2,4%; com HTLV 0,66%; e com doença de Chagas de 0,017 a 2,76 %. Já entre os artigos com dados brasileiros, a prevalência de doadores com exames soro-reatores para hepatite C variou de 0,18 a 1,76%; com hepatite B de 0,05 a 7,9%; com HIV de 0,03 a 0,82%; com sífilis de 0,37 a 3,51%; com HTLV 0,02 a 0,3%, e com doença de Chagas de 0,8 a 0,5%. **Conclusão**: As IST são pouco abordadas na literatura científica em estudos com o tema inaptidão sorológica. Além disso, uma minoria de artigos era com dados brasileiros. Entretanto, resultados demonstram que, apesar de pouco abordadas na literatura científica em estudos com o tema inaptidão sorológica, as IST possuem percentuais de soropositividade estatisticamente significativos. Além disso, as hepatites C e B possuem soroprevalência relevante, podendo chegar a 8,2 e 4,8%, respectivamente, no cenário internacional. Já no cenário nacional, brasileiro, a hepatite B continua ocupando um lugar de destaque, com soroprevalência de até 7,9%. Todavia, a sífilis passa a ocupar um papel de altíssima relevância, com percentual máximo de 3,51%. São necessários mais estudos para mais reflexão: apesar de as IST serem pouco abordadas em estudos acerca da inaptidão sorológica em bancos de sangue humano, seriam elas contribuintes para a manutenção e a não redução da frequência geral de infecções transmitidas por transfusão sanguínea?

Palavras-chave: Inaptidão sorológica. Soroprevalência. Hepatite B. Hepatite C. HIV. Sífilis. Infecções sexualmente transmissíveis. Sangue.

INTRODUCTION

Sexually transmitted infections (STIs) are currently a serious public health problem, impacting the health of the entire population in the world[1]. Many infections are transmissible through blood transfusions, also becoming widely known and publicized global health challenges[2].

Collaborative screening for transfusion-borne infections among blood donors is essential, as blood safety has always been an issue of great concern to the field of transfusion medicine. This is because transfusion-transmitted infections (TTI) are among the greatest threats to blood safety for transfusion recipients and represent a major public health issue[3-5].

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A transfusion-transmitted infection (TTI) is any infection transmitted from person to person through the injection of blood or blood products. To assess its severity, the WHO (World Health Organization) recommends pre-transfusion blood tests for human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV) and syphilis as mandatory tests[6].

Human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV) and *Treponema pallidum* (TP) infections are considered typical transfusion-transmitted infections, and remain one of the leading infectious diseases worldwide[7,8].

However, other viruses such as HTLV (types 1 and 2) and *Trypanosoma cruzi* can be transmitted by whole blood transfusion, in addition to sexual intercourse. The concern with the HTLV virus is that it is an asymptomatic infection that is not commonly screened in blood banks around the world. *Trypanosoma cruzi*, the causative agent of Chagas disease, is a protozoan widely distributed in the Americas. Blood transfusion is the second most important way to acquire infections. In the blood bank, tests are performed to eliminate blood that may be infected[9-11].

Assessing trends in the prevalence of transfusion-transmitted infections (TTI) in blood donors is critical to monitoring the safety of the blood supply and the reliability of donated samples. In addition, the increase in cases of syphilis may have contributed to the fact that the overall frequency of transfusion-transmitted infections has remained unchanged, and has not decreased[12].

Although several scientific articles address the issue of serological inadequacy in the literature, few direct a particular focus on sexually transmitted infections (STIs). Furthermore, finding studies that broadly address more STIs together and include HTLV and Chagas disease is even more complex. Brazilian national studies relating STIs and serological inadequacy in blood banks are also lacking in the national and, consequently, international literature. However, it is extremely important to determine which are the STIs most related to the contamination of blood samples in the world, and mainly in Brazil, in order to facilitate and direct the donor screening process, reduce the number of contaminated samples and make the donation and analyzes in blood banks safer and more efficient. Thus, the national literature lacks studies that carry out a survey and systematic analysis of scientific articles that address the issue of serological inadequacy with a focus on STIs, even with the strong suspicion that the increase in cases of syphilis may have contributed to the fact that the frequency of the overall rate of transfusion-transmitted infections has not reduced.

OBJECTIVE

Identify in publications in scientific journals in Brazil and in the world, if there is a strong association between serological ineptitude and sexually transmitted infections.

METHODS

Systematic review of articles published in the last five years (2018–2023), using the keywords: [serological inadequacy] or [seroprevalence in blood donors] in the LILACS, SciELO and PubMed databases that concomitantly addressed the subjects serological inadequacy and STIs.

Inclusion criteria

Original studies in Portuguese, English and Spanish with national and international data, published in scientific journals in the last five years, were included.

Exclusion criteria

Editorial type publications, letters to the editor, letters from the editor or comments on the subject of serological inadequacy and sexually transmitted infections.

Data collection and analysis

Articles published in the last five years (2018–2023) with the descriptors [serological inadequacy] or [seroprevalence in blood donors] were searched in the SciELO, PubMed and LILACS databases.

With the active search for articles, studies that had quantitative data on rates and percentages of STIs were analyzed and selected.

Due to the few results obtained from national studies, a second search was carried out for Brazilian studies and dissertations in Google Scholar using the same descriptors with the same inclusion criteria.

Data were analyzed qualitatively according to content analysis, a technique used to describe and interpret documents and texts. It can be said that content analysis consists of five main stages: preparation of information, transformation of content into units, classification of units into categories, description and interpretation.

The analysis aims to identify, in publications in scientific journals nationwide and in the world, whether there is a strong association between serological ineptitude and STI, in order to determine how many articles that address the current serological ineptness theme (in the last five years) mention STI, and which infections are most cited.

There are no risks involved in the study, as it is an exclusively online systematic review.

RESULTS

Of the total of 571 articles found on the three platforms with the descriptors, 106 met the inclusion criteria.

In this systematic review study, initially, 106 articles on the subject were included, as well as their objectives and respective conclusions. In PubMed and LILACS, 105 studies that met the inclusion criteria were found. In SciELO, one study was found. In SciELO, six articles were searched for by the descriptors, one of which met the inclusion criteria. In PubMed and LILACS, 570 studies were found, and 105 met the criteria and were not concomitantly present in SciELO.

A total of 106 articles (18.40%) of the total explained that there is a strong association between serological ineptitude and STI. Among the most cited STIs were HIV, HCV and HBV, with an important number of studies that encompass these diseases being raised, contrary to what was observed in relation to Chagas disease, syphilis and HTLV. Studies covering Chagas disease were restricted to Latin America, mainly to Brazil. A total of four studies (3.77%) were from Brazil.

Of the 106 studies included, 4 were national, 2 referring to Chagas disease, 1 to Syphilis and 1 to HTLV. Individually calculating which STIs were included in each article, Hepatitis B was cited 61 times (29.9%), hepatitis C 53 (25.98% of the times), HIV 40 (19.6%), syphilis

31 (15.19%), HTLV 13(6.37%) and Chagas disease 6 times (2.96%). It is interesting to note that, among those included above, 22 (20.75%) studies addressed hepatitis B and C, HIV and syphilis concomitantly, 12 (11.32%) dealt with hepatitis B and C, 12 (11.32%) with HIV and hepatitis B and C, and 2 (1.88%) with Syphilis and HIV. Of those that only addressed 1 STI, 19 (17.92%) studies only covered hepatitis B, 13 (12.26%) only HTLV, 8 (7.54%) only hepatitis C, 7 (6.60%) only syphilis , 6 (5.66%) only Chagas disease and 5 (4.75%) only HIV.

A total of 13 international articles demonstrated the percentages of positive donors for the researched diseases. Of these articles, 8 presented the percentage of positivity for HBV, 6 for HCV, 4 for HIV, 1 for HTLV, 2 for syphilis and 2 for Chagas disease. The prevalence of donors with Hepatitis C ranged from 0.12 to 4.8%; with hepatitis B, from 1.3 to 8.2%; with HIV, from 0.0021 to 2.5%; with syphilis, from 1.73 to 2.4%; with HTLV, 0.66; and with Chagas disease, from 0.017 to 2.76% (**Table 1**). Two studies concluded that 4.2% and 4.61% of blood samples tested positive for an STI.

Among national articles from a total of 11 studies, 10 presented the percentage of positivity for HBV, 10 for HCV, 9 for HIV, 8 for HTLV, 10 for syphilis, and 9 for Chagas disease. The prevalence of donors with hepatitis C ranged from 0.18 to 1.76%; with hepatitis B, from 0.05 to 7.9%; with HIV, from 0.03 to 0.82%; with syphilis, from 0.37 to 3.51%; with HTLV, from 0.02 to 0.3; and with Chagas disease, from 0.8 to 0.5% (**Table 2**).

Table 1. Percentage of samples contaminated by each Sexually Transmitted Infection, in relation to the total number of samples, in international studies.

Sexually Transmitted Infection	Maximum and minimum prevalence percentage of blood samples contaminated by each STI (%)
Hepatitis C	0.12 to 4.8
Hepatitis B	1.3 to 8.2
HIV	0.0024 to 2.5
HTLV	0.66
Shyphilis	1.73 to 2.4
Chagas disease	0.017 to 2.76

STI: Sexually Transmitted Infection; HIV: human immunodeficiency virus; HTLV: human T-cell lymphotrophic virus.

Table 2. Percentage of samples contaminated by each Sexually Transmitted Infection, in relation to the total number of samples, in national studies

Sexually Transmitted Infection	Maximum and minimum prevalence percentage of blood samples contaminated by each STI (%)
Hepatitis C	0.18 to 1.76
Hepatitis B	0.05 to 7.9
HIV	0.03 to 0.82
HTLV	0.02 to 0.3
Syphilis	0.37 to 3.51
Chagas disease	0.08 to 0.5.
Total contaminated samples	1.88 to 7.03

STI: Sexually Transmitted Infection; HIV: human immunodeficiency virus; HTLV: human T-cell lymphotrophic virus.

DISCUSSION

Sexually transmitted infections are currently a major public health problem. In addition, many of these infections are transmissible through blood transfusions, such as HIV, hepatitis B and C, syphilis, HTLV and Chagas disease[1,2,7,8,9,11].

Importantly, assessing trends in the prevalence of transfusion-transmitted infections (TTI) in blood donors is critical to monitoring the safety of the blood supply and the reliability of donated samples. The literature points out that the increase in cases of syphilis may have contributed to the general frequency of transfusion-transmitted infections remaining unchanged, rather than decreasing[12]. However, syphilis was mentioned individually with a frequency of 15.19% in relation to other STIs.

Among the STIs mentioned in the studies, those that were included most often are hepatitis B and C and HIV. Syphilis was the most cited immediately after them, with a difference of only 4.41% in relation to HIV. HTLV and Chagas disease were rarely mentioned in relation to the others. Chagas disease was addressed in articles from Latin America, Colombia, Brazil and Mexico.

Less than a quarter of the articles (18.40%) that dealt with the subject Serological disability was dated from the last five years, and simultaneously addressed STIs. In addition, a minority of 3.77% of the articles contained Brazilian data, two on Chagas disease, one on syphilis, and one on HTLV.

Two studies concluded that 4.2 and 4.61% of blood samples tested positive for an STI, meaning that around 100 out of 4 to 5 donors have an STI. In addition, hepatitis C and hepatitis B were the diseases that encompassed the highest percentages of seroprevalence among international studies. However, it is important to emphasize that syphilis, HIV and Chagas disease also had statistically significant percentages, greater than 2%.

During the first search in the SciELO, LILACS and PubMed databases, only two national studies were found. In view of this fact, we opted to carry out an active search for national articles and dissertations using the same keywords in Google Scholar. Even adopting this strategy, few Brazilian studies were found that demonstrated quantitative data on seroprevalence and STIs. On the national scene, syphilis and hepatitis B were the diseases that encompassed the highest percentages of seroprevalence. The others had a prevalence of less than 2%.

The study titled "Serological inadequacy of blood donors at the Army Institute of Biology" by Rubim[13], showed the highest seroprevalences for hepatitis C and syphilis, of 1.76 and 3.51%, respectively. In this retrospective study with a quantitative approach, 14,732 bags collected at the IBEx from 2015 to 2020 were evaluated. The author highlighted that it is essential to implement continuous campaigns of sexual education in order to improve the quality of the blood offered to the military family, as well as minimize blood disposal.

The study that presented the highest seroprevalence for hepatitis C and syphilis was entitled "Reasons for unsuitability of candidates for blood donation in Brazil: a narrative review" by Winter et al.[14] In this study, seroprevalences for HCV and syphilis were 0.18% and 0.37%, respectively. This is a bibliographic review that pointed out data from a municipality in Amazonas where 9.25% of the donors were unfit.

Thus, hepatitis C and B have a relevant seroprevalence that can reach 8.2% and 4.8% in the international scenario. On the national scene, hepatitis B continues to occupy a prominent place with a

seroprevalence of up to 7.9%; however, syphilis now occupies a highly relevant role with a maximum percentage of 3.51%.

The results demonstrate that STIs are little discussed in the scientific literature in studies with the topic of serological inadequacy, despite the percentages of seropositivity for STIs being statistically significant. Faced with the exposed problem, we launched the questions: what can explain high rates in Brazil? Do people donate blood to be tested? Do countries with high human development indices, health education and hepatitis B vaccination rates have lower percentages of serological disability overall?

Concluding our reflections, we emphasize that the high rates of serological inadequacy in blood banks in Brazil certainly impact the costs of all services that use such products, whether in public or private activities or supplementary medicine.

Strengths

The Brazilian study in order to value the national literature in the areas of Sexually Transmitted Infections and serological disability, which are themes that are rarely addressed, not only as a unit in the Brazilian scientific literature, but also simultaneously.

Limitations

The systematic review has limitations, since it does not assess the quality of the studies, even though our results serve for debate in the context of publications in scientific journals based in Brazil and in the world.

CONCLUSION

STIs are rarely discussed in the scientific literature in studies on serological inadequacy and blood banks. In addition, the minority of articles were with Brazilian data, although the prevalence rates here are high.

The results show that STIs, despite being little discussed in the scientific literature in studies with the subject of serological inadequacy, have significant percentages of seropositivity, especially syphilis and hepatitis B. In addition, hepatitis C and B have a relevant seroprevalence in the international scenario. On the national scene, hepatitis B and syphilis continue to occupy a prominent place.

More studies are needed to address the following question: although STIs are rarely addressed in studies about serological inadequacy in human blood banks, would they contribute to the maintenance and non-reduction of the general frequency of infections transmitted by transfusion?

Approval by the Human Research Ethics Committee

Not applicable

Participation of each author

JSSM: Conceptualization, Methodology, Resources, Writing – original draft, Writing – review & editing. LLCC: Conceptualization, Methodology, Resources, Writing – original draft, Writing – review & editing. CVLP: Conceptualization, Methodology, Resources, Writing – original draft, Writing – review & editing. PVLP: Conceptualization, Methodology, Resources, Writing – original draft, Writing – review & editing. FDLP: Conceptualization, Methodology, Resources, Writing – original draft, Writing – review & editing. ACG: Project administration, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare no conflicts of interest.

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