

Trends in Serological Markers of Transfusion Transmissible Infections Among Blood Donors in a Tertiary Care Hospital

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ABSTRACT

Objective: The study aimed to determine the prevalence and trends of transfusion transmitted infections (TTIs), among blood donors in a tertiary care hospital in Pakistan.

Methodology: Sample collection and processing was carried out by drawing donor's blood in two blood collection vacutainers. One containing the anticoagulant i.e. ethylene-diamine tetra-acetic acid (EDTA) which was used to analyze the blood grouping, and to confirm the status of the donor fit for donation of blood, whereas the other vacutainer without the anticoagulant was used for screening of the serological markers for HBV, HCV, HIV, Treponema pallidum by ELISA and for Plasmodium spp. by rapid immunochromatography.

Results: According to the results obtained in our study, regarding the burden of disease, from the total of 10,939 blood donors, 844 were found positive for at least one transfusion transmitted infection i.e. an overall positivity of TTIs was 7.71%. 99.95% of the donors screened during the study period were males with 35.09% of the donors in the age group 20 to 30 years. Regarding the prevalence of the diseases, maximum prevalence observed was that of Hepatitis C virus. i.e. 4.89 %.

Conclusion: The reported prevalence of TTIs substantiates that the risk of transfusion transmitted infections is considerably high. More studies need to be conducted on regular basis, as each study shows the effectiveness and the necessity of the continuation of strict screening protocols, along with spreading awareness in order to limit the risk of transmission of TTIs in Pakistan.

Key words: Blood donor screening, ELISA, HBV, HCV, HIV, Syphilis, Malaria, TTIs.

Authors' Contribution:

^{1,2}Conception; ¹Literature research; ¹manuscript design and drafting; ^{3,4}Critical analysis and manuscript review; ^{5,6}Data analysis; ⁵Manuscript Editing.

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Introduction

According to Food and Drug Administration, Transfusion transmitted infection (TTI) is defined as the infection caused by a pathogen that has the potential to produce life-threatening infection, or be able to cause severe impairment and is transmissible through blood.¹ Although, blood transfusion is a major procedure in modern medicine in order to

save lives, but the associated risk factors in terms of transfusion transmissible infections including Hepatitis B virus, Hepatitis C virus, Human immunodeficiency virus, Treponema pallidum and Malaria persist, if screening of blood is not performed properly.¹ Dr. James Blundell an English obstetrician, was the first to carry out safe blood transfusion for the first time in the history.¹ 118.5

million blood donations are collected per year throughout the world as reported by WHO.² It is also necessitated to carry out screening of all blood donations regularly in the blood banks in order to avoid the transmission of infectious diseases.³ Blood transfusion is still a vast and challenging process in low and middle income countries (LMICs) like Pakistan, facing multiple problems at different levels due to the lack of financial resources and accessibility.⁴ In many countries screening for TTIs, is still being carried out by using rapid diagnostic tests (RDTs)⁵ which are reportedly associated with low sensitivity and therefore can easily miss infections especially during “window period” and rarely in fully developed/occult hepatitis B virus infection, in which HBV DNA is present, but hepatitis B surface antigen (HBs Ag), the principal serological marker is absent.¹⁰ Unreliability of the supply and diagnostic performance of these RDTs along with, lacking the capacity building of the laboratory staff, are the important factors associated with high prevalence of TTIs in low and middle income countries.⁷ WHO recommends the voluntary non-remunerated donors to carry out transfusions, as documented that the paid donors or replacement donors are unsafe relatively.⁸ These blood borne infections can produce a clinical picture which has huge diversity in terms of signs and symptoms, ranging from being completely asymptomatic to an ideal clinical presentation.⁹ In countries like Pakistan, which are endemic for TTIs, there is a high prevalence of asymptomatic individuals coming as donors, camouflaged among healthy individuals. Strict compliance to screening is mandatory in order to rule out these asymptomatic, but diseased individuals. According to the Government of Pakistan, Ministry of National Health Services, Regulations and Coordination (MoNHSR & C), Safe Blood Transfusion Guidelines were issued for screening five important pathogens associated with TTIs.¹⁰ Multiple studies have been conducted in the past as well in order to determine the prevalence of

TTIs among blood donors globally, reporting an either increasing or decreasing trend, pressing upon the major role of Blood Banks in all the institutions in implementing thorough screening, and therefore helping in the limiting TTIs.

Methodology

This was a retrospective, cross-sectional study conducted from 1st of January, 2022 to 1st of January, 2024 at the Microbiology Department and Blood Bank section of Main Pathology laboratory of Bacha Khan Medical Complex, Swabi, after seeking approval from the Institutional review board (IRB), F. No. 6304/Ethical Board/GKMC., making sure that the included donor’s information was kept confidential. Consecutive convenience sampling was carried out during this period of study. As per the inclusion criteria, only healthy blood donors who visited the Blood Bank section of Main Pathology Laboratory and fulfilled the donor selection criteria according to the WHO EMRO guidelines for the prevention and control of hepatitis in Pakistan, were allowed to donate blood, whereas the remaining were excluded.¹¹ Sample collection and processing was carried out by drawing donor’s blood in two blood collection vacutainers. One containing the anticoagulant i.e. ethylene-diamine tetra-acetic acid (EDTA) which was used to analyze the complete blood picture and blood grouping, and to confirm the status of the donor fit for donation of blood, whereas the other vacutainer without the anticoagulant was used for screening of the serological markers for HBV, HCV, HIV, Treponema pallidum by ELISA and for Plasmodium spp. by rapid immunochromatography. Screening of the received samples of the donor’s serum was carried out using the COBAS E-411 system (Roche, Germany), which is a fully automatic/autoanalyzer applied to the immune analysis, the basis of measurement of which is electrochemiluminescence (ECL). ECL technology uses streptavidin-coated magnetic microparticles as a solid phase, antigen/antibody interactions, and interference suppression methods. The sample was considered reactive if the sample’s

concentration was > 1.0. For screening of the blood donors for Malaria, immunochromatography (ICT) kits, (Abbott, USA) were used. Blood grouping of the received samples was carried out using DIAGAST, FRANCE, a manual technique using a plate utilizing the principle of hemagglutination. The being tested red blood cells bearing an antigen, agglutinated in the presence of the reagent containing the corresponding antibody.

Results

From 1st of January 2022 to 1st of January 2024, total number of blood donors analyzed was 10939. Out of these 10,063 (92%) were replacement donors, while the remaining 876 (8%) were voluntary donors. All the 10,939 blood donors were screened for the serological parameters including HBV, HCV, HIV, Syphilis, and Malaria during the mentioned study period. According to the results obtained in our study, regarding the burden of disease, from the total of 10,939 blood donors, 844 were found positive for at least one transfusion transmitted infection i.e. an overall positivity of TTIs in Swabi region of Khyber Pakhtunkhwa being 7.71%. Due to conservative culture and customs of the area most of the participants screened were primarily males. The total number of male participants was 10,934 and only 05 females were screened in the said duration.

Age Group	No. of cases n=10939	Percentage
20 to 30 years	3839	35.09%
31 to 40 years	3405	31.12%
41 to 50 years	2594	23.71%
51 to 60 years	1101	10.06%
Gender		
Male	10934	99.95%
Female	05	0.045%

Table II: Distribution of the TTIs in blood donors (n=10939)

		Frequency	Positive Results (%)
HCV	Reactive	535	4.89%
	Non-Reactive	10404	95.10%
HBV	Reactive	234	2.13%
	Non-Reactive	10705	97.86%
HIV	Reactive	44	0.40%
	Non-Reactive	10895	99.59%
Syphilis	Reactive	30	0.27%
	Non-Reactive	10909	99.72%
Malaria	Reactive	01	0.009%
	Non-Reactive	10938	99.99%

Out of the 05 females none were found positive for any of the serological markers being analyzed in our study. Regarding the demographic distribution of the donors as shown in Table I, out of a total of 10,939, maximum number of donors (35.09%) belonged to the age group 20 to 30 years of age. The percentage for the remaining age groups showed 31.12% in 31 to 40 years of age, 23.71% in 41 to 50 years of age and minimum number of donors were from the age group 51 to 60 years of age being 10.06%. Regarding the prevalence of the diseases being screened in our study, maximum prevalence observed was that of Hepatitis C virus i.e. 4.89 %, followed by the prevalence of the Hepatitis B virus which was 2.13%. The disease burden shared by HIV was 0.40%, followed by 0.27% for Syphilis and only one patient was found positive for Malaria i.e. 0.009% as shown in Table II. The forward blood group profiling of the donors who showed positive results revealed that 93.72% (791) of donors belonged to the Rh D-positive blood group, and 6.27% (n=53) were from the Rh D-negative blood group. Out of the donors which

Table III: Prevalence wise distribution of ABO and Rh D blood grouping among positive donors							
RHESUS FACTOR							
ABO	BLOOD GROUP	POSITIVE (n)	PERCENTAGE (%)	NEGATIVE (n)	PERCENTAGE (%)	TOTAL (n)	PERCENTAGE
	B	276	32.70%	17	2.01%	293	34.71%
	O	245	29.02%	13	1.54%	258	30.56%
	A	226	26.77%	18	2.13%	244	28.90%
	AB	44	5.21%	05	0.59%	49	5.80%
	TOTAL	791	93.7%	53	6.27%	844	100

were Rh D- positive Rh D-positive donors, In the case of donors which were found to be Rh D-positive, a major proportion were from the B positive blood group i.e., n = 276, followed by the O positive blood group where it was n = 245, followed by A positive blood group where it was n = 226. The minimum number of the patients found positive for the serological markers of TTIs were from the AB positive blood group, n = 44 as shown in Table III. In the case of donors turning out to be Rh D-negative, the frequency of the donors for, A-negative, B-negative, AB-negative and O-negative donors was n = 244, n = 293, n = 49, and n = 258, respectively as shown in table III.

Discussion

Screening for TTIs gives a comprehensive understanding of the magnitude of the burden in an area.¹² Effective in saving millions of lives especially in the life threatening situations like road traffic accidents and many other diseases which require regular transfusions, however in LMICs, transmission of infections through blood transfusions is still a challenge¹³, due to the associated transmission of infectious agents like human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), Treponema pallidum, Malaria and others.¹³ 99.95% of the donors screened in our study were males, during the mentioned two years. These results were consistent with results from many other studies conducted in the past not only in Pakistan, but globally.^{14,15,16} The major male predominance observed in our study in

addition to the cultural and ethnic reasons of the area where the study was conducted, is mainly due to the considerable volume of blood and iron reserves in men making them fit for blood donation. On the contrary, females due to many physiological and pathological issues are usually not considered fit for donating blood. Demographic distribution of the donors in our study showed that maximum number of donors (35.09%) were between 20 to 30 years of age, which was consistent with the results in a study conducted in an area in the vicinity of Swabi, namely Attock¹⁴. There was a decline in the number of donors with increasing age as observed in our study, which makes evident that younger age groups fulfil the selection criteria for blood donations more effectively as compared to the older age groups. The overall prevalence of TTIs among blood donors according to the results obtained in our study was 7.71%, which is higher than the results obtained in the study conducted in a tertiary health care facility in Islamabad who reported it to be 3.72%.¹⁷ Two other studies one conducted in Faisalabad reported a prevalence of 6.5%¹⁸ and 6.2% as reported from Guyana,¹⁹ both of which report a higher prevalence than the study conducted in Islamabad, but still lower than the prevalence reported in our study. On the contrary, the prevalence of TTIs as reported in our study was much higher than 0.4% reported in a Chinese study²⁰. The reason for this very low prevalence internationally could be due to better awareness and availability of resources. Still, it was comparable with the results declared in a study to be 5.59%²¹ which also is comparatively higher than other studies. Regarding the prevalence of different

serological markers measured in the study, the prevalence of HCV was reported to be the highest among the other TTI's i.e. 4.89 %, in our study comparable with the results reported by many other studies being 3.75%,²² 2.62% and 1.4% respectively.^{23,24} A systematic analysis comprising of 33 studies showed a seroprevalence of HCV (2.44 %), Syphilis (1.1%), and HBV (2.04%).²⁵ In our study, HBV was the second highest with a prevalence of 2.13% which although is quite high, but still much lower than the prevalence of HCV. This mainly would be due to the availability of vaccine in Pakistan for prevention and awareness about the transmission and prevention of this disease. These results were comparable with the results declared in a study to be 2.04%²⁵ and higher than 1.10% reported in another study from Rawalpindi.²⁴ The prevalence of HIV as reported in our study was 0.40%, which was higher than 0.26% reported in a study conducted in Rawalpindi²³ and also 0.24% reported by Siddiqui et al.¹⁷ After having said that highest prevalence was that of HCV, followed by HBV and HIV the sequence was followed by prevalence of 0.27% for Syphilis, which was reported to be much up the scale in many other studies i.e. 0.9%²⁴ and 0.75%²⁶ and also being the second highest in their study whereas in our study in comparison to this showed a much lower prevalence of Syphilis and being on the fourth number of prevalence of TTIs. As consistent with many other studies, the least number of donors were found positive for Malaria and in our study, it was only one patient found positive i.e. 0.009%, which was consistent with the results declared by Sara et.al.,²⁶ who also had Malaria as the minimally prevailing disease in their study. The order of prevalence of TTIs reported in our study with HCV being the highest followed by HBV, HIV, Syphilis and lastly Malaria was not to be found to be the exact same in other studies due to higher prevalence of Syphilis in their areas as compared to ours and reported Syphilis as the second most prevailing disease.²⁴ As reported in our study, maximum donors possessed the Rh D- positive blood group,

out of which the major proportion was that of B positive blood group followed by O positive, A positive and AB positive comparable with Arif et.al.,²¹ who also reported B positive as the major blood group in their study. Lack of awareness about the disease, both about the available treatment and prevention options and stigma associated in being infected with these diseases are the major factors in delaying the treatment and therefore further possibility of spreading the disease.

Conclusion

The risk of transfusion transmitted infections is considerably high. More studies need to be conducted on regular basis, as each study reflects the effectiveness and the necessity of the continuation of strict screening protocols, along with spreading awareness to limit the risk of transmission of TTIs in Pakistan.

Limitations

Being a single center based study and males being in a major proportion, limit our findings to be generalized to the entire population of Pakistan.

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