

Transfusion transmissible infections in Brunei Darussalam: A blood donor study

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ABSTRACT

Abstract: Despite the improvement with blood screening, transfusion transmissible infections (TTI) remain a concern. In Brunei Darussalam, blood is collected based on voluntary non-remunerated blood donations. This study was carried out to determine the sero-prevalence of TTI in Brunei Darussalam based on blood donations collected over a five years period (2005 to 2009). **Materials and Methods:** Blood donors were all screened for Hepatitis B virus (HBV), Hepatitis C virus (HCV), Syphilis (VDRL) and Human Immune Deficiency virus (HIV). Blood samples were collected and centrifuged before they were screened using Abbott ARCHITECT i2000SR analyser. Reactive samples were retested and confirmed with supplementary testing. Comparisons were made with published studies from 1988 and 1989. **Result:** Out of 56,645 donation units, 874 donations units were positive (1.49%) for any of the screening tests: 520 (0.92%) for HBV, 175 (0.31%) for HCV, 173 (0.31%) for syphilis and 6 (0.01%) for HIV. A decreasing trend was noted for HBV from 1.15% to 0.53% ($p < 0.05$) over the five years. For HCV, there was only a slight decreasing trend while there were increasing trends for syphilis and HIV. Compared to earlier studies, the current sero-prevalence of HBV was significantly lower (overall and per year, p values < 0.001). Similarly, the sero-prevalence of VDRL was also significantly lower ($p < 0.001$). **Conclusion:** The sero-prevalence of HBV was the highest among all TTI. The rates are significantly lower than earlier studies. Of concern are the increasing trends of syphilis and HIV. Effective donor education including counseling of reactive donors, establishment of donor management system and introduction of nucleic acid testing may need to be introduced to reduce the incidence of TTI.

Keywords: Blood transfusion, hepatitis B, hepatitis C, human immune deficiency virus, risk factors, transfusion associated infections

INTRODUCTION

Blood and its components are life-saving, however, they are also associated with life-

threatening hazards such as transfusion transmitted infections. Quality and safe blood is paramount to all patients. Rigorous donor selection following established guidelines is crucial to exclude donors who have potential transfusion transmissible infections (TTI).¹ Despite all the policies and strategies, trans-

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mission of transfusion associated infectious disease is difficult to prevent, primarily due to difficulty with detection of the disease during the pre-seroconversion or so called "window period". During this phase, infections may be asymptomatic but infectious.² Inadvertent laboratory testing errors, increased cost of screening, immunologically variant viruses, lack of fund and trained personnel are recognised as important factors in the failure to identify infections during this phase.³ With every unit of blood, there is a one percent chance of transfusion associated problem including TTI.

A majority of known cases of post transfusion diseases have been caused by human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), treponema pallium (VDRL) and malarial parasites. Hilda *et al.*, reported that the prevalence of HBV was the highest (0.34%) followed by syphilis (0.11%), HIV and HCV (0.06%) and malaria (0.01%).³ Another disease known as variant Creutzfeldt-Jakob disease (vCJD) can also be transmitted by blood transfusion. One patient reportedly developed symptoms of vCJD 6.5 years after receiving blood transfusion of red cells donated by an individual 3.5 years before the donor developed symptoms of vCJD.⁴

Blood collected in Brunei is based on voluntary non-remunerated blood donations. Donor mandatory screenings for infectious diseases in Brunei Darussalam are hepatitis B, hepatitis C, syphilis and HIV. All positive screening tests require further confirmatory and supplementary testing to establish whether the results represent a genuine positive case. Two previous studies in our local

setting based on two districts showed HBV rates to be 2.9% and 4.71% respectively.^{5,6} The earlier study also showed VDRL to be positive in 0.64% of blood donor in Kuala Belait.¹⁴ The aim of the study was to determine the prevalence of TTI among voluntary non-remunerated donations to the Blood Donation Centre over a five years period (Jan 2005 to Dec 2009). We also compared the current rates to the rates reported from the earlier studies.

MATERIALS AND METHOD

Data was collected retrospectively from Blood Donation Centre registry in RIPAS hospital as well as from three other satellite district hospitals. A total of 56,645 of voluntary non-remunerated donations were analysed for the incidence of TTI over a period of five years from January 2005 to December 2009.

Voluntary donations were obtained from walk-in donors and outdoor blood donors. These donors comprised of students, employees of government sectors and non-government organisations. Prior to donation, information regarding the age (18-60), weight (> 50kg), serum haemoglobin level, types of medication, health status (blood pressure and pulse rate), social lifestyle, travel history and number of previous donation were obtained. These are crucial in order to determine the eligibility of a blood donor. Donation interval could be three to four times per year.

Blood samples were taken into a plain tube and left to clot during the blood collection. The tubes were centrifuged for 10 minutes at 2,500 rpm prior to analysis. All blood units were screened using the Abbott ARCHITECT i2000SR analyser. The tests were based

on Chemiluminescent Microparticle Immunoassay (CMIA) for the qualitative determination of HBV surface antigen (HBsAg), HCV antibody, HIV antigen/antibody and syphilis antibody (VDRL).

Non-reactive samples were not required to be tested further. All reactive samples were retested in duplicate. Reactive samples were samples which were found to be positive for any one of the screening tests. Samples found to be positive on retesting were subjected to confirmatory and supplementary testing. HCV antibody and HIV antibody were confirmed by a line immunoassay method using the INNO-LIA HCV Score and INNO-LIA HIV I/II Score respectively. VDRL reactive samples were subjected using either Human Syphilis RPR test and Fujirebio Serodia TP-PA. Low reactive HBsAg samples were confirmed using the Abbott HBsAg confirmatory test. High reactive HBsAg samples were confirmed using the Abbott Determinate HBsAg test.

The data was tabulated and analysed looking at the incidence of individual infections over the five year period. Comparisons were made with data from 1989 for Kuala Belait district ⁶ and 1989 for Brunei Muara district. ⁵ Comparison was made using the Statistical Program for Social Science (SPSS)

Version 10.0, Chicago, IL, USA. Chi-square test was used for comparing the categorical variables. A *p* value of less than 0.05 was taken as significant.

RESULTS

The total number of blood donations were 56,645 units over the five year period with an increasing trend over the years (Table 1). Out of these, 874 units that tested positive for any of the TTI tested giving an overall positivity rate 1.49%.

The sero-prevalence of the individual TTI is shown in Table 2. Of all the TTI, HBV was the most common with an overall rate of 0.92%. A declining trend was observed from 1.15% in 2005 to 0.53% in 2009.

HCV and syphilis infections were next with an overall rate of 0.31%. There was an overall declining trend for HCV whereas for syphilis, there was an overall increasing trend. HIV accounted for only 0.01%, equivalent to one in 10,000 transfusions with an increasing trend.

Compared to the two previous studies (4.7% and 6%, respectively), the current HBV rates were significantly lower (all *p* values <0.001). Similarly, the current syphilis rates were also significantly lower compared

Table 1: The total number of blood donations and the total reactive cases from year 2005 to 2009.

Year	2005	2006	2007	2008	2009	Total
Total number of donations	10,743	10,841	10,773	11,708	12,580	56,645
Total Reactive cases (HBV, HCV, Syphilis and HIV)	196	196	143	198	141	874
Overall sero-prevalence (%)	1.82	1.86	1.33	1.69	1.12	1.49

Table 2: Incidence of Hepatitis B, Hepatitis C, Syphilis and HIV positive tests from 2005 to 2009.

Year	2005	2006	2007	2008	2009	TOTAL
Hepatitis B	124 (1.15)	128 (1.18)	87 (0.81)	114 (0.97)	67 (0.53)	520 (0.92)
Hepatitis C	53 (0.49)	36 (0.32)	20 (0.19)	35 (0.30)	31 (0.25)	175 (0.31)
Syphilis	19 (0.18)	31 (0.29)	36 (0.32)	48 (0.41)	39 (0.31)	173 (0.31)
HIV	0 (0)	1 (0.01)	0 (0)	1 (0.01)	4 (0.03)	6 (0.01)

Figures presented in absolute number and percentage in parenthesis

to the only published report (0.64%, $p < 0.001$). No comparisons could be made for HIV as this was not assessed in the previous studies.

DISCUSSION

In our study we showed that over the five year period, the total annual number of blood donations tested had increased steadily with a cumulative total of 56,645. In our setting, the majority of donors were male and in the age group of 25-44 years. This differs from the figures published by the World Health Organisation (WHO) which reported that 45% of donors were aged 25 or less and that 40% of donors were female. Therefore, based on the differences, we still have a large potential of increasing the donor pool by encouraging and recruiting the younger age group and potential female blood donors. This will also help to ease blood shortages that we may encounter from time to time.

Overall, there were 874 (1.49%) donation units that had tested positive for any of the TTI. From 2005 to 2009, there was an overall decrease in numbers of reactive cases. This might be due to decline in TTI such as HBV among our population and donor pool. Alternatively, it might be due to better awareness among our donor pool which had

resulted in fewer people with these infections coming forward for blood donation.

HBV was the most common among the tested TTIs followed by HCV and syphilis. The least common was HIV with a positive rate of one in 10,000 units tested.

Our finding of HBV being the most common among all TTI tested is not unexpected. Brunei Darussalam lies within the zone that is still considered as highly endemic for chronic HBV infection with rates reported to be more than eight percent by WHO. However, the true rate for chronic HBV infection is likely to be lower than eight percent but higher than the rate reported for blood donors given that blood donors are a self-selected group. Encouragingly, the annual rates have been declining from 2005 to 2009. This decline is most evident when we compared the current rates to the rates reported from two earlier studies conducted in the late eighties and early nineties.^{5, 6} In the first study conducted in Kuala Belait, the second largest district among 3,276 blood donors, the reported rate for HBV was 4.7%. There were significant differences in reported rates between the various ethnic groups.⁵ In the second study, the overall rate for HBV was six percent, the rate being significantly higher among the

Chinese.⁶ However, in the latter study, it was not restricted to blood donor population and included all serology tests carried out that year. Apart from these two studies, studies on pregnant women and volunteers with tattoos had been reported.^{7,8} A rate 3.2% was reported among pregnant women. Among volunteers with tattoos, the rate was higher at 19.5% compared to control without tattoo (9%).^{7,8} Again, these two studies were conducted in Kuala Belait.

The next common TTI were HCV and syphilis with overall rates of 0.31%. HCV rate initially decreased in 2005 but had remained stable thereafter. On the other hand, an initial increase was noted for syphilis and had remained stable thereafter. Overall, the trend seemed to be decreasing for HCV and increasing for syphilis respectively. The earlier study that had reported on the sero-prevalence of syphilis, reported a rate of 0.64%, higher among the Ibans.⁵ Our current rate is lower. To date, apart from haemodialysis patients, there had been no previous studies done looking at the prevalence of HCV among blood donors. This group of patients are known to be a higher risk for HCV infection.⁹

Fortunately, the least common was HIV. However, in our study, most of the cases were detected in the last two years (2008 and 2009). Further studies will be required to ascertain this trend.

Generally, the incidence of TTI varies between countries and even between regions within a country. A recent study from Nigeria reported overall sero-prevalence of HBV, HCV, syphilis and HIV at 18.6%, 6.0%, 1.1% and 3.1% among blood donors respectively.¹⁰

In contrast, a study from Southern Haryana India, reported sero-prevalence of 1.7%, 1.0%, 0.9% and 0.3% for HBV, HCV, syphilis and HIV among blood donors respectively.¹¹ A study from Albania among blood donors (n=52,727) similar to our study reported an overall TTI rate of 7.4% over a five year period; 0.03%, 6.7%, 0.6%, and 0.07% for HIV, HBV, HCV, and syphilis, respectively.¹² Their results are comparable to ours with the exception of higher HBV. They also reported higher rates between different groups of donors, higher among commercially remunerated donors (13.8%) compared to voluntary donors (9.4%) and family replacement donors (9.7%). This situation is true in most countries.¹³ Elimination of paid donors has been shown to reduce the risk of hepatitis transmission through blood transfusion.¹⁴

Despite the adoption of voluntary non-remunerated donations in our local setting, risk for TTI exists. Some reactive donors may not be aware of the status and donate several times. Lack of a proper blood donor data management system might have also contributed to the unawareness among blood donation service staff. Currently, donor data are recorded on paper as "hard copy" which is labour-intensive and could at times encounter error-prone procedures in trying to manually clerk and retrieve them.

Several steps or approaches can be introduced and implemented to reduce the incidence of TTI. It is imperative to counsel reactive donors and to exclude them from the donor pool. Our current compounding problems includes problems in contacting some of the reactive donors. Introduction of a donor data management system will eliminate many

of these problems. Such a system will help track blood and blood components from the time of its registration, donation, through all of the processing steps, to the patient who receives it. It can also help to trace in reverse order, from recipient back to the donor.¹⁵ This will ensure the safety and traceability of blood product by alerting any reactive donors during the registrations or donations.

Another approach to improve the safety of blood donation is the introduction of more sensitive test such as the Nucleic Acid Testing (NAT). NAT has been widely implemented in many countries since 1999. NAT can detect viraemia and acute viral infections during the serological window period when all serological markers are still negative. Glyn *et al.*, reported that introduction of NAT in the screening blood donation reduced the risk by two fold for HIV and almost 10 fold for HCV.¹⁶ However, the yield of NAT testing may be small in countries where the incidence is already low. Li *et al.*, from Taiwan reported only one positive HCV NAT among 10,727 seronegative donations screened.¹⁷ Incorporation of NAT screening in the blood donor screening will improve the yield but will increase the cost and eventually reduce the cost-benefit ratio.

Apart from improvement in the detection methods, it is also important to educate potential blood donors by providing knowledge and information about the risk of infection as well as the risk of social behaviours. This will also promote self-exclusion by donors.

In conclusion, our study showed that the overall TTI rates are low compared to

earlier studies and there is a decreasing trend for HBV while the trends seem to be stable in HCV and syphilis. Although still considered low, it is of concern that most of the HIV positive cases were detected in the last two years of the five years study. Introduction of a comprehensive donor data management system will likely reduce further the incidence of reactive cases among our blood donor pool. Recruitment of the young donors may also help as the prevalence of HBV is now much lower in this group. Overall, further studies are required to assess the trends of the tested infections in particular HCV, syphilis and HIV where the rates have not shown any declining trends.

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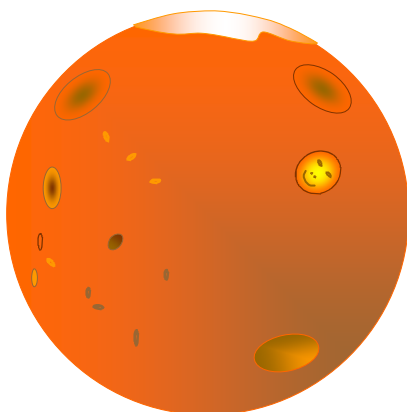


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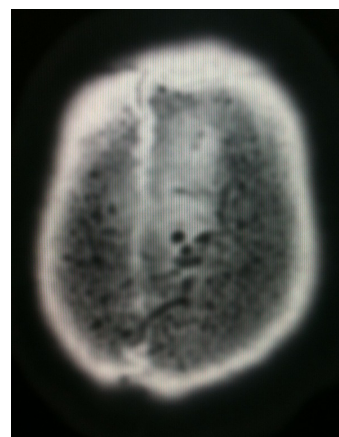


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