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Original Article

TRANSFUSION TRANSMITTED HIV & HBV INFECTIONS IN PUNJAB, PAKISTAN

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ABSTRACT

Objective: To assess the prevalence and risk of transfusion transmitted HIV and HBV infections in Punjab

Design: The retrospective sero epidemiological data of the Institute of Haematology and Blood Transfusion Service, Punjab from 1996-2000 was analysed with regard to:
a) Number of donors bled, b) Percentage of screening coverage, c) Percentage prevalence of HIV & HBV, d) Probability of receiving an infective unit P(R), probability of transmitting infection P(I) & spreading index evaluation and e) Cost assessment.

Setting: The data was obtained regularly from 71 field units established in the government hospitals throughout the Province of Punjab from 1996- 2000.

Subjects: A total of 1176284 directed first time or replacement blood donors as well as voluntary non-remunerated blood donors who donated blood at these blood banks or at mobile sessions have been included in this study.

Main outcome measures: Assessment of prevalence of HIV and HBV in blood donors and risk estimation.

Results: The screening coverage on the average has been 77.42% for HIV and 86.84% for HBV. The prevalence of HIV is 0.001% and of HBV is 2.259%. The probability of receiving an infective unit P(R) per 10000 donations is 0.023 for HIV and 29.72 for HBV. The probability of transmitting infection P(I) per 10000 donations is 0.021 for HIV and 26.75 for HBV The spreading index for both viral infections combined is 26.75 per 10000 donations. The cost of collecting and screening a single unit is Rs.350, while the cost of preventing the transfusion of a single infective unit is Rs.17836.

Conclusions: Efforts should be made to extend 100% screening coverage, with development of altruistic voluntary non-remunerated blood donor registries, donor deferral registries and donor counseling service. There is a need to move away from hospital based blood donation system to a community-based system which would mean moving to a central and regional service concept in blood transfusion. An independent external QA programme or monitoring system is needed. The target should be to decrease prevalence to a minimum to ensure blood safety.

KEY WORDS: Blood safety; Seroprevalence/ Risk of HIV & HBV transmission.

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INTRODUCTION

The transmission of diseases has taken a central stage amongst the hazards of blood transfusion. This is an area of particular concern, as proactive measures can minimise this risk. Apart from the appropriate selection of blood donors, serological testing for Transfusion Transmitted Infections (TTIs) to a large extent protects the recipients from the risk of infectious diseases. It is true that no blood is totally safe and that transmission can occur if the donor is in the window period especially with regard to

diseases in which serological markers for antigens is lacking. However, at the end of the day serological testing is the ultimate gatekeeper of the safety of blood.

In a country like Pakistan, testing for TTIs is important as very few voluntary repeat donors are available. Altruistic donors are few and far between and the bulk of donations come from replacement or family donors. Empathy plays a large role as unfortunately all blood transfusion centres are hospital based and a community based blood donor system has not yet developed fully.

The only well established blood transfusion service in the public sector in Pakistan is that in the Province of Punjab. It has a large network of blood banks and a substantial annual collection. Since few repeat donors exist in the system, data from the blood donors in a way also reflects as data from the general population in the relevant age group[1].

Epidemiological studies of transfusion transmitted diseases, forms an important aspect for improvement of transfusion practices. Analysis of previous records gives us an insight to safety of blood supply, quality of screening procedures and associated risks of transfusion transmitted diseases.

Several diseases, for example, HBV, HCV, HIV, Malaria and syphilis are transmitted by transfusion. Due to financial constraints, the Blood Transfusion Service Punjab has been screening blood for HIV and HBV only for the last five years and only recently screening for HCV has also been started.

We report here our data, for the years 1996 to 2000 as a first step towards dissemination of information. A well-documented record system is in place in the Blood Transfusion Service in Punjab; all units send monthly reports to the directorate. A surveillance system has also been put to work wherein samples are randomly obtained from the field units and known positive and negative controls are sent to the units as blind samples for testing as a limb of a quality assurance programme. Re-testing of positives by better methodologies (ELISA method) is also undertaken. Screening is initially done by cheaper modalities of testing for cost saving purposes. The figures reported here will allow a reasonable estimation of the risk of these transfusion transmitted infectious diseases in Punjab, Pakistan.

MATERIALS AND METHODS

Source of Information

The records of the Institute of Blood Transfusion Service Punjab from 1996 - 2000 were perused to obtain the data with regard to the overall number of donors, the number of donors screened and the prevalence of the serological markers for HIV & HBV.

As there are few repeat donors in the transfusion service currently, the data presented here can also be construed to reflect the general population in the relevant age group.

Testing Methodology:

Screening for both HIV & HBV has been carried out by Serodia passive haemagglutination test kit manufactured by Fujirebio Inc Japan and latex particle agglutination method kit manufactured by Biotech, UK respectively. Instruction inserts were strictly followed in the performance of the tests.

All HIV reactive donor serum was sent to National Institute of Health, Islamabad for reconfirmation by ELISA or Western Blot. All initially reactive HBV donors were re-screened by ELISA at the Institute.

Procedures used in blood banks throughout the province were uniform and performed by trained staff. The reagents were of satisfactory quality and were supplied by WHO. The testing was subjected to periodic supervision and performance evaluation of staff was duly carried out. As fractionation is minimal in our transfusion set up, it was also assumed that each blood donation was used for a single transfusion to one recipient.

Estimates:

Risk for transfusion transmission of disease:

The percentage of blood donors screened for

each disease is the screening coverage percentage. The probability of receiving a potentially infective transfusion unit, P(R), in each year was calculated by multiplying the prevalence of a specific serologic marker by the proportion of unscreened donors (100-screening coverage %).

The probability of acquiring a TTI, P(I) was calculated as the result of the probability of receiving a potentially infected transfusion P(R), multiplied by the risk of infectivity[1].

The infectivity risk is defined as the chance of getting infected through transfusion of a unit of blood or blood product. It was assumed to be 90% for both HIV & HBV[2,3,4].

The total number of infections induced by transfusion was calculated by number of donations in a given year multiplied by P(I). The total number of transfusion related infections P(I) divided by the total number of donations is the index of the spread of infectious viral disease (HIV & HBV) via blood transfusion[1]. This index gives an indication of the risks associated with blood transfusion.

Costs:

Taking into consideration the total budgetary outlay inclusive of grant from the federal government for HIV & HBV screening the total cost of one unit of whole blood works out to Rs. 350 (US $ 6.0 approximately). The cost for preventing the transfusion of one infective unit is estimated by the total number of donations screened multiplied by cost of a single unit divided by the total number of blood units testing positive for TTIs screened.

RESULTS

There are a total of 124 blood banks in the public sector in Pakistan, with the maximum number (57.3%) being in Punjab (Table I).

The largest and perhaps the most well organised blood transfusion service in the country is in the Province of Punjab. A well established system of record keeping, quality checks, surveillance, periodic inspections and performance evaluation is carried out in this service.

A total of 1176284 donors were bled in Punjab from the year 1996 to the year 2000. A progressive increase from 185946 in the year 1996 to 317587 in the year 2000 was observed (Table II).

Table - I: No. of blood banks in the public sector in Pakistan*

Province	*No. of Blood banks*
Federal	06
Punjab	71(57.3%)
Sindh	-
NWFP	30
Baluchistan	11
AJK	06
Total	124

* Source departmental communication with NIH Islamabad

Table - II: Blood collection data Institute of Blood Transfusion Service, Punjab

Year	*No. of Donors bled*
1996	185946
1997	198357
1998	215031
1999	259363
2000	317587
Total	1176284

On analyses of the data pertaining to donors for the year 2000 only, it was seen that the bulk of donations come from male, family/replacement donors and mostly first time donors. (Male: 285000,(89.7%), Female: 828 (0.3%)). Regular repeat donors or the voluntary non remunerative donors who made a true altruistic donation at least twice in the year constituted only 10% of the donor pool (Male:29000(9.1%), Female:2759(0.9%)). Representative estimates available for other years was no better.

The population of the Province of Punjab is 72.59 million of which 50 % is below the donor eligibility age. According to the 1998 census, women constitute 48.32% and men are 51.68%[5].

Table III shows that the screening coverage percentage over the study has been variable.

Table - III: Screening coverage* (SC) % & Prevalence** (P) % of infectious disease markers in blood donors

YEAR	No. Donors bled	HIV No. Tested	HIV No. Positive	HIV SC %age	HIV P %age	HBV No. Tested	HBV No. Positive	HBV SC %age	HBV P %age
1996	185946	159999	04	86.04	0.003	179601	3774	96.58	2.101
1997	198357	174988	02	88.21	0.001	190020	4674	95.79	2.460
1998	215031	145712	02	71.94	0.001	173265	3886	80.57	2.243
1999	259363	146920	Nil	56.65	0.000	220905	4644	85.17	2.102
2000	317587	283087	03	84.69	0.001	257714	6094	97.11	2.365
Total	1176284	910706	11	77.42	0.001	1021505	23072	86.84	2.259

* Screening coverage% (number of screened donors/total number of donors) x 100.
** Prevalence% (number of positive donors/total number of screened donors) x 100

Table - IV: Probability of receiving an infected unit, P(P)* and of acquiring A transfusion transmitted infection, P(I)***, Per 10,000 donations

Year	HIV P(R)	HIV P(I)	HBV P(R)	HBV P(I)
1996	0.042	0.038	7.19	6.471
1997	0.012	0.011	10.36	9.324
1998	0.028	0.025	43.58	39.22
1999	0.000	0.000	31.17	28.06
2000	0.015	0.014	6.83	6.15
TOTAL	0.023	0.021	29.72	26.75

* P(R)=Prevalence of infection x 100-screening coverage %;
** P(I)= P(R) x infectivity index(infectivity indexes used were HIV=90%,HBV=90%).

Table - V: Potential number of transfusion - transmitted viral infections* and spreading index** per 10,000 donations

Year	HIV	HBV	Total	Spreading Inex
1996	0.707	120.33	121.04	6.509
1997	0.218	184.95	185.17	9.335
1998	0.537	843.35	843.89	39.22
1999	0.000	727.77	727.77	28.06
2000	0.445	195.32	195.77	6.164
Total	2.470	3148.00	3150.47	26.77

* Number of infections transmitted by blood transfusion:-
=(total number of donors) x P(I)/10000.

** Spreading Index:-
=(total number of infections transmitted/number of donors) x 10000.

On the average for HIV it has been 77.42%,and 86.84% for HBV. The percent prevalence of serologic markers for HIV and HBV have been 0.001% and 2.259% respectively.

The probability of receiving (P(R)) an HIV infected unit has decreased from 0.042 per 10,000 donations in 1996 to 0.015 in 2000 and averaged at 0.023. The probability of transmission(P(I)) of HIV infection was estimated to be 0.038 per 10,000 donations in 1996 which has also decreased to 0.014 in 2000 and is averaged at 0.021/10000 donation over the study period. Similarly, the risk of receiving an HBV infection in 1996 was 7.19 and the probability of transmitting HBV was 6.471 per 10000 donations. Both these figures have shown improvement in the year 2000 and stood at 6.83 and 6.15/10000 donations. However due to repeated fall in screening coverage in the years 1997 to 1999 the average rates have gone up. In general, the P(R) and P(I) are inversely proportional to the screening coverage.

The estimate of potential number of viral infections that may have been acquired through transfusion over the five years is 3150.47 while the spreading index is 26.77 per 10000 dona-

Table - VI: Amount of infective blood collected & discarded and its cost from 1996-2000

Province/ Country	*Units Collected*	*Screening Coverage %*	*Total No. of infected units discarded*	*Cost of units discarded in Rs. million*	*Cost of Units discarded in Rs. million/ Year*	*Cost of Preventing Transmission of one infective unit In Rs.*
Punjab/ Pakistan	1176284	77.42HIV 86.84HBV	23083	8.08	1.62	17836

tions. Again both these parameters have been static in the years that screening coverage has been good even though not 100%.

Table 6 gives us an idea of how much expense is being borne on collection of infectious blood which is eventually discarded and the amount that is invested by the service in providing one, safe unit of blood, according to the prevalent standards and costs of the service.

DISCUSSION

Public health data has certain limitations being secondary source information. This data can at best be considered as an estimation[6]. However a large sample size collected over a substantially long period lends credibility to such data. We have presented here a very large volume of blood donors, approximately 1.2 million and the study is spread over half a decade. We believe that this data justifiably represents a true assessment of the risk of TTIs in Punjab. An underestimation or an over estimation although theoretically possible, is limited.

It can be argued that laboratory procedures might not have been the same in all blood banks or QC system might not have been strictly followed or even performance evaluations may have been skipped. At times inaccuracy in reporting or generation of several blood products from the same unit might have taken place.

These perhaps, are the limitations of public health data. In order to minimize such fallacies we have spread the study over a long period of time, coupled with meticulous record keeping. Furthermore, blood banks were regularly subjected to inspections and performance evaluation.

Risk of transmission of disease in the window period has not been taken into consideration[7]. To follow voluntary donors who make repeat donations in order to detect duration of pre seroconversion period is currently impractical, at least at this stage where majority of donors are directed first time donors. Unfortunately, the screening coverage in spite of best efforts has never been 100%. We presume negligible false negative reactivity as there have been no reports of serious hazards or transfusion transmitted infections from any hospital.

Double check of HIV reactivity was carried out by two institutions by Elisa. P24 antigen testing was not affordable and therefore not performed. Reconfirmation of initial reactive HBV donors by Elisa has been carried out. Follow up of seronegative donors for missed infections requires additional studies. Our approach was of exclusion of all initially reactive or cross reactive donors on screening methodology to ensure safety of the donated blood. There may have been dropout of healthy donors due to false positive reactivity[8].

The only well organised and developed blood transfusion service in the Public sector in Pakistan is that in the Province of Punjab. Out of a total of 124 blood banks of various categories with varying levels of instrumentation, 71(57.3%) are in Punjab (Table-I). Recently, another 46 blood banks have been established at THQ hospitals and are awaiting staff recruit-

ment before being commissioned. Soon, there will be about 117 blood banks in the public sector in Punjab alone and the collection figures are expected to increase.

Even with the existing infrastructure, this blood transfusion service has a substantive annual collection figure. However, there are little or negligible data available regarding repeat donors. Almost all are directed first time donors. Haphazard registries of voluntary non-remunerated donors are held in some of the blood banks being manned by enthusiastic blood transfusion officers especially of valuable negative groups. On gender basis, female donors constitute a negligible pool. It is worth noting that the female general population is almost 35.08 million(48.3%) and 50% of this population is in the donor eligible age group[5], Clearly marked strides have to be taken towards registration of voluntary non-remunerated community based blood donors in order to attain a sustainable blood donor base. This will also ensure added safety as repeat donors are considered safer as compared to first time donors[9]. Factors such as physical eligibility, social taboos, education and socio-economic status may be affecting donor recruitment on gender basis or otherwise.

The screening coverage percentages and percentage prevalence rate have been shown in Table 3. The service has been unable to extend 100% screening coverage as kits supply obtained from WHO have been interrupted for a variety of reasons from time to time. The screening coverage over the five year period for HIV has ranged from 56.65 to 84.69% with an average of 77.42%; while that for HBV has fared better ranging from 80.57% to 97.11% with an average of 86.84%. The maximum drop has been observed in the years 1998 and 1999. This is another aspect which needs commitment from policy decision makers in health care sector.

The prevalence for HIV is fortunately very low and ranges from zero to 0.003% with an average of 0.001%. For HBV the prevalence ranges between 2.101% to 2.460%, with a five year average of 2.259%. The pool size is remarkably large and as most donors are healthy first time directed donors, these figures may also be considered to assess the prevalence in the general population in the donation eligible age group(18-60years). The prevalence of HIV is low in the blood donors in Pakistan. However, other high risk groups may have higher prevalence rates [10,11]. Prevalence of hepatitis B in comparison is markedly high. According to these figures Punjab falls in the intermediate seroprevalence region.[12] Inclusion of hepatitis B vaccination in the EPI schedule in Pakistan from July 2002 is a welcome step, however immediate free vaccination to all healthy blood donors is also urgently needed both to preserve the donor pool and perhaps as an incentive for voluntary altruistic donors. It is apparent from the analysis of the data that the prevalence has remained static rather than the natural expectation of a downslide.

An issue that needs to be addressed is the reinforcement of the surveillance and quality assurance system. Testing in the service is done primarily by screening devices, which is followed by Elisa for all positive donors detected on screening. It is true that adding tests or changing to a better methodology will increase the sensitivity and specificity of the diagnosis, however it will also add to the cost.

In a situation, where the service is yet to attain 100% SC or even screen for total recommended TTIs, introducing initial screening by Elisa may sound difficult. This is where an independent surveillance and EQA programme both for the public as well as the private sector will be most helpful especially if instituted either by a professional body or governmental regulatory authority. The problem with governmental regulatory authorities is that even if they work efficiently, the violators often go underground and do not cease to function. Professional bodies, by extending a licensing or respectable membership may help create awareness of quality amongst end users and could bring a positive change.

The probability of receiving an infective unit P(R), and the probability of transmitting infection P(I) for both HIV and HBV increased sharply in the period that the SC decreased.

(Table-IV) However, HIV due to its low prevalence still compares well internationally [13,14,15] while HBV hovers around 6-7/10000 donations[6] (Table V). Similarly, the spreading index is also inversely linked to SC.

It is note worthy that, in spite of all efforts in introducing maximum screening coverage keeping in mind meager resources the service has been unable to reduce the prevalence, P(R), P(I) (Table-IV) and spreading index (Table-V) over a substantially long period of five years.

Even if the SC was to be 100% in all of the years, the data presented here would have been static and at best would have been that of the year 2000-the best year for SC. In this year, at least one recipient of a single unit of blood for every 67665 donations could have received a unit infected with HIV which is again fair compared to for example in Argentina where the case to donor ratio is 1:16496; however, the HBV track record is very poor where the case to donor ratio in Punjab is 1:44 while it is 1:6873 in Argentina[6].

What is needed in view of the above data is to immediately shift the donor pool to include majority of repeat donors only, which should be voluntary and non-directed even if replacement donations are accepted. Again donor records need to be computerised, a donor deferral registry set up and donor counseling started through motivation and a regular practice of mobile bleeding sessions at potential sites. Unless a serious move is made towards a community-based system away from the present hospital based system which is working heavily on the empathy factor for motivation for blood donation, safety concern of the blood will loom large over the units transfused.

Perhaps the best choice would be to shift the working to regional blood transfusion services and the strengthening of the central blood transfusion service via the existing Institute of Blood Transfusion Service, Punjab. All hospital-based blood banks should obtain regular inventories from the Institute and its regional centres. Collection, screening and component preparation should be undertaken here. Strengthening in terms of staff and resources will be needed but would be well worth the effort.

Apart from the improvement in health care which is of utmost importance, this effort will also be financially feasible as each year approximately 5000 infected units are collected and discarded. Each unit of blood costs Rs.350 and a total of Rs1.62 million per annum is wasted in collection of large number of infected units. Apart from the financial aspect, the hazards of disposal of infectious waste or the element of corruption that may be taking place through the underhand sale of these units is tremendous. The resources so saved could be profitably invested in strengthening quality assurance measures. This would serve two purposes, firstly, it would make blood safer and secondly it will increase the availability of blood.

CONCLUSIONS

In the light of our findings, we conclude that the following measures will be helpful in reducing the risk of TTIs and improving blood safety:

1. The screening coverage should be 100% under all circumstances.
2. Stress should be on collecting blood from voluntary non-remunerated donors
3. Donor deferral registers should be developed in order to target a decrease in the prevalence of TTIs.
4. It should be the responsibility of regional and central blood transfusion services to collect, screen, & process blood while hospital based blood banks should requisition required inventories.
5. Free Hepatitis B vaccination should be given to all eligible blood donors.
6. External quality evaluations should be regularly carried out.

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