The Risk of Acquiring Human Immunodeficiency Virus Infection by Transfusion of Screened Blood in Thailand

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Abstract

The risk of acquiring human immunodeficiency virus (HIV) infection from blood transfusion remains, despite the routine serological screening of donated blood. In Thailand, about 300 persons per year are estimated to be infected by HIV by receiving transfusion of screened blood. "Worst scenario" estimates indicate that more than 6,800 persons per year may be infected. The public health strategy for preventing HIV transmission by transfusion of blood includes two components, exclusion of donors at relatively high risk of infection and serological screening of donated units of blood. The first component has largely been neglected by Thai blood collection establishments. To make the blood supply system safer, Thailand should make implementation of this component the national priority.

INTRODUCTION

Of all modes of transmission of human immunodeficient virus (HIV), blood transfusion is the most efficient. Almost all persons exposed by this route became infected.1-2 In March, 1985 commercial immunoassay (ELISA) screening tests were licensed and confirmatory Western Blot tests became available for use in screening all blood donors in the United States of America.3 Although the several HIV ELISA tests that are licensed for screening donors vary somewhat in their sensitivity, all are quite effective (97.8% - 99.5% or more) in detecting established HIV infection.4-7 However, these ELISA tests are much less sensitive in detecting early infection.8-13 In addition to decreased sensitivity in the first several months after infection, a "window period" of seronegativity in the first 8-16 weeks is characteristic.11,14-22 Mainly because of the "window period" of seronegativity in early HIV infec-
tion and the decreased sensitivity of screening ELISAs in the first few months after infection, cases of acquired immunodeficiency syndrome (AIDS) have been reported from recipients of screened (anti-HIV negative) blood.15,23,24 For example, Ward et al. reported 13 HIV-infected cases acquired via transfusions from seven infected donors who were seronegative at the time of donation.15 At Chiang Mai University Hospital, routine serological screening of blood donors began in February, 1988. However, a study was recently reported of 165 children with beta thalassemia who had been transfused with 280 units of screened packed red blood cells; three (1.8%) of these children seroconverted.25 Thus the risk of acquiring HIV infection from transfusion remains, despite the routine serological screening of donated blood. This communication illustrates a case of HIV infection acquired by transfusion of screened blood, attempts to quantify the risk and the magnitude of the problem in Thailand, and suggests ways to make the Thai blood supply system safer.

CASE ILLUSTRATION

A seventy-year-old Thai woman was admitted to a hospital in Chiang Mai in early May 1989 because of lower abdominal pain and constipation for one month. A mass measuring about four centimeters in diameter was found by rectal examination. A biopsy revealed that the mass was an adenocarcinoma. She had undergone a surgery to remove the mass in early June. During the surgery two units of whole blood were given. The postoperative course was uneventful and in early July the patient was referred to a hospital in her home province in Northeastern Thailand for further care. In October the hospital in Chiang Mai was notified that the patient was found to be positive for the anti-HIV antibody by ELISA. This was subsequently confirmed by a Western Blot test. The ELISA was originally performed because the hospital had just set up the test and blood samples from several patients were used to test the machine. The patient was hospitalized only once before in 1981 with the diagnosis of pemphigus and had never received any transfusion of blood or blood product prior to the surgery.

One of the two units of whole blood given during the surgery was traced to a thirty-one-year-old professional donor. The unit of blood was screened by ELISA and found to be negative before it was given to the patient. On June 25, 1989 he donated another unit of blood. This unit was found to be positive for anti-HIV antibody and was discarded. He was told of the result and was instructed not to donated again. However, on April 22, 1991 he showed up and donated another unit of blood. It was again found to be positive for anti-HIV antibody and promptly discarded.

Estimation of risk

False negative results in blood donation screening have two main causes. One is donation in the "window period", before antibody has developed; the other is the failure of the screening test to detect HIV antibody, especially in early infection. It seems probable that the risk of seronegativity due to early infection among donors (from both causes) is directly related to the seroprevalence in the same donor population. Estimates have been made that donors who have false negative ELISA screening tests might occur at a rate of 2.7-14.4 per cent (mean 8%, median 7.5%) of those found to be seropositive from the same population (Table 1). These estimates are obtained from three publications using statistical modeling,14,15,24 and one prospective study23

Table 1  Estimates of anti-HIV false negative units as a percentage of anti-HIV positive units of donated blood from the same population.

<table>
<thead>
<tr>
<th>Period and area of evaluation</th>
<th>Units tested</th>
<th>Positive units</th>
<th>False negative units</th>
<th>False negative/positive (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistical models</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/85-2/87 U.S.A. (Cumming)</td>
<td>over 17 million</td>
<td>2,559</td>
<td>131</td>
<td>5.1</td>
</tr>
<tr>
<td>3/85-2/87 Los Angeles (Kleinman and Secord)</td>
<td>739,700</td>
<td>402</td>
<td>11</td>
<td>2.7</td>
</tr>
<tr>
<td>Prospective study</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4/85-12/88 Baltimore/Houston (Cohen et al.)</td>
<td>36,282</td>
<td>-</td>
<td>1</td>
<td>10**</td>
</tr>
</tbody>
</table>

*Weighted average of 0.012 per cent (repeat blood donors) and 0.041 per cent (first time donors)
**K.E. Nelson, personal communication
In Thailand, about 800,000 units of blood are transfused annually. In the latest standardized HIV seroprevalence survey among blood donors (the so-called sentinel surveillance) in June 1991 carried out by the Ministry of Public Health, the highest prevalence among the 67 provinces surveyed was 5.9 per cent and the median prevalence was 0.46 per cent. Using these figures, the author estimates that the median incidence of HIV infection by transfusion in Thailand is 276 persons per year (800,000 *0.46% *7.5%) and the "worst case scenario" incidence is 6797 persons per year (800,000 *5.9% * 14.4%). The true incidence may be higher than these estimates for three main reasons. In country like Thailand which is in the "ascending limb" of the HIV epidemic, the prevalence of early infection among those who are infected can be expected to be higher than in the U.S.A. Thus the 2.7-14.4 per cent figures should be regarded as minimum estimates. Secondly, lack of uniform quality assurance among medical laboratories in Thailand may allow more false negative units into the national blood supply system. And thirdly, in many medical centers units of whole blood are separated into two or more blood component units.

**DISCUSSION**

About 300 persons per year are estimated to be infected by HIV by receiving screened (anti-HIV negative) blood transfusion in Thailand. The true incidence is not known but may be 6,800 persons per year or higher. The public health strategy for preventing HIV transmission by transfusion of blood or blood products includes two components, exclusion of donors at relatively high risk of infection and serological screening of blood with elimination of all positive units from the donor supply (Figure 1).

The procedures designed to exclude donors at high risk of HIV infection include 1) exclusion by blood collection establishments of identifiable high risk groups e.g. prisoners, professional donors, etc.; 2) donor self exclusion; 3) confidential unit exclusion; and 4) providing alternative anonymous testing sites.

**Exclusion by blood collection establishments.** Although most provinces in Thailand have stopped taking blood "donation" from prisoners, many still use other high risk groups e.g. professional donors, "replacement" donors (who are essentially professional donors hired by the patients' relatives), and military recruits.

**Donor self exclusion.** In the U.S.A., people with symptoms of AIDS, homosexually active men, intravenous drug abusers, hemophiliac patients, immigrants from Haiti, and sexual partners of persons at increased risk for AIDS are asked not to donate. This is done by educating potential donors through information leaflets and other educational materials.

**Confidential unit exclusion (CUE)** CUE is a confidential method for donors to indicate that their blood donation should not be used for transfusion to patients. Because of the possibility that a person at high risk of HIV infection could be pressured by employers or coworkers to donate blood, CUE is designed to prevent these units of blood from entering the general blood supply. Donors are asked to complete a confidential form that described AIDS high-risk groups and the possibility of AIDS transmission by blood transfusion. The donor is then requested to indicate whether "my blood donation should be used only for studies" or "my blood donation may be used for transfusion". Donors complete the form at privacy stations. The form contains the identifying marker attached to the blood unit but does not have the donor's name or signature.

**Providing alternative anonymous testing sites.** In one report, a donor knowingly at risk for HIV infection gave blood to learn his HIV-antibody status. This illustrates the importance of establishing alternative testing sites where people concerned about HIV infection could obtain anonymous testing and counseling.

These four procedures designed to exclude donors...
at high risk of HIV infection were estimated to eliminate 49 of every 50 donors likely to be HIV positive.\(^\text{14}\) Mainly by using these non-testing techniques to exclude donors at high risk, only 0.008 per cent of donors in the U.S.A. in 1989 had positive anti-HIV tests that were confirmed by Western blot.\(^\text{29}\) The median prevalence of HIV infection in donor population in Thailand, which did not employ most of these non-testing techniques, was 0.46 per cent, approximately 57 times the prevalence in the U.S.A.\(^\text{26}\) Thus, Thailand should make implementation of these non-testing techniques the national priority. It was thought that there was a relatively larger impact of non-testing as compared with testing technique in eliminating HIV infected donation from the blood supply.\(^\text{14}\)

Laboratory screening of blood may be improved by using more sensitive and specific antibody kits when they become available and by more careful control of the laboratory operations in blood collection establishments. Other possibilities include the use of HIV antigen testing and polymerase chain reaction (PCR) techniques in laboratory screening. Antibody tests have been reported to be useful in the diagnosis of patients with the acute HIV infection syndrome.\(^\text{30,31}\) In blood donors, assays to detect p24 antigen have been evaluated.\(^\text{32-34}\) In U.S.A. over half a million donors were tested nationwide for the p24 antigen, and not one who was negative for the antibody was positive for the antigen. On the basis of this study and other data the food and drug administration recommended against routine screening of the blood supply for p24 antigen, in a memorandum issued to all registered establishments handling blood (October 4, 1989). However, two cases of antibody negative infected donors identified by antigen testing were recently reported.\(^\text{35,36}\) One of these was a Thai blood donor.\(^\text{35}\) The relative cost effectiveness of screening all blood donors in Thailand by antigen test in comparison with implementing the non-testing procedures needs further study and careful evaluation. At the current time, the PCR technique is reserved for research purposes for detection of HIV. Development of this procedure is being monitored. If sufficient progress in made, PCR testing will likely be adopted readily by blood collection establishments. Finally, Thai physicians need to be educated to limit the use of blood and blood components to circumstances in which they are unequivocally indicated. A risk-to-benefit assessment need to be made before each transfusion. Alternative to homologous transfusion must be considered as well as autologous banking for defined need, intraoperative blood salvage, and medical management of mild anemia or bleeding without transfusion.

REFERENCES


