2003, 3 894 894 units of blood were tested for HCV RNA and 2 186 468 for HIV RNA. Twelve HCV RNA-positive/anti-HCV antibody-negative, and four HIV RNA -positive/anti-HIV antibody-negative donors were detected, with an observed NAT versus antibody-based assay yield of 3.1 per 10^6 donations for HCV and 1.8 per 10^6 for HIV, respectively. Significantly, 5 of the 12 HCV RNA positive/anti-HCV negative donors had abnormal ALT. Since ALT testing is systematically performed in Italy, donations from such donors would have been discarded even in the absence of NAT results. Thus, the yield of NAT versus all mandatory tests for HCV is 1.79 per 10^6 donations.

The projected values (2.2 per 10^6 for HCV and 1.1 per 10^6 for HIV) were calculated on the basis of epidemiological data collected in the Lombardia region, which amounts to approximately one fifth of Italy's total number of blood donors and donations. Differences between the observed and the expected yields were not significant. This data indicates the satisfactory quality of both the surveillance system and the mathematical model.

So far, data on transfusion-transmitted HBV infection have not been collected at a national level, although there are plans to do so in the future. At present, the Ministero della Salute (Ministry of Health) is not planning to introduce HBV NAT testing for blood screening although the HBV predicted residual risk, calculated through mathematical modelling based on incident infections in donors screened in Lombardia during the period 1996 and 2003, is estimated to be 13.9 per 10^6.

Now that NAT has been implemented, the residual risk for transmitting HCV or HIV by blood transfusion in Italy is extremely low. The surveillance system described in this publication will be maintained to observe eventual shifts in the epidemiology of these infections, as well as the opportunity to introduce additional assays or to remove some of the currently performed tests.

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ORIGINAL ARTICLES

Surveillance report

INCIDENCE OF VIRAL MARKERS AND EVALUATION OF THE ESTIMATED RISK IN THE SWISS BLOOD DONOR POPULATION FROM 1996 TO 2003

C Niederhauser[1], P Schneider[2], M Fopp[3], A Ruefer[4] , G Lévy[5]

Among the well known transfusion-associated risks, the transmission of pathogenic viruses is regarded as one of the most serious. Over the past two decades, a series of overlapping safety procedures have been successively implemented to minimise this risk. It is now generally considered that the risk of transmitting viral infections via blood products is very low in developed countries. The present study analyses the incidence of the key infectious diseases HIV, hepatitis B virus (HBV) and hepatitis C virus (HCV) between 1996 and 2003 from 99% of voluntary repeat blood donors visiting the blood transfusion service of the Swiss Red Cross. Furthermore the estimated risk of these viral markers was calculated. From 1996 to 2003 the incidence rate for HCV decreased continuously, whereas no significant decrease in the incidence rate of HIV and HBV was observed. From 2001 to 2003, the last calculated period, the residual risk was estimated to be 1 in 1 900 000 for HIV, 1 in 2 200 0000 for HCV and 1 in 115 000 for HBV, respectively. This agrees with international studies, which have been shown that the estimated residual risk for HBV between 1996 and 2003 is higher than that of HCV and HIV.

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Introduction

Successes in preventing transmission of viral infections during the last 10 to 20 years have led to very low incidence rates and estimated residual risk for transfusion-transmitted viral infections [1]. This reduction was primary achieved by a careful medical selection of the donors improved sensitivity of serological tests and the introduction of NAT in minipools for HCV and HIV [2-4]. This study presents data on the incidence rate and the estimated residual risk for the key infectious disease HIV, HBV and HCV between 1996 and 2003, among non-remunerated voluntary repeat donors in the blood transfusion service of the Swiss Red Cross.

Methods

Clinical and laboratory data collected between 1996 and 2003 at 13 regional blood transfusion services (RBTS) of the blood transfusion service of the Swiss Red Cross (BTS SRC), were analysed. Data were available on 99% of the blood donations given by the voluntary non-remunerated blood donors in Switzerland. All donations were tested according to the recognised screening test algorithms for hepatitis B surface antigen(HbsAg), anti-HCV, anti-HIV1/2, syphilis and alanine aminotransferase (ALAT).

I) Samples repeatedly reactive or indeterminate for HBsAg were further analysed with a second independent HBsAg EIA, and if further reactive, tested by a neutralisation assay. In addition, anti-HBc and anti-HBs tests, were performed;

II) Samples repeatedly reactive or indeterminate for anti-HCV were confirmed with an additional independent anti-HCV EIA and with a HCV-RIBA assay;

III) Samples repeatedly reactive or indeterminate for HIV were confirmed with a second independent anti-HIV1/2 test, a p24 Ag assay and a HIV western blot.

HCV-NAT has been mandatory in Switzerland since July 1999, whereas HIV-1-NAT was not introduced until March 2002, nearly 3 years later. NAT analysis for HCV and HIV-1 were performed at seven independent laboratories with minipools ranging from 16 up to 49 donations per minipool. All donations were tested with the HCV and HIV-1 Cobas Ampliscreen assays (Roche Diagnostics, Rotkreuz, Switzerland).

Repeat donors were defined in Switzerland as donors who had been tested previously at a given regional blood transfusion service. Incident cases were confirmed positive blood donors whose previous donation had been negative.

Incidence was calculated using the following formula: Incident cases/number of repeat donations x mean number of donations per year and donor. Due to the lack of data on the interdonation interval, we assessed the average number of donations per year and donor from the data calculated in the RBTS Berne, which accounted for approximately 35 % of all donations in Switzerland. For HBV, the incidence data was adjusted by a factor 2.38 according to the model of Korelitz et al [5].

The estimated risk was determined using the following formula: Incidence x window period in days/ 365 [6]. The serological window period used for HIV, HCV and HBV were 22, 66 and 59 days respectively and the NAT window period for HIV and HCV were 11 and 11 days, respectively [7,8]. The same window periods were used for each of the six 3 year periods. Residual risk for HCV and HIV were calculated taking in account NAT windows, for 1999 to 2003 for HCV and 2002 to 2003 for HIV.

Results

A total of 3 759 671 blood donations were tested during the study period from 1996 to 2003. As shown in Table 1, the number of blood donations has decreased by an average of 3.5 % per year. The percentage of repeat and first time donors varied from 90.4 % to 95.4 % and from 4.6 % to 9.6 %, respectively.

Table 1

Donors tested since 1996, HIV, HCV and HBV positive donations found in repeat and first time donors, Switzerland, 1996-2003

	1996	1997	1998	1999	2000	2001	2002	2003	Total
RD tested	532 441	481 963	454 232	422 145	423 149	400 401	391 060	395 379	3 500 770
FD tested	40 063	39 370	26 793	31 005	29 149	31 577	41 772	19 172	258 901
RD HIV +	9	4	3	1	1	6	1	2	27
FD HIV +	4	2	0	4	3	1	1	3	18
RD HCV +	54	8	8	19	8	1	3	6	107
FD HCV +	65	61	25	33	33	22	14	30	283
RD HBV +	21	10	4	7	9	7	3	5	66
FD HBV +	66	70	34	34	32	34	36	43	349
HIV NAT -	-	-	-	-	-	-	0	0	0
HCV NAT -	-	-	-	0	0	1	0	0	1

RD: repeat donors; FD: first time donors

The number of confirmed positive donations for all 3 viruses HIV, HCV and HBV [Table 1] is detailed below:

I) In 1996 thirteen confirmed HIV positive donations have been identified, but since 1997 no trend in the number of confirmed HIV positive donations from repeat and first time donors was observed (between 2 and 7 cases per year)

II) Conversely, the number of confirmed HCV positive donations decreased between 1996 and 2002 from 119 to 17 (repeat and first time donors), but increased again in 2003 (36 repeat and first time donors).

III) The number of confirmed HBV positive donations decreased up to 1998 then remained stable up to 2002 with approximately 40 (range: 38 – 41 repeat and first time donors) positive HBV donations per year, however it increased again in 2003 from 39 to 48.

From 1996 to 2003, 18, 283 and 349 confirmed positive results were reported in first time donors for HIV, HCV and HBV respectively, whereas 27, 107 and 66 positive results were reported for repeat donors [Table 1].

The incidence rates for HIV, HCV and HBV for the study period 1996 to 2003 are presented in Table 2. The incidence rate for HCV has decreased for the period 1996/98 in comparison to the period 2001/03 by a factor of five, whereas the incidence rates for HIV and HBV have not markedly decreased.

Table 2

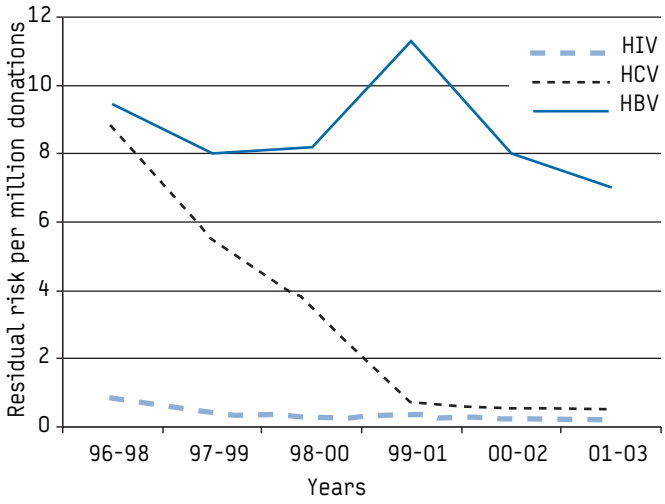
Incidence rates per 100 000 for HIV, HCV and HBV for the years 1996 to 2003, Switzerland

Year	HIV	(CI 95%)	HCV	(CI 95%)	HBV	(CI 95%)
1996-1998	1.77	(1.01 – 2.87)	7.74	(6.03 – 9.78)	9.21	(6.41 – 12.81)
1997-1999	0.96	(0.41 – 1.88)	4.18	(2.91 – 5.81)	5.97	(3.69 – 9.12)
1998-2000	0.64	(0.21 – 1.50)	4.50	(3.13 – 6.26)	6.12	(3.74 – 9.45)
1999-2001	1.10	(0.48 – 2.17)	3.86	(2.57 – 5.58)	7.55	(4.79 – 11.33)
2000-2002	1.16	(0.50 – 2.28)	1.74	(0.90 – 3.04)	6.55	(3.94 – 10.23)
2001-2003	1.35	(0.62 – 2.57)	1.50	(0.72 – 2.76)	5.36	(3.00 – 8.85)

The estimated residual risks for all 3 viral markers HIV, HCV and HBV from 1996 to 2003 are shown in Figure. The estimated residual risk for HIV was relatively stable over the period 1996 to 2003. For HCV the estimated residual risk decreased significantly for a factor of 30 over the same period, whereas for HBV no decrease was observed. In the 3 year period 2001 to 2003 the theoretical calculated residual risk for HIV, HCV and HBV is 1: 1.9 million donations (95% CI: 0.97 – 4.0 mill.), 1: 2.2 million donations (95% CI: 1.2 – 4.6 mill.) and 1: 115 000 donations (95% CI: 69 900 – 206 000), respectively.

FIGURE

Estimated risks in the Swiss repeat donor population from 1996 to 2003



These figures were calculated for the whole of Switzerland, based on the number of incident cases and the number of donations, donated yearly by repeat donors. Due to the lack of data on the interdonation interval, we assessed the average number of donations per year and donor from the data calculated at the RBTS Berne, which accounted for approximately 35 % of all donations in Switzerland. NAT was included in the risk calculation for HCV since 1999, and for HIV since 2002.

Discussion

Recent studies performed in other countries have shown that the estimated risk for transfusion-transmitted HIV and HCV infections and to a lesser extent also HBV infections via blood products is very low [1,9-12]. Glynn et al reported that since the introduction of NAT in the screening procedure of blood donations, the estimated risk of HCV and HIV infection has decreased two-fold for HIV and by a factor of almost 10 for HCV [13].

In Switzerland, the theoretical estimated risk for HIV is now considered as very low. However, a comparison of the calculated residual risk between 1996 to 2003 does not indicate a clear trend of a reduction. Even after the introduction of HIV NAT in 2002 no clear-cut decrease was observed. We believe the main reason lies in the fact that HIV positive donations are extremely rare in Switzerland and the relatively low number of total donations (400 000 to 450 000 per year) prevents statistically significant calculations. In 2002 and 2003, approximately 750 000 donations were tested for HIV RNA but no HIV RNA positive but anti-HIV negative unit has been detected.

For HCV the picture is clearer. A 30-fold reduction in the calculated estimated risk was observed between the periods 1996-1998 compared with 2001-2003. The reduction probably arose from the introduction of a more stringent donor selection policy. The donor population is composed of 90.4% to 95.5% repeat donors, who are well aware of the importance of having safe blood products. Repeat donors appear more attentive to the different information provided by the medical questionnaire and as a consequence, a selection is introduced before the blood is donated. In addition, the introduction of NAT in 1999 also played a role in reducing the risk. From 1999 to 2003, approximately 2 000 000 donations from repeat donors were tested for HCV RNA. One single HCV RNA positive, anti-HCV negative unit from a donor who donated regularly since 1999 has been identified.

The estimated residual risk for HBV between 1996 and 2003 is different to that observed for HIV and HCV. After an initial slight decrease in the estimated residual risk up to 1997 the number for HBV has remained quite stable between 8 and 12 estimated cases per million donations.

The estimated residual risk for HBV is significantly higher than those of HCV and HIV during the 3 years period 2001 to 2003. Despite the complicated serological course of HBV infection, which leads to difficulties in performing the residual risk calculations, the estimated risk of HBV transfusion-transmitted infections presented here agrees with those reported in other international studies [13-15].

In conclusion, the risk of transfusion-transmitted HIV, HCV and HBV infections is very low in Switzerland. The data obtained using incidence and window period models follow similar trends to results of similar studies performed in other developed countries. However the estimated residual risk for HBV remains higher and we are presently evaluating the possibility of introducing additional HBV tests to our screening algorithm as it has been recently discussed in international meetings.

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