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*Original Article*

# Prevalence and Factors Associated with Hepatitis C Virus Infection among Myanmar Blood Donors

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**We studied the prevalence of hepatitis C virus infection among blood donors from 3 hospitals of Central Myanmar and 7 hospitals of Lower Myanmar in the Yangon area, and analyzed the factors associated with the infection. The study period was from November, 2005 to June, 2007. A pre-tested questionnaire was used to obtain information on age, ethnic group, marital status, tattooing, body piercing, history of receiving transfusions, and liver diseases in self and in sexual partners. Data on seropositivity to hepatitis C, hepatitis B and human immunodeficiency virus infections were recorded. A total of 65,240 blood donors participated in the study. Their ages ranged from 18 years to 60 years (mean ± SD = 29.5 ± 9.3). The male-to-female ratio was 6 : 1. The prevalence of the antibody to hepatitis C was found to be 0.95% with varying rates (0.34 to 2.03) among hospitals. Females had a slightly higher rate (1.06%) than males (0.93%) ($p = 0.237$). Multivariate analyses revealed the following factors to be related to HCV infection: HIV infection, odds ratio (OR) = 3.0 ($p = 0.003$); history of liver disease, OR = 8.9 ($p = 0.001$); and age 30 years and above, OR = 2.6 ($p = 0.001$). We discuss the varying prevalences of HCV around the world.**

**Key words:** Myanmar, hepatitis C prevalence, blood donors, associated factors

Hepatitis C virus (HCV) infection is an important health problem in many countries [1]. According to a review in 2000, 3 percent of the world's population or almost 200 million persons are infected with HCV [2]. HCV has been shown to be associated with blood transfusion; although the acute infection is usually asymptomatic, the subsequent chronic infection is usually life-long and may lead to chronic liver disease, liver cirrhosis, and hepatocellular carcinoma. In fact in Japan where the incidence of hepatitis B virus infection is low, HCV has been proven as the single most important etiological factor for the development of hepatocellular carcinoma, [3].

HCV is regarded as an emerging health problem in Myanmar. Reports in the early 90s showed HCV infection in one-third of patients with hepatocellular carcinoma (Khin-Pyone-Kyi *et al.*, (1992) presented at the 38th Myanmar Medical Conference, Yangon), and in 2.5% of apparently healthy subjects (Khin-Pyone-Kyi *et al.*, (1995) presented at the Myanmar Health Research Congress, Yangon) in Myanmar.

In May, 2000, anti-HCV testing was introduced at blood banks in Yangon. From May, 2000 to October, 2003, a total of 102,632 donors were screened, and the overall anti-HCV positivity rate was found to be 2.8% (Paing-Soe *et al.*, (2002) presented at the

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Myanmar Health Research Congress, Yangon). In 2005, hepatitis C screening of blood donors was extended to Upper Myanmar. Blood banks from major hospitals in Mandalay and Magwe were included in the protocol. Although more data on the prevalence of HCV infection among blood donors became available (Myo-Khin *et al*., (2006) presented at the Myanmar Health Research Congress, Yangon), blood bank personnel have emphasized a lack of information on the factors associated with HCV infection in blood donors.

We carried out this study to determine the associated factors of HCV infection in blood donors for use in the deferral of high-risk blood donors.

## Subjects and Methods

Blood donors from 3 hospitals in Central Myanmar (Mandalay General Hospital, Magwe General Hospital, Pyinmana Township Hospital) and 7 hospitals (Yangon Children Hospital, Central Women Hospital, East Yangon General Hospital, West Yangon General Hospital, Insein General Hospital, Thingangyun Sanpya Hospital and North Okkalapa General Hospital) in the Yangon area were included. Prior to the study, informed consent was obtained from each donor. The study was conducted in accordance with the principles of Good Clinical Practice and the Declaration of Helsinki.

The OneStep HCV RapiDip test (CORTEZ Diagnostics Inc. Calabasas, CA, USA) was used at the hospitals for HCV seropositivity screening. This one-step test is based on the principle of a double antigen sandwich immunoassay for determination of anti-HCV in serum. It is very sensitive and only takes 10–20 min for the result to be read. Test results are read visually without any instrument.

The study period was from November, 2005 to June, 2007. A pre-tested questionnaire was used to obtain information on age, ethnic group, marital status, tattooing, body piercing, history of receiving transfusions, and liver diseases in self and in spouses. Data was collected by the laboratory personal from the participating hospitals. Data on seropositivity to hepatitis C, hepatitis B and human immunodeficiency virus infections were also recorded.

***Statistical methods.*** Data analysis was performed with computer software MINITAB Statistical Package Version 14.1; MINITAB Inc., (PA, USA) The chi-square test or Fisher's exact test was used as appropriate to evaluate the statistical significance in the distribution of each factor between blood donors who were seropositive and seronegative hepatitis C. Multiple logistic regression analysis was used to determine the independent association between potential factors and HCV seropositivity after controlling for potential confounding factors. Crude and adjusted odd ratios (ORs) and 95 percent confidence intervals (CIs) were calculated [4].

## Results

***General characteristics.*** A total of 65,240 blood donors participated in the study. Their ages ranged from 18 years to 60 years (mean ± SD = 29.5 ± 9.3). Male blood donors dominated female blood donors with a ratio of 6 : 1. Females were significantly older than the males (Table 1).

***HCV antibody prevalence.*** The prevalence of the antibody to hepatitis C among the study population was found to be 0.95%. The HCV seropositivity rate in blood donors varied from 0.34 to 2.03 among hospitals (Table 2).

Females had a slightly higher prevalence of anti-HCV seropositivity than males (1.06% vs 0.93%; Student's *t* test, $p$ = NS). The anti-HCV seropositivity rate increased with increasing age group with the exception of the oldest group. It was found to be the lowest (0.53%) in the 18–20 years age group and highest (1.88%) in the 41–50 years age group (Table 3).

***Associated risk factors for anti-HCV seropositivity.*** After univariate analysis, it was found that the significant associated factors among the population were: (a) marital status, (b) history of liver disease, (c) age of 30 years and above, (d) hepatitis B surface antigen seropositivity, and (e) presence of the antibody to HIV. There was no significant association

Table 1 Mean age of blood donors in relation to gender

| Sex | Number | Mean age (yrs) ± SD | Student's '*t*' test |
|---|---|---|---|
| Males | 55920 | 29.4 + 9.3 | *T*-value 7.25 |
| Females | 9320 | 30.2 + 9.2 | df = 11981 |
| Both | 65240 | 29.5 + 9.3 | *P*-value = 0.0001 |

**Table 2** HCV seropositivity rate in blood donors by participating hospitals

| Hospital | Number of donors | Number HCV positive | HCV seropositive rate |
|---|---|---|---|
| Children Hospital Yangon | 6,716 | 58 | 0.86 |
| Central Women HospitalH | 6,022 | 44 | 0.73 |
| East Yangon General Hospital | 1,847 | 16 | 0.87 |
| West Yangon General Hospital | 919 | 12 | 1.31 |
| North Okkalapa General Hospital | 8,397 | 45 | 0.54 |
| Insein General Hospital | 2,274 | 9 | 0.40 |
| Sanpya General Hospital | 4,630 | 23 | 0.50 |
| Mandalay General Hospital | 31,079 | 351 | 1.13 |
| Magwe General Hospital | 3,060 | 62 | 2.03 |
| Pyinmana Hospital | 293 | 1 | 0.34 |

**Table 3** Anti-HCV seropositivity by age group

| Age group | Total | Anti-HCV seropositivity | |
|---|---|---|---|
| | | Positive (%) | Negative (%) |
| 18–20 yrs | 10907 | 58 (0.5%) | 10,849 (99.3%) |
| 21–30 yrs | 27596 | 186 (0.7%) | 27,410 (99.3%) |
| 31–40 yrs | 14923 | 211 (1.4%) | 14,712 (98.6%) |
| 41–50 yrs | 7489 | 141 (1.9%) | 7,348 (98.1%) |
| 51–60 yrs | 1608 | 23 (1.4%) | 1,585 (98.6%) |

Chi-Square = 142.907, DF = 4, *P*-Value = 0.0001

with sex, history of receiving transfusions, history of body piercing, history of tattooing, or history of hepatitis in spouse. (Table 4).

Multiple logistic regression was applied for controlling confounders and for evaluating the effects of associated factors on HCV infection in the blood donors. After analysis, 3 variables history of liver disease, age of 30 years and above, and presence of the antibody to HIV were found to have an effect on the presence of HCV infection. (Table 5).

**Table 4** Associated factors for anti-HCV seropositivity by univariate analysis

| Associated factors | | Anti-HCV seropositivity | | *p* value |
|---|---|---|---|---|
| | | No. tested | No. positive (%) | |
| Sex | Male | 56,383 | 526 (0.93) | $p = 0.237$ |
| | Female | 8,834 | 94 (14.2) | |
| Marital status | Never | 14,942 | 183 (1.22) | $p = 0.001$ |
| | Ever | 48,628 | 426 (0.88) | |
| History of liver diseases | Yes | 47 | 3 (6.38) | $p = 0.01$ |
| | No | 65,189 | 618 (0.95) | |
| History of receiving transfusion | Yes | 59 | 0 (0.00) | $p = 0.907$ |
| | No | 65,177 | 621 (0.95) | |
| History of body piercing | Yes | 638 | 2 (0.31) | $p = 0.095$ |
| | No | 64,598 | 619 (0.96) | |
| History of tattooing | Yes | 408 | 4 (0.98) | $p = 0.953$ |
| | No | 64,828 | 617 (0.95) | |
| History of hepatitis in spouse | Yes | 5 | 0 (0.00) | $p = 0.90$ |
| | No | 65,230 | 620 (0.95) | |
| Age 30 years and above | Yes | 23,645 | 375 (1.56) | $p = 0.001$ |
| | No | 38,502 | 244 (0.63) | |
| Hepatitis B surface antigen seropositivity | Positive | 2,221 | 11 (0.50) | $p = 0.024$ |
| | Negative | 63,015 | 610 (0.97) | |
| Antibody to HIV | Positive | 288 | 8 (2.78) | $p = 0.001$ |
| | Negative | 64,948 | 613 (0.94) | |

Table 5 Factors associated with anti-HCV seropositivity among blood donors by multivariate analysis

| Associated factors | | Adjusted OR | 95% CI of OR | *p* value |
|---|---|---|---|---|
| History of liver diseases | Yes | 8.86 | 2.65–29.65 | $p = 0.001$ |
| | No | 1 | | |
| Age 30 years and above | Yes | 2.59 | 2.18– 3.08 | $p = 0.001$ |
| | No | 1 | | |
| Presence of antibody to HIV | Yes | 2.96 | 1.46– 6.02 | $p = 0.003$ |
| | No | 1 | | |

## Discussion

The problem of hepatitis C virus infection in Myanmar is well recognized, and efforts to control it in the blood donor population were initiated in 2000. Hepatitis C screening of 154,161 blood donors from May, 2000 to April, 2004 demonstrated the prevalence of HCV infection among Myanmar blood donors to be 2.6% [5]. Low HCV seropositivity in blood donors (<1%) has been reported from Europe [2] and the Far East (1%) [6]. However, high rates of HCV infection had been reported in Egypt, with 4% of blood donors being positive for anti-HCV antibodies and a higher prevalence rate of 15% in the rural areas of the country [7]. The HCV prevalence in Myanmar could be termed intermediate as the global seroprevalence of HCV among blood donors varies from 0.4 to 19.2% [8].

The present study highlights the increasing prevalence of anti-HCV seropositivity with age. The lowest seropositivity was observed in the 18–20 years age group; and seropositivity tended to increase with age reaching a maximum in the 41–50 years age group. Comparable results have been observed in studies on blood donors from India [9]. A similar pattern has also been reported from Japan [10], most likely due to the tumultuous period after World War II, marked by illicit intravenous amphetamine abuse and unsafe healthcare-related procedures like the use of unsafe needles in group vaccinations. With these results in mind, efforts should be made to increase retain young motivated voluntary donors to maintain a safe blood supply.

The seroprevalence of HCV in voluntary blood donors from different hospitals in India was shown to vary between 0.12 and 4 percent [11]. In the present study, HCV seropositivity among blood donors varied from hospital to hospital. Although the differences could be geographical in nature, a recent study highlights the benefit of earlier introduction of hepatitis C screening, as evidenced by the lower rates of hepatitis C seropositivity among blood donors in Yangon compared to Mandalay and Magwe (Myo-Khin *et al.*, (2006) presented at the Myanmar Health Research Congress, Yangon). This finding is also supported by the results of the present study where anti-HCV seroprevalence among blood donors in hospitals from Yangon was much lower than that of blood donors from Mandalay and Magwe.

The present study highlights the associated factors of HCV infection among blood donors. A previous history of liver diseases, age of 30 years and older, and seropositivity to HIV were identified as independently associated factors. Coinfection with HIV and the hepatitis C virus (HCV) has been reported in the past. The diseases are spread in similar ways, notably through shared use of needles to inject illicit drugs and sexual activities. Many people are coinfected with HIV and HCV, HIV and HBV, or even all 3 viruses [12]. A previous study carried out among Yangon blood donors also outlined associated factors. A higher prevalence of anti-HCV positivity was found in those with a history of surgical operation, tooth extraction, ear piercing and tattooing (Thein-Saw *et al.*, (1998) presented at the Myanmar Health Research Congress, Yangon). However, due to the nature of the present study, only minimal relevant data could be collected.

Variables that could cause confusion and were difficult to recall were not included. It was decided that an individual's history of surgical operation and tooth extraction procedures might not be easily defined and thus were excluded from the data collection form. Ear piercing was also not included as it is a very common practice among the Myanmar population, especially among females.

Although HCV prevalence surveys among blood donors could not be considered to be representative of the population at large, it could be concluded that the prevalence of HCV infection in blood donors is generally less than that in the general population as demonstrated by surveys carried out among apparently healthy populations. The prevalence of the antibody to HCV was found to be 2.8% among 569 subjects (246 males, 323 females), aged 3 months to 74 years residing in Yangon [13]. It has been reported that rates of HCV infection among populations residing in border areas of Myanmar were higher ($>10\%$) than that of blood donors from Yangon and Mandalay [14].

The risk factors for HCV seropositivity among Israelis include gum surgery, hospitalization without surgery, and therapy in injection form [15]. We did not include these items in our data form as our previous studies among blood donors and the general population did not establish them as significant factors in Myanmar [13, 14]. A study from Australia identifies the use of injected drugs as a potential risk factor [16]. However, drug use is not easy to define, and as self-revelation of such a factor is also not dependable, it was not included in the data collection form.

The present study was based on the experiences of a field study where characteristics of hepatitis C seropositive subjects from communities in the border areas of Myanmar were used to develop a simple cost-free system for assessment of HCV infection [17]. Many health care facilities in Myanmar do not have the resources to implement routine HCV testing of blood donors given the current availability and the cost of the test. The factors identified by the present study as associated with HCV infection could help local health personnel in the deferral of blood donors who are likely to be seropositive to HCV infection.

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