

Prevalence of Hepatitis E Virus in Chinese Blood Donors[∇]

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A point prevalence study of hepatitis E virus (HEV) in Chinese blood donors was conducted, and the prevalences of antibodies against HEV immunoglobulin G (IgG) and IgM among Chinese blood donors were 32.60% and 0.94%, respectively. HEV viremia was 0.07%.

Hepatitis E virus (HEV) can cause sporadic as well as epidemic hepatitis. While HEV transmission usually occurs by eating and drinking contaminated foods and water (4), blood transfusion is another route of infection (1).

During HEV infection, the first antibody to appear is immunoglobulin M (IgM) at week 4, followed by IgG at week 5 (2). The usual length of IgM positivity is between 2 and 3 months. Viremia appears during acute HEV infection at week 2 and normally lasts for 2 to 3 weeks but can last for up to 112 days (1).

In China, HEV seroprevalence of the general population is about 40% and increases with age at a rate of about 1% per year (3). Acute infection, as estimated by the prevalence of IgM anti-HEV and the spontaneous rise of IgG anti-HEV levels, occurs at about 4% per year. Asymptomatic viremia has been estimated to be approximately 0.3% (5). With such figures, an appreciation of the prevalence of HEV in Chinese blood donors seems prudent from a public health perspective.

Eligible plasma samples ($n = 44,816$) were collected from 6 urban blood centers in China during the past 7 years (from approximately December 2002 to October 2008). Demographic details of the sex and age of the subjects are provided in Table 1. All donors tested negative for syphilis, hepatitis B and C, HIV type 1, and HIV type 2, had normal alanine aminotransferase (ALT) levels, and had no signs of acute virus hepatitis at the time of donation.

Antibodies against HEV IgG and IgM were tested by commercial enzyme-linked immunosorbent assay (ELISA) kits (Wan Tai, Beijing, China), according to manufacturer's instructions. Table 2 shows that the HEV seroprevalences of blood donors ranged from 29.9% to 41.7%. As estimated by use of IgM anti-HEV, the rates of acute HEV infection ranged from 0.43% to 1.51%. All anti-HEV IgM-reactive samples were also anti-HEV IgG positive.

A random selection of 420 anti-HEV IgM-reactive samples and more than 100 negative (including IgG-positive and -negative) samples were tested for HEV RNA using an in-house PCR system. RNA was extracted from 250 μ l of the specimen with Trizol (Invitrogen). Reverse transcription-PCR (RT-PCR) was then performed (3, 5), with a 150-bp fragment of the viral genome carried by ORF2 being amplified and sequenced. The nucleotide sequences of the amplified products were aligned by using Jotun-Hein methods in the software program MegAlign (DNASStar package version 7.1.0, Lasergene; DNASStar, Inc., Madison, WI). The rates of viremia among the donors in 6 different regions of China ranged from 0.02% (Xiamen) to 0.14% (Huzhou) ($P < 0.01$). These results also showed a high prevalence of viremia among anti-HEV IgM-positive samples. A total of 7.14% (30/420) of anti-HEV IgM-positive samples were RNA positive, but none of the IgM-negative samples were HEV RNA positive. Phylogenetic analysis shows that 17 of 30 isolates belonged to genotype 1, and the remaining 13 belonged to genotype 4 (GenBank accession no. FJ606805 and FJ972142 to FJ972170).

In conclusion, HEV presents a risk of infection through blood transfusion in China, with a high prevalence of viremia among anti-HEV IgM-positive samples. Preventive strategies such as serological screening of anti-HEV IgM of donors should be introduced to reduce transfusion-transmitted risk for HEV infections. This may be of especial importance to individuals who are immunocompromised or who are unable to achieve viral clearance and thus may suffer from other clinical consequences.

TABLE 1. Age-related prevalences of HEV RNA in male and female blood donors

Age group (yr)	% of samples positive for HEV RNA (no. of samples positive/total no. of samples)		
	Male	Female	Total
<20	0.08 (3/3,941)	0.06 (3/5,078)	0.07 (6/9,019)
21–40	0.07 (14/19,359)	0.07 (9/12,710)	0.07 (23/32,069)
>41	0.04 (1/2,299)	0 (0/1,429)	0.03 (1/3,728)
Total	0.07 (18/25,599)	0.06 (12/19,217)	0.07 (30/44,816)

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TABLE 2. Prevalences of anti-HEV IgG, anti-HEV IgM, and HEV RNA in blood donors

Area ^a	Time collected (mo/yr)	No. of donors (% positive)			
		Total	IgG anti-HEV	IgM anti-HEV	HEV RNA
HZ	12/2002–4/2003	3,047	1,271 (41.71)	46 (1.51)	6 (0.20) ^b
WH	2/2005–4/2005	10,136	3,175 (31.32)	92 (0.91)	10 (0.10)
XM	3/2005–4/2007	20,389	6,215 (30.48)	186 (0.91)	4 (0.02) ^b
SX	6/2005–5/2006	3,701	1,107 (29.91)	50 (1.35)	5 (0.14)
QZ	4/2006–4/2007	4,860	1,974 (40.62)	21 (0.43)	2 (0.04)
WZ	2/2008–10/2008	2,683	866 (32.28)	25 (0.93)	3 (0.11)
Total	12/2002–10/2008	44,816	14,608 (32.60)	420 (0.94)	30 (0.07)

^a Abbreviations: HZ, Huzhou; WH, Wuhan; XM, Xiamen; SX, Shaoxing; QZ, Quzhou; WZ, Wenzhou.

^b The differences between Huzhou and Xiamen were statistically significant ($P < 0.01$).

Nucleotide sequence accession numbers. The sequences newly determined in this work are available in GenBank under accession no. FJ972142 to FJ972170.

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