A cross-sectional study on HGV infection in a rural population *

LING Bin-Hua[1], ZHUANG Hui[1], CUI Yi-Hui[1], AN Wen-Feng[1], LI Zhi-Jie[1], WANG Shu-Ping[2], ZHU Wan-Fu[2]

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Abstract

AIM To determine the epidemiological characteristics and clinical significance of HGV infection, and to compare with HBV and HCV infections.

METHODS Anti-HGV, HBsAg, anti-HBs, anti-HBc and anti-HCV were detected by enzyme-linked immunoassays (EIA). Anti-HGV positive sera were further tested for HGV RNA by a nested reverse transcription polymerase chain reaction (RT-nPCR).

RESULTS The anti-HGV prevalence rate was 12.9% in the rural population. It was relatively low in children under 10 years of age, and then increased with age and peaked in the group of 50-59 years (29.2%). The Carrier rate of HBsAg was 12.6% in the population and quickly reached the highest (16.2%) in the 5-year age group. The prevalence rate of HBV infection was 64.9%, and rose to a high level in the group of 10 years, and maintained high till up to the top of 79.2% in the 50-59 age group. The HCV infection rate was 15.3%. No Anti-HCV positive cases were found in the group under 10 years of age. It was particularly high in the 20-40 age group, and reached the peak in the group of 30 years old. No significant differences were found in the infection rates of HBV, HCV and HGV between male and female. HGV infection was associated with the history of blood donation and the sexual transmission. The anti-HGV positive rate in wives of husbands with HGV infection was 53.3%, significantly higher than that in those with anti-HGV negative husbands (7.8%). HGV coinfection with HBV or HCV had no influence on serum alanine aminotransferase (ALT). No ALT elevation was found in the group with HGV infection alone.

CONCLUSION The epidemiological characteristics of HGV infection are different from that of HBV and HCV. HGV is transmitted by blood and sex, and does not seem to cause liver damage.

[1]Department of Microbiology, Beijing Medical University, Beijing 100083, China.
[2]Anti-Epidemic Station of Zhoukou Area, Henan Province, China
Dr. LING Bin-Hua, female, born on 1966-09-11 in Pingxiang City, Jiang xi Province, graduated from Beijing Medical University as a Master, now assistant researcher, and a Ph. D candidate, majoring viral hepatitis, having 7 papers published.
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Correspondence to: LING Bin-Hua, Department of Microbiology, Beijing Medical University, No.38 Xueyuan Road, Beijing 100083, China
Tel. +86·10·62092221, Fax. +86·10·62091617, 62921804
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INTRODUCTION

Since the discovery of hepatitis C virus (HCV) in 1989. 90% of blood-borne non-A, non-B hepatitis cases, acute as well as chronic, are attributed to HCV. The remaining 10%-15% patients with non-A, non-B hepatitis have no evidence of HCV infection, indicating the existence of additional causative agents. GBV-C and HGV were newly discovered putative non-A to E hepatitis viruses reported by two groups of investigators[1,2]. However, the sequence homology analysis of the two viruses revealed that they are different isolates of the same virus and tentatively designated GBV-C/HGV. It is a positive single-stranded RNA virus, and has a similar genome organization as the flaviviruses, in particular, hepatitis C virus (HCV), and is classified in the same genus[3]. GBV-C/HGV is transmitted mainly through blood or blood products. This study was carried out in a rural population with a high proportion of plasma donors in Zhoukou Area, Henan Province of China, to determine the epidemiological characteristics and clinical significance of HGV infection, and to compare with that of HBV and HCV infection.

MATERIALS AND METHODS

Subjects

All 541 registered residents in the village of Zhoukou Area, Henan Province were investigated.

Data collection

Every resident enrolled in this study received a

questionnaire including 17 items such as age, sex, hepatitis history, blood donation history, etc., and all questionnaires were filled out by the investigators. Then 3.5ml blood was drawn from each resident and the serum was immediately separated, and stored at -20℃ until tested.

Laboratory tests

All residents were tested for serum alanine aminotransferase (ALT) levels by Reitman's method; antibody to hepatitis G virus (anti-HGV), hepatitis B surface antigen (HBsAg), antibody to hepatitis B surface antigen (anti-HBs), antibody to hepatitis B core antigen (anti-HBc) and antibody to hepatitis C virus (anti-HCV) by enzyme-linked immunoassays (EIA); and HGV RNA by RT-nPCR. The anti-HGV EIA kit was developed by our laboratory[4]; HBsAg, anti-HBs, anti-HBc and anti-HCV EIA kits were produced by Shanghai Ke Hua Co.. RT-nPCR kit for detection of HGV RNA was established by our laboratory[5].

Diagnostic Criteria

The diagnosis of HGV infection was made on the reactivity of anti-HGV in serum. HBV infection was diagnosed by the presence of one of HBV markers (HBVM) including HBsAg, anti-HBc and anti-HBs. Individuals previously inoculated with HBV vaccines were excluded from the study. HCV infection was diagnosed on the basis of anti-HCV positivity in serum.

Statistical analysis

Frequency distributions and dichotomous variables were performed using the two-tailed Mantel-Haenszel chi-square test or the two-tailed Fisher's exact test (EPI-INFO software). Logistic regression analysis (SPSS statistical package) was applied to identify the independent variables associated with HGV, HBV or HCV infection. *P* value of less than 0.05 was considered to indicate statistical significance.

RESULTS

Age and sex distribution of HGV, HBV and HCV infections

The anti-HGV positive rate was 12.9% in the rural population. Fourty-two of 70 anti-HGV positive individuals tested were also HGV RNA positive (60%). The anti-HGV prevalence rate was relatively low in children under 10 years, and then increased with age and peaked in the group of 50-59 years (29.2%). The HBsAg carrier rate was 12.6% in the population, and quickly reached the highest (16.2%) in the 5-year old group. The prevalence rate of HBV infection was 64.9% in the population. It increased to a high level in the group of 10 years of age, and maintained high up to 79.2% in the 50-59 age group. The anti-HCV positive rate was 15.3% in the population. No anti-HCV positive cases were found in the group under 10 years of age. The anti-HGV prevalence was particularly high in the 20-40 age group, and reached the peak in the group of 30 years. It was 2.2%, 28.2%, 40% and 32.7% in the age groups of 10, 20, 30 and 40 years, respectively, and decreased quickly in the group above 50 years (Table 1).

No significant differences of HBV, HCV and HGV infection rates were found between male and female.

Table 1 Age distribution of HGV, HBV and HCV infection in the rural population

Age group	Cases	Anti-HGV(+)		HBsAg(+)		HBVM*(+)		Anti-HCV(+)	
(yrs)	tested	No.	%	No.	%	No.	%	No.	%
0-	52	1	1.9	7	13.5	25	48.1	0	0.0
5-	74	3	4.1	12	16.2	42	56.8	0	0.0
10-	92	10	10.9	13	14.1	62	67.4	2	2.2
20-	110	12	10.9	12	10.9	68	61.8	31	28.2
30-	70	12	17.1	10	14.3	47	67.1	28	40.0
40-	55	9	16.4	6	10.9	39	70.9	18	32.7
50-	48	14	29.2	10.4	5	38	79.2	2	4.2
60-	40	9	22.5	3	7.5	30	75.0	2	5.0
Total	541	70	12.9	68	12.6	351	64.9	83	15.3

* One of HBsAg, anti-HBc and anti-HBs positive

Epidemiological factors of HGV, HBV and HCV infections

Among 17 doubtful factors tested by single factor analysis, the blood donation history, anti-HBs, anti-HBc and HBVM (one of HBsAg, anti-HBs and anti-HBc) were related to HGV infection. The hepatitis history and age were risk factors for HBV infection, while the blood donation history, ALT level and HBsAg were associated with HCV infection. Multifactors were further analyzed using non-conditional logistic regression. Table 2 shows the risk factors correlated with HGV, HBV and HCV infections.

Table 2 Non-condition logistic regression analysis of HGV, HBV and HCV infections

Markers	Related factors	B value	OR value	*P* value
Anti-HGV	Blood donation history	0.6759	1.97	<0.05
	Anti-HBc	0.7629	2.14	<0.05
HBsAg	Hepatitis history	1.1079	3.03	<0.05
	Blood donation history	-1.0001	0.37	<0.05
	Anti-HBs	-1.8481	0.16	<0.001
	Anti-HBc	2.3166	10.14	<0.001
HBVM	Hepatitis history	0.9554	2.59	<0.05
Anti-HCV	Blood donation history	5.0103	149.95	<0.001
	Frequency of plasma donation	2.6594	14.29	<0.05
	HBsAg	-2.7363	0.06	<0.01
	ALT level	1.1172	3.06	<0.05

Anti-HGV positive rate was not correlated to the duration and frequency of plasma donation, whereas anti-HCV positive rate was associated with them. The anti-HCV positive rate of individuals with plasma donation more than 1 year (32/37, 86.5%) was significantly higher than that of those with less than 1 year (45/69, 69.2%) or without plasma donation (6/433, 1.4%).

Analyses of HGV, HBV and HCV infection between couples

Eighty-three couples were divided into two groups: in one group, both wife and husband had blood donation, and in another group, only one or neither of the couple had blood donations. The results showed that anti-HGV and HBVM positive rates in wives of husbands with anti-HGV or HBVM were significantly higher than in wives of anti-HGV or HBVM negative husbands ($P<0.001$ and $P<0.05$, respectively). However, no significant correlation was found in HCV infection between wives and husbands (Table 3).

Relationship between ALT and HGV, HBV and HCV infections

The abnormal rate of ALT in the individuals with HCV infection (34.5%) was significantly higher than in those with HGV or HBV infection (0% and 6.6%).

Table 3 Positive rates of anti-HGV, HBsAg, HBVM and anti-HCV of wives and husbands

Husbands infection	Wives anti-HGV positive rate(%)		Wives HBsAg (%)		Wives HBVM (%)		Wives anti-HCV (%)	
status	A	B	A	B	A	B	A	B
+	40.0 (2/5)	53.3 (8/15)	0 (0/1)	11.1 (1/9)	60.0 (6/10)	72.0 (36/50)	68.8 (11/16)	11.1 (1/9)
-	8.3 (1/12)	7.8 (4/51)	17.6 (3/17)	8.9 (5/56)	62.5 (5/8)	40 (6/15)	100.0 (4/4)	7.4 (4/54)
Total	17.6 (3/17)	18.2 (12/66)	16.7 (3/18)	9.2 (6/65)	61.1 (11/18)	64.6 (42/65)	75.0 (15/20)	7.9 (5/63)
OR value	7.4	13.4	0	1.3	0.9	3.9		0
χ^2	2.29	16.1	0.20	0.04	0.01	5.09	1.58	0.14
P value	<0.05	<0.001	>0.05	>0.05	>0.05	<0.05	>0.05	>0.05

*A: Both had blood donations; B: One or neither had blood donations

Table 4 Relationship between ALT and HGV, HBV and HCV infections

Group	No. tested	ALT abnormal rate (%)	*P* value
HBV-HCV-HGV+	11	0.0(0/11)	>0.05
HBV-HCV-HGV-	145	5.5(8/145)	
HBV+HCV-HGV+	46	8.7 (4/46)	>0.05
HBV+HCV-HGV-	256	6.6(17/256)	
HBV-HCV+HGV+	5	60.0(3/5)	>0.05
HBV-HCV+HGV-	29	34.5(10/29)	
HBV+HCV+HGV+	8	50.0 (4/8)	>0.05
HBV+HCV+HGV-	41	43.9(18/41)	

DISCUSSION

The enzyme-linked immunoassay (EIA) for detection of anti-HGV used in this study was established by our laboratory. The total coincidence rate between HGV RNA RT-nPCR and anti-HGV EIA kits was 94%, as reported previously[4]. So the anti-HGV positive rate determined by anti-HGV EIA reflects the actual status of HGV infection in the population. The epidemiological characteristics and risk factors of HGV infection in the population appear to be different from that of HBV and HCV.

The anti-HGV positive rate was 12.9% in the

population, significantly higher than that in the general population of China[6]. The HBsAg carrier rate and the prevalence of HBVM in this rural population were 12.6% and 64.9%, respectively, which were similar to that of the general population in China reported by Liu *et al*[7]. However, the anti-HCV positive rate of this population (15.3%) was much higher as compared with the general population of the country (15.3% *vs* 3.2%)[8]. The high prevalence of HGV and HCV infections may be associated with the high proportion (19.6%) of plasma donors in the rural population.

The age distributions of HGV, HBV and HCV infections were different. The anti-HGV positive rate was relatively low in children under 10 years, and then increased with age and peaked in the group of 50-59 years (29.2%). However, the HBsAg carrier rate quickly reached the highest (16.2%) in the 5-year age group, and the prevalence rate of HBVM increased to a high level in the group of 10 years of age, and maintained high up to 79.2% in the 50-59 age group. HCV infection in the population had a special pattern of age distribution different from HGV and HBV. It mainly concentrated in groups of 20, 30 and 40 years of age, with the prevalence rates of 28.2%, 40.0% and 32.7%, respectively. No anti-HCV positive cases were found in the groups under 10 years of age. The high-prevalence rate of HCV infection in the groups of 20-40 years was related to the high proportion of plasma donors among them.

The anti-HGV positive rate in wives of husbands with HGV infection was 53.3%, significantly higher than that in those with HGV negative husbands (53.3% *vs* 7.8%).The same phenomenon is also seen in HBV infection. The prevalence rate of HBVM in wives of husbands with HBV infection was significantly higher as compared with those of husbands without HBVM (72% *vs* 40%). Although the anti-HCV positive rate in Wives of husbands with HCV infection was relatively higher than that in those of anti-HCV negative husbands (11.1% *vs* 7.4%), but there was no statistical significance. The data demonstrated that the sexual transmission of HGV and HBV seems to be more important as compared with HCV.

The ALT abnormal rate in the individuals with HCV infection alone was significantly higher than that in those with HGV or HBV infection alone (34.5% vs 0% or 5.6%). It is interesting to note that the ALT levels in HBV patients with or without HGV coinfection had no difference[6]. It suggests that HGV, unlike HBV and HCV, may not cause the liver damage[2,9,10].

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