A prospective study of vertical transmission of hepatitis C virus

De-Gui Sun, Cai-Yun Liu, Zong-Da Meng, Yong-De Sun, Shu-Cong Wang, Yu-Qi Yang, Zheng-Lun Liang, Hui Zhuang

INTRODUCTION

It is well known that mother to infant transmission of hepatitis B virus (HBV) is the main cause of chronic carrier HBV, and the vertical transmission rate of human immunodeficiency virus (HIV) is also high with grave consequences. However, the existence and extent of vertical transmission of hepatitis C virus (HCV) are still largely unclear. Serological markers (anti-HCV) indicate various rates of vertical transmission of HCV[1-3]. Recently, the polymerase chain reaction (PCR) has been developed, which has enabled more accurate and reliable studies of vertical transmission of HCV[4,5]. In this study, we prospectively followed 15 infants born to 13 mothers with post transfusion HCV (PT-HCV). The results suggest that the rate of vertical transmission of HCV is high, but that the consequences in the infants are not serious, and that the transmission occurs mainly in the uterus.

MATERIALS AND METHODS

Mother to infant transmission

Pregnant women with PT-HCV and their offspring were selected (13 mo and 15 offspring). Mothers were interviewed, and their sera were collected at three, seven and nine months during pregnancy, and at one month after delivery. Sera of infants was collected at the ages of one, three, and six months, and every six months thereafter. Parents provided informed consent for the infants.

Infection in uterus

Five fetuses from five anti-HCV-positive women with induced labor and 97 fetuses from 97 anti-HCV-negative women with induced labor were studied. Liver tissue and sera of the fetuses were collected and frozen.

Serologic tests and gene amplification

Anti-HCV antibody was tested by second generation ELISA kits provided by YesBiotech Lab (C, Ns3, Ns4, Ns5) and Shenyang Huimin, Co.
Infection of mothers

Between 1988 and 1990, we recruited 13 children aged 22 to 40 years (mean: 28.6 ± 4.6 years) who suffered from PT-HCV. None of these mothers was infected with HBV. Table 2 shows the mothers’ sera makers of HCV. During pregnancy, five cases had clinical HCV, one had subclinical HCV, six had unapparent HCV, and three were only anti HCV positive. All mothers had normal ALT levels at one month after delivery, but two cases still had symptoms and signs of HCV.

Infection of infants

Of the 15 infants (5 male, 9 female), seven were followed up for three years, six for one year, and two for nine months. The infection rate of HCV was 86.7% (13/15), and two infants (13.3%) were negative both for anti-HCV antibody and HCV RNA. Among the 13 infected infants, one (7.7%) had clinical HCV, 2 (23.1%) subclinical infection, and 9 (69.2%) inapparent HCV infection (Table 3). Table 4 summarizes the characteristics of anti-HCV antibody and HCV RNA during follow-up. The seroconversion rate was 100% before three months, increasing to 33.3% at 18 months. Anti-HCV was persistently positive in one infant over 36 months (16.7%). The detection rates of anti-HCV antibody and HCV RNA were the same as that of anti-HCV antibody before 9 months, but the seroconversion rate decreased to 33.3% at 18 months. Anti-HCV was persistently positive in one infant over 36 months (16.7%). The detection rates of HCV RNA were the same as that of anti-HCV antibody before 9 months, but the seroconversion rate decreased to 33.3% at 18 months. Anti-HCV was persistently positive in one infant over 36 months (16.7%). The detection rates of HCV RNA were the same as that of anti-HCV antibody before 9 months, but the seroconversion rate decreased to 33.3% at 18 months.
**Table 4 Serological profiles of infants during follow-up**

| Month(s) | Number | Anti HCV antibody + | hepatitis C virus RNA + |
|----------|--------|---------------------|-------------------------|
| 3        | 12 (13)| 100.0 (100.0)      | 100.0 (100.0)           |
| 6        | 10 (11)| 90.0 (90.0)        | 100.0 (100.0)           |
| 9        | 11 (13)| 90.0 (90.0)        | 100.0 (100.0)           |
| 12       | 12 (15)| 54.5 (46.2)        | 41.7 (38.5)             |
| 18       | 6 (13) | 33.3 (15.4)        | 66.7 (30.8)             |
| 24       | 6 (13) | 22.2 (11.7)        | 33.4 (15.4)             |
| 36       | 6 (13) | 16.7 (7.7)         | 3.2 (2.2)               |

**DISCUSSION**

In this prospective study, we used a nested PCR for HCV RNA detection and a second generation ELISA for anti-HCV detection. The results suggest that the vertical transmission rate of HCV is high (86.7%). This vertical transmission can lead to clinical HCV, subclinical HCV, and inapparent infection. These results are consistent with the results reported by Thaler et al. Our results also showed that the types of clinical manifestations and the duration of HCV RNA was related to the conditions of mothers in pregnancy.

Infants born to mothers with clinical HCV had a high rate of clinical HCV. Their HCV RNA and anti-HCV antibody could persist for a long time-as much as three years in 2. Furthermore, the clinical manifestations types of infants were related to the clinical manifestations of their mothers. One baby born to a mother who had acute HCV during pregnancy had clinical HCVs, with persistent viremia up to three years, but three babies whose mothers were infected with chronic or inapparent HCV during pregnancy showed inapparent infection and their HCV RNA and anti-HCV disappeared in six to nine months.

Infection of HCV in uterine

Four fetuses from women who underwent induced labor were positive for both anti-HCV antibody and HCV RNA in cord and heart sera, and their liver tissues were HCV RNA positive as well. However, a fetus from a woman who was positive only for anti-HCV was uninfected with HCV, and the sera and liver tissues were all negative for anti-HCV and HCV RNA.

**REFERENCES**

1. Karaki T, Nishiguchi S, Fukuda K, Shiomi S, Monna T, Murata R, Ishihiki G, Hayashi N, Shikata T, Kohyashi K. Mother-to-child transmission of hepatitis C virus. *J Infect Dis* 1991; 164: 427-429 [PMID: 1649879 DOI: 10.1093/infdis/164.2.427]

2. Resnik HW, Wong VC, Ip HM, van der Poel CL, van Exel-Oehlers PJ, Leie PN. Mother-to-infant transmission and hepatitis C virus. *Lancet* 1990; 335: 1216-1217 [PMID: 1971054 DOI: 10.1016/0140-6736(90)92734-Y]

3. Chen DX, Lin HB, Chang MH. Mother to child transmission of hepatitis C virus: reply. *J Infect Dis* 1991; 164: 428-431 [DOI: 10.1093/infdis/164.2.428]

4. Thaler MM, Pauk CK, Landers DV, Wara DW, Houghton M, Veereman-Wauters G, Sweet RL, Han JH. Vertical transmission of hepatitis C virus. *Lancet* 1991; 338: 17-18 [PMID: 1676685 DOI: 10.1016/0140-6736(91)90006-B]

5. Novati R, Thiers V, Monforte AD, Maisonneuve P, Principi N, Conti M, Lazzarin A, Brechot C. Mother-to-child transmission of hepatitis C virus detected by nested polymerase chain reaction. *J Infect Dis* 1992; 165: 720-723 [PMID: 1318370 DOI: 10.1093/infdis/165.2.720]

6. Garson JA, Tedder RS, Briggs M, Tuke P, Blairbrook JA, Trute A, Parker D, Barbara JA, Contreras M, Aloysius S. Detection of hepatitis C viral sequences in blood donations by "nested" polymerase chain reaction and prediction of infectivity. *Lancet* 1990; 335: 1419-1422 [PMID: 1972209 DOI: 10.1016/0140-6736(90)91446-H]

7. Okamoto H, Sugiyama Y, Okada S, Kurui K,Akahane Y, Sugai Y, Tanaka T, Sato K, Tsuda F, Miyakawa Y. Typing hepatitis C virus by polymerase chain reaction with type-specific primers: application to clinical surveys and tracing infectious sources. *J Gen Virol* 1992; 73 (Pt 3): 673-679 [PMID: 1312125 DOI: 10.1099/0022-1317-73-3-673]

S- Editor: Filipodia  L- Editor: Jennifer  E- Editor: Liu WX
