

HCV infection: Seroprevalence in blood donors and high risk populations – A study of 1658 subjects

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Abstract

Background: Hepatitis C has a worldwide prevalence. Various risk factors are blood transfusion, intravenous drug use, chronic hemodialysis etc.

Aim: To study the seroprevalence of hepatitis c virus in blood donors, and seropositivity in different high risk population subjects. Compare our results with previous published studies.

Materials and Method: Serum of total 1658 subjects were tested with microwell enzyme immunoassay method for detection of antibodies to hepatitis c virus, out of them 1408 were blood donors and 250 were high risk population subjects.

Results: Of 1408 normal healthy blood donors, 3 were found seropositive post blood donation. In Comparison, 15 were seropositive for anti-hepatitis c virus antibody (6%) in 250 high risk population subjects.

Conclusion: Hepatitis C is currently an emerging disease with years of chronic infection in patients. There is no vaccine for hepatitis C, therefore prevention of HCV infection depends upon reducing the risk of exposure to the virus in health-care settings and in higher risk populations, for example, people who inject drugs, and through sexual contact.

Keywords: Hepatitis c Virus, Blood Donor, Enzyme Immunoassay.

Introduction

Hepatitis C has a worldwide prevalence. Globally approximately 130-200 million people are infected with it.^(1,2,3) 11 million new cases were found in the year of 2013.⁽⁴⁾ A study of 2011 shown worldwide prevalence of hepatitis to be 2.35%.⁽⁵⁾ CDC estimates that there were 19,659 deaths with HCV as an underlying or contributing cause of death in 2014.⁶ Hepatitis c virus infection can cause chronic liver disease namely hepatic cirrhosis, hepatocellular carcinoma and end stage liver disease in 5-25%.⁽⁵⁾

The following populations are known to be at increased risk for HCV infection: 1) Current or former injection drug users, including those who injected only once many years ago, 2) Recipients of clotting factor concentrates made before 1987, when more advanced methods for manufacturing those products were developed, 3) Recipients of blood transfusions or solid organ transplants before July 1992, when better testing of blood donors became available, 4) Chronic hemodialysis patients, 5) Health care workers, 6) Recipients of blood or organs from a donor, 7) Persons with HIV infection, 8) Children born to HCV-positive mother.⁽⁶⁾

Hepatitis C virus antibody is detected by ELISA method routinely in modern Indian blood banking practices which is one of the accurate methods. It has been estimated that patients on hemodialysis have conversion rate of being seropositive is around 1.38 to 1.9 % per year.^(7,8) Seropositivity of HCV is 5-93% in intravenous drug abusers, and with HIV co infection it reaches up to 100%.⁽⁹⁻¹⁴⁾

In this article, we have studied seroprevalence of Hepatitis C virus in blood donors and seropositivity in different high risk group cases.

Materials and Method

A retrospective study was conducted of blood donors at a tertiary care center in Himmatnagar in north Gujarat area of Gujarat, India from January 2016 to December 2016. Blood was tested for HCV post donation. A prospective study of randomly selected different high risk population subjects was done in collaboration with various clinical and Para clinical departments.

Total numbers of study cases were 1658. Out of these 1658 cases, 1408 cases were screened healthy voluntary blood donors. Another 250 cases were high risk individuals- Intravenous drug abusers (10), hemodialysis patients (40), patients of chronic liver disease (40), persons infected with human immunodeficiency virus (100), peripheral multipurpose health workers prone to needle stick injury or injury with sharp objects (60). Before drawing blood from them, an informed consent was taken from every single case.

With the help of disposable needle and syringes, 3 ml of venous blood was drawn in disposable plain vacutainer. The plain vacutainers containing whole blood were centrifuged at 1000 rpm for 15 minutes before performing tests. Samples stored in refrigerators having 4 to 8 degree Celsius temperature for 7 days. Micro well enzyme immunoassay method was used which uses enzyme linked immunosorbent assay method for detection of antibodies to hepatitis c virus in human serum. Before performing tests all the samples and reagents were brought to room temperature.

Results

In our study of 1408 normal healthy blood donors with voluntary donation, 03 donors were seropositive for anti-hepatitis c virus antibody (0.21%). All serum samples were tested by ELISA method. Repeat tests by ELISA with rapid immunochromatographic testing by two different manufacturers were done for confirmation and to rule out false positive. Serum samples were tested post donation. Standard operating procedure for donor selection was followed for screening purpose. (Table 1)

In Comparison, out of 250 high risk population subjects, 15 were seropositive for anti-hepatitis c virus antibody (6%). And out of these 15 anti HCV antibody positive cases, 3(20%) were intravenous drug users, 1(6.66%) was patient on hemodialysis, 5(33.33%) were patients with chronic liver disease and 6(40%) were HIV positive individuals. All the multipurpose health workers were found negative for anti-hepatitis c virus antibody. (Table 2)

Seropositive cases in Parenteral drug abusers were 2 in 31 to 40 (66.66%) and 1 in 21 to 30 years (33.33%) age group. No female was positive for anti-hepatitis c virus antibody. (Table 3)

Table 1: Seroprevalence of anti-hepatitis c virus antibody in blood donors

Control group	Number	ELISA Positive	Percentage
Healthy blood donor	1403	03	0.21%

Table 2: Seroprevalence of anti-hepatitis c virus antibody in different high risk categories

High risk group	Number	ELISA Positive	% In respect of total elisa positive
Intravenous drug user	10	03	20%
Hemodialysis	40	01	6.66%
Chronic liver disease	40	05	33.33%
Multipurpose Health care workers	60	00	0%
HIV positive cases	100	06	40%

Total	250	15	15%
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Table 3: Seroprevalence in intravenous drug users in relation to age and sex

Age	Male	Female	Total Male+ Female	Total positive	Percentage
10-20	01	00	01	00	00
21-30	05	00	05	01	33.33
31-40	04	00	04	02	66.66
41-50	00	00	00	00	0
Total	10	00	10	03	100

Table 4: Positive hepatitis c virus cases in chronic liver disease

	Number	Total positive
Cirrhosis	36	04 (10%)
Hepatocellular carcinoma	02	00
End stage liver disease	02	01 (2.5%)

Discussion

Blood transfusion was once amongst the top causes of Hepatitis c virus infection, but after introduction of stringent screening and examination procedures of blood donors with modern technique for anti HCV antibody detection the rate of transmission reduced post transfusion.⁽⁶⁾ with more advanced screening tests for HCV are used in blood banks, the risk is considered to be less than 1 chance per 2 million units transfused in united states.⁽⁶⁾ Before 1992, when blood screening for HCV became available, blood transfusion was a leading means of HCV transmission.⁽⁶⁾ The rate of seroconversion of hepatitis c after blood transfusion have been reduced to 0.57% from 3.84% in united states of America and to 1.9% from 4.9% in Japan.^(15,16) The highest so far has been 54% in 147 Chilean patients suffering from chronic hepatitis c post transfusion.⁽¹⁷⁾ In Kolkata and New Delhi study, 2% and 1.85% anti HCV antibody positivity was found in a study amongst healthy blood donors.^(18,19) In a separate study of blood donors at Cuttack, 2.12% prevalence was detected.⁽²⁰⁾ 0.35% prevalence was present in a case paper from Kolkata, 2010.⁽²¹⁾ In our study the seropositivity was about 0.21% in voluntary healthy blood donors. It is compared with other previous studies as shown in Table 5.

Table 5: Seroprevalence of HCV

Comparison of HCV seroprevalence in blood donors in india			
Place	Seroprevalence	Reference	Year
Ludhiana	1.09%	Gupta N et al ⁽²²⁾	2004
Delhi	0.66%	Pahuja S et al ⁽²³⁾	2007
Lucknow	0.85%	Chandra T et al ⁽²⁴⁾	2009
Southern haryana	1.0%	Arora D et al ⁽²⁵⁾	2010
West Bengal	0.31%	Bhattacharya P et al ⁽²⁶⁾	2007
Bangalore	1.02%	Shrikrishna A et al ⁽²⁷⁾	1999
Our study	0.21%	2016	2016

From randomly selected 250 high risk individuals, 15 subjects were found seropositive for HCV. Out of these 15 seropositive subjects, 6 subjects (40%) were HIV positive, 5(33.33%) were of chronic liver disease, 3(20%) were IV drug abusers and 1(6.66%) was on hemodialysis.

It has been well documented that transmission rate is much higher in intravenous, intramuscular drug abusers with multiple needle punctures. With IV drug abuse still remains a practice in different parts of world; the transmission rate is high in these groups. Two different studies have found 30.3% and 71% prevalence in parenteral drug users respectively in Baltimore and Antwerp.^(28,29) In a separate study of London, 44% anti HCV antibody positivity was found in total 428 chronic parenteral drug users.⁽³⁰⁾ In a tribal north east region of India, the prevalence rates of 71.2% and 92% were found in a study conducted at Mizoram and Manipur respectively.^(31,32) Proper treatment of intravenous drug users, and also use of disposable new needles and syringes reduces risk of hepatitis c in IV drug abusers by 75%.⁽⁴⁷⁾

Seroprevalence of HCV in patients with chronic liver disease is 3 to 31 %.⁽³⁴⁾ Tamilnadu and Punjab study have shown 5.6% and 48% prevalence of anti HCV antibody in chronic liver disease patients.^(35,36) In Patients of chronic liver disease, 12.5% (5 out of 40) subjects were found positive in ELISA for anti HCV antibody. Males were more (4) with one female having anti HCV antibody positivity. Hepatitis B virus can also coexist with hepatitis c virus. Study in Punjab have shown this to 24.7%.⁽³⁶⁾

Long term hemodialysis patients are more prone to develop hepatitis c infection from contaminated circuit. Previously in the nineties, in hemodialysis patients seroprevalence of HCV was 10 to 50% worldwide.⁽³⁷⁻³⁹⁾ The conversion rate was 1.38-1.9 % per year in dialysis patients having no concurrent high risk behaviours in 2000.^(40,41) In Hyderabad and Delhi study, 13% and 4.3% seropositivity was present.^(42,43) Nowadays with strict testing, proper maintenance and precautions the rate have been declined. Our study shows 2.5% (1/40) seropositivity of HCV in patients on hemodialysis for chronic kidney disease.

Multipurpose health workers at the peripheral placed primary health centers are more prone to get infected secondary to accidental needle stick injuries. After a needle stick or sharp objects exposure to HCV-positive blood, the risk of HCV infection is approximately 1.8%.⁽⁶⁾ Different studies have shown the seroprevalence of hepatitis c virus to be from 0 to 4% amongst them.^(44,45) Out of 60 multipurpose health workers in our study, nobody was found seropositive for HCV.

Conclusion

Hepatitis c is currently an emerging disease with years of chronic infection in patients. Previously

transfusion of blood and blood products was amongst the major cause of HCV infection, but with modern investigation and testing of blood donors, spread by blood transfusion is reduced. There is no vaccine for hepatitis C, therefore prevention of HCV infection depends upon reducing the risk of exposure to the virus in health-care settings and in higher risk populations, for example, people who inject drugs, and through sexual contact. Regular screening of high risk group should also be a routine as per center of disease control (CDC) guidelines.

References

1. Hepatitis C Fact sheet N°164. WHO. July 2015. Retrieved 4 February 2016.
2. Gravitz L. A smouldering public-health crisis. *Nature*. 2011;474(7350):S2-4.
3. Mohd Hanafiah K, Groeger J, Flaxman AD, Wiersma ST. Global epidemiology of hepatitis C virus infection: new estimates of age-specific antibody to HCV seroprevalence. *Hepatology* (Baltimore, Md.). 2013;57(4):1333-42.
4. Vos T, Barber R et al. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*. 2013;386(9995):743-800.
5. Lavanchy D. Evolving epidemiology of hepatitis C virus. *Clinical Microbiology and Infection*. 2011;17:107-115.
6. Center for disease control and prevention. Hepatitis C FAQs for health professionals. <https://www.cdc.gov/hepatitis/hcv/hcvfaq.htm>. retrieved 3 march 2017.
7. Solowon SS, Hawcroft CS, Narashima P, Subbaraman R, Srikrishnan AK, Cecelia AJ et al. Comorbidities among HIV infected injection drug users in Chennai, India: A cause for concern. *J Acquir Immune Defic Syndr*. 2008;49:327-32.
8. Halfon P, Khiri H, Feryn JM, Sayada C, Chanas M and Ouzan D. Prospective virological follow up of hepatitis C infection in a haemodialysis unit. *J viral Hepat*. 1998;5:115-21.
9. Seelff LB, Buskell-Bales Z, Wright EC, Deeraco SJ, Alter HJ, Iber FL et al. Long term mortality after transfusion associated non-A, non-B hepatitis. The National Heart, Lung and Blood Institute study Group. *New Engl J Med*. 1992;327:1906-11.
10. Mathers BM, Deglenhardt L, Philips B, Wiessing L, Hickman M, Strathdee SA et al. Global epidemiology of injecting drug use and HIV among people who injects drugs: a systemic review. *Lancet*. 2008;372:1733-45.
11. Aceijas C, Friedman SR, Cooper HL, Wiessing L, Stinson GV, Hickman M. Estimates of injecting drug users at the national and local level in developing and transitional countries and gender and age distribution. *Sex Transm Infect*. 2006;82(suppl 3):10-7.
12. Kumar MS, Mudaliar S, Thyagarajan SP, Kumar S, Selvanayagam A, Daniels D. Rapid assessment and response to injecting drug use in Madras, south India. *The International J of Drug Policy*. 2000;11:83-98.
13. Mahanta J, Medhi GK, Paranjape RS, Roy N, Kohli A, Akoi Tam BS, et al. Injecting and sexual risk behaviours, sexually transmitted infections and HIV prevalence in injecting drug users in three states of India. *AIDS*. 2008;22(suppl 5):559-68.

14. Jain M, Chakravarti A, Verma V, Bhala P. Seroprevalence of hepatitis viruses in patients infected with human immuno deficiency virus. *Indian J pathol Microbiol.* 2009;52:17-19.
15. Fabrizi F, Martin P, Dixit V, Brezina M, Russell J, Conrad A, schimid P, Gerosa S, Gitnick G. Detection of de novo hepatitis C virus infection by polymerase chain in haemodialysis patients. *Am J Nephrol.* 1999;19:383-388.
16. Theodore S, Jamal M. Epidemiology of Hepatitis C virus (HCV) infection. *Int. J. Med Sci.* 2006;3:41-46.
17. Soza A, Arrese M, Gonzalez R, Alvarez M, Perez RM, Cortes P, Patillo A, Riquelme A. Clinical and epidemiological features of 147 Chilean patients with chronic hepatitis C. *Ann Hepatol.* 2004;3(4):146-151.
18. Panigrahi AK, Panda SK, Dixit RK, Rao KV, Acharya SK, Dasarathy S, Nanu A. Magnitude of hepatitis C virus infection in India. Prevalence in healthy donors, acute and chronic liver diseases. *J Med Virol.* 1997;51:167-174.
19. Hazara SC, Chatterjee S, Das Gupta S, Choudhary V, Jana CK and Neogi DK. Changing scenario of transfusion related viral infection. *J Assoc Physicians India.* 2002;50:879-881.
20. Mishra S, Chayani N, Sarangi G, Mallick B, Pati SB. Serprevalence of anti HCV antibody in and around Cuttack, Orissa. *Indian J Med Microbiol.* 2002;20:40-1.
21. Das BK, Gayen BK, Aditya S, Chakrovorty SK, Datta PK, Joseph A. Seroprevalence of Hepatitis B, Hepatitis C, and human immunodeficiency virus among healthy voluntary first-time blood donors in Kolkata. *Ann Trop Med Public Health.* 2011;4:86-90.
22. Gupta N, Kumar V, Kaur A. Seroprevalence of HIV, HBV, HCV and syphilis in voluntary blood donors. *Indian J Med Sci.* 2004;58:255-257.
23. Pahuja S, Sharma M, Baitha B, Jain M. Prevalence and trends of markers of hepatitis C virus, hepatitis B virus and human immunodeficiency virus in Delhi blood donors. A hospital based study. *Jpn J Inf Dis.* 2007;60:389-391.
24. Chandra T, Kumar A, Gupta A. Prevalence of transfusion transmitted infections in blood donors: an Indian experience. *Trop Doct.* 2009;39:152-154.
25. Arora D, Arora B, Khetarpal A. Seroprevalence of HIV, HBV, HCV and syphilis in blood donors in Southern Haryana. *Indian J Pathol Microbiol.* 2010;53:308-309.
26. Bhattacharya P, Chakraborty S, Basu SK. Significant increase in HBV, HCV, HIV and syphilis infections among blood donors in West Bengal, Eastern India 2004-2005: Exploratory screening reveals high frequency of occult HBV infection. *World J Gastroenterol.* 2007;13:3730-3733.
27. Srikrishna A, Sitalakshmi S and Damodar P. How Safe Are Our Safe Donors. *Indian Journal of Pathology and Microbiology.* 1999;42:411-416.
28. Villano SA, Vlahov D, Nelson KE, Lyles CM, Cohn S, Thomas DL. Incidence and risk factors for hepatitis C among injection drug users in Baltimore, Maryland. *J Clin Microbiol.* 1997;35:3274-3277.
29. Mathei C, Robaey G, Van Danne P, Buntire F, Verrando R. Prevalence of Hepatitis C in drug users in Flanders, determinants and geographic differences. *Epidemiol. Infection* 2005;133:127-136.
30. Judd A, Hickman M, Jones S, Mc Donald T, Parry JV, Stimson G.V, Hall AJ. Incidence of hepatitis C virus and HIV among new injecting drug users in London. Prospective cohort study. *BMJ.* 2005;330:24-5.
31. Challeng PK, Borkakoty BJ, Chetia M, Das HK, Mahanta J. Risk of hepatitis C infection among injection drug users in Mizoram, India. *Indian J Med Res.* 2008;128:640-646.
32. Saha MK, Chakraborty S, Panda S, Nayak TN, Manna B, Chatterjee A, Detels R and Bhattacharya SK. Prevalence of HCV and HBV infection among HIV seropositive intravenous drug users and their non-injecting wives in Manipur, India. *Indian J Med Res.* 2000;111:37-39.
33. Hagan H, Pouget ER, Des Jarlais DC. A systematic review and meta-analysis of interventions to prevent hepatitis C virus infection in people who inject drugs. *The Journal of Infectious Diseases.* 2011;204(1):74-83.
34. Singh V, Katyal R, Kochar RK, Bhasin DK, Agrawal RP. Study of hepatitis B and C viral markers in patients of chronic liver disease. *Indian J Med Microbiol.* 2004;22:269-70.
35. Anbazhagan GK, Krishnamoorthy S, Thiyaagrajan T. Seroprevalence of HCV and its coinfection with HBV and HIV among liver disease patients of south Tamil Nadu. *World J Hepatol.* 2010;2(1):42-48.
36. Sood AS, Midha V and Jyoti D. High seroprevalence of hepatitis C virus and dual infection (hepatitis B and C virus) in non-alcoholic liver disease in north India. *J Assoc. Physicians India.* 1999;47:405-407.
37. Niu MT, Coleman PJ, Alter MJ. Multicentre study of hepatitis C virus infection in chronic haemodialysis patients and staff. *Am J kidney.* 1993;22:568-573.
38. Medin C, Allander T, Roll M, Jacqilson SH, Grillner L. Seroconversion to hepatitis C virus in dialysis patients, a retrospective and prospective study. *Nephron.* 1993;65:40-45.
39. Theodore S, Jawal M. Epidemiology of Hepatitis C virus (HCV) Infection. *Int J Med Sci.* 2006;3:41-45.
40. Halfon P, Khiri H, Feryn JM, Sayada C, Chanas M, Ouzan D. Prospective virological follow up of hepatitis C infection in a haemodialysis unit. *J viral Hepat.* 1998;5:115-121.
41. Fabrizi F, Martin P, Dixit V, Brezina M, Russell J, Conrad A, Schimid P, Gerosa S, Gitnick G. Detection of de novo hepatitis C virus infection by polymerase chain in hemodialysis patients. *Am J Nephrol.* 1999;19:383-388.
42. Reddy AK, Murthi KV and Lakshmi V. Prevalence of HCV infection in patients on hemodialysis: Survey by antibody and core antigen detection. *Indian J Med Microbiol.* 2005;23:106-110.
43. Agarwal SK, Dash SC and Irshad M. Hepatitis C virus infection during haemodialysis in India *J Assoc Physicians.* 1999;47:1139-1143.
44. Arankalle VA, Favorv MO, Chaudhuri A, Fields HA, Banerjee K. Contribution of HEV and HCV in causing fulminant non-A, non-B hepatitis in western India *J viral Hepatol.* 1995;2:189-193.
45. Ganju SA and Goel A. Prevalence of HBV and HCV infection among health care workers (HCWs). *J Commun Dis.* 2000;32:228-30.