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Original Research Article

An assessment of burden of active hepatitis C virus infection in HCV seropositive individuals in Gujarat- A retrospective study

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ABSTRACT

Introduction: Viral hepatitis is a major public health challenge that requires an urgent response as the disease is a 2nd leading infectious cause of death globally causing 1.3 million deaths per year. Hepatitis B and C, the two main types of the five hepatitis infections are responsible for 96% of viral hepatitis related mortality. HCV is commonly associated with chronicity, cirrhosis and hepato-cellular carcinoma. Screening for HCV is done with antibody detection. Sero-positivity is not an evidence of an active HCV infection, for which viral RNA detection is necessary. As appropriate standard testing by RTPCR for active infection is not done, patients do not receive proper treatment and data pertaining to true burden of disease in community remains hidden.

Aim and Objective: To determine prevalence of active hepatitis C virus infection in HCV antibody positive individuals.

Materials and Methods: Retrospective study was conducted at Microbiology Department, GMERS Medical College and hospital, Ahmedabad, from January 2020 to March 2024. A total of 763 sero-positive samples were received and tested for active HCV infection from 18 districts of Gujarat with RTPCR assay to ascertain active infection.

Results: Of 763 samples tested, 47.31% samples were positive and 48.23% samples were negative for HCV RNA. In active infection cases, 63.99% were male and 38.78% were female. Most common age group affected was 40-60 yrs. Highest prevalence was seen in South Gujarat. Regional variations in active disease burden was demonstrated.

Conclusion: Sero- positivity of HCV does not inform about active infection of HCV. Active infection is very high in sero-positive individuals. To reduce chronicity and associated mortality and morbidity of HCV infection, RNA detection, a gold standard diagnostic tool should be adopted for ascertaining the active infection status. With the availability of very effective directly acting antivirals for HCV, morbidity and mortality associated with HCV can be reduced.

1. Introduction

Viral hepatitis poses a serious threat to public health. In 2015, viral hepatitis was responsible for 1.34 million fatalities, which is more than HIV-related mortality and on par with TB deaths. It is estimated that 1.75 million new cases of HCV infection occurred in 2015, bringing the overall number of persons living with the HCV to 71 million.[1] The Hepatitis C virus (HCV) is a linear, single-stranded, positive-sense RNA virus belongs to the Flaviviridae family.[2] The transmission of HCV can occur via the parental route, as well as through perinatal, sexual, and needle-sharing routes, percutaneous exposure to infected blood products, and organ transplants from infected

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donors.[3]

Chronic HCV infection establishes itself when the body fails to eliminate the virus after an initial acute phase. This persistent infection can silently progress for years, often without noticeable symptoms, until significant liver damage occurs. According to estimates, 6 to 12 million people are living with chronic hepatitis C. Chronic HCV infection contributes to 12–32% of HCC and 12–20% of cirrhosis cases.[4]

The World Health Organization (WHO) estimates that roughly 50 million people globally live with chronic HCV, with approximately 1.0 million new infections occurring annually.[5]

The burden of this disease is substantial, impacting healthcare systems and individual well-being. With the availability of directly acting antiviral, chronic HCV case can be effectively cured. Sero-positivity does not reflect upon the active infection or chronicity of the HCV infection. Detection of viral RNA is required for demonstration of HCV active infection or chronicity.

This study focuses on assessing the prevalence of active infection among HCV antibody reactive (seropositive) individuals majority of whom are asymptomatic. Understanding the hidden burden of active diseases or chronic infections can provide significant insight that not only helps patients in receiving timely treatment but also influences public health strategies that aim to eliminate HCV infection by 2030.[5]

The prevalence of active infection in seropositive individuals for HCV has not been extensively studied in our region. Most of the studies have focussed on assessing the seroprevalence of HCV only. Hence this study will also function as a reference for future researchers.

2. Material and Methods

This retrospective study was conducted at Model diagnostic centre, Microbiology Department, GMERS Medical College, Sola, Ahmedabad, from January 2020 to March-2024.

2.1. Sample size

The sample size consisted of plasma samples from 763 HCV seropositive individuals received from various districts of Gujarat that were reactive for anti HCV Antibody.

2.2. Sample type

3-5 ml of whole blood was collected in a sterile EDTA vacutainer. Plasma separation was done by centrifugation within 6 hours of collection of whole blood. Plasma was stored at -20°C until testing.

2.3. Methods

Plasma samples were tested with quantitative real time RTPCR assay which allowed detection of RNA. Results were available as number of copies and then were converted to internationally accepted quantification in IU/ml. RNA extraction was done using column based kit QiaAmp viral RNA Mini Kit (QIAGEN) and on Automated RNA extraction system (Qiasymphony. RTPCR kit of Altona, Altostar HCV RTPCR 1.5 kit and Artus® HCV RG were used. RNA detection by RTPCR was considered a case of active infection.

3. Result

Out of 763 seropositive samples tested, HCV RNA was detected in 361samples with a prevalence rate of 47.31% and in 368 samples HCV RNA was not detected. In 34 samples, results were inconclusive and a repeat sample was requested anyhow, fresh repeat samples were not received. (Table 1)

There was higher positivity in males than in females. 63.99% samples from male cases and 38.78% samples from female cases were positive. (Table 2)

The age-wise distribution of the patients is shown in table 3. The majority of the cases belong to age group between 41 to 60 years (41.55%) followed by 21-40 years (38.78%). In extremes of age groups is more than 60 years and between 0-20 years positivity was less ie 14.96% and 4.7% respectively. (Table 3)

hows the region wise distribution of active infection status. Samples were received from 18 different cities of Gujarat falling under various zones like North, South, Central and West Gujarat. North Gujarat region showed prevalence of 47.15% while western Gujarat, central Gujarat and south Gujarat showed a prevalence of 48.20%, 40.20% and 79.16% respectively. Within the regions, diversity was seen. In majority of the cities, positivity ranged from 40-50%. However some regions likeMehsana, Patan, Surat and Valsad showed high positivity of 75 %, 76.92% and 81.81% respectively. However positivity was very low in some regions like Bharuch and Gandhinagar.

4. Discussion

Hepatitis C virus infection is ongoing challenge in India and might have long-term complications showing major contribution of liver illness in different parts of India. Serological tests like ELISA or rapid test that detect antibodies to HCV are used for screening purposes. Apart from this, during the early stage of acute HCV infection, there is a window period when these tests may not detect the antibodies, resulting in a false negative result. False negative results are common in patients with chronic renal failure receiving haemodialysis, individuals with HIV coinfection, patients receiving chemotherapy,

Table 1: Prevalence of active Hepatitis C Virus Infection

	Number of Cases	Percentage
Total number of Seropositive Cases	763	
HCV RNA detected	361	47.31%
HCV RNA not detected	368	48.23%
Inconclusive	34	4.46%

Table 2: Gender wise distribution of cases with active infection (n=361)

	Number of Cases	Percentage
Male	231	63.99%
Female	140	38.78%

Table 3: Age group wise distribution of cases with active HCV virus infection (n=361)

Age Group (in yrs.)	Number of Cases	Percentage of cases
0-20 yr.	17	4.7%
21-40 yr.	140	38.78%
41-60 yr.	150	41.55%
>60 yr.	54	14.96%

Table 4: Region wise distribution of cases with active infection (n=361)

Region	City	Number of Seropositive cases	Number of cases with RNA detection	Percentage of Active infection
Central Gujarat	Vadodara	32	20	62.50%
	Bharuch	21	3	14.29%
	Panchmahal	21	9	42.86%
	Nadiad	70	28	40.00%
	Petlad	55	20	36.36%
	Total	199	80	**40.20%**
Western Gujarat	Bhavnagar	3	2	66.66%
	Jamnagar	34	22	64.71%
	Khambhaliya	29	9	31.03%
	Porbandar	26	12	46.15%
	Rajkot	22	10	45.45%
	Total	114	55	**48.20%**
South Gujarat	Surat	13	10	76.92%
	Valsad	11	9	81.81%
	Total	24	19	**79.16%**
North Gujarat	Mehsana	37	27	72.97%
	Palanpur	2	1	50.00%
	Himmatnagar	117	61	52.14%
	Patan	16	12	75.00%
	Gandhinagar	102	29	28.43%
	Ahmedabad	152	73	51.41%
	Total	426	203	**47.15%**
Total		763	361	47.31%

steroid treatment, immunosuppressive medication and newborns. [6–8]

Sero-positivity does not reflect upon the active infection in acute stage or chronicity in patient. In such cases, RTPCR testing for HCV RNA is considered the standard method for detecting the infection as well as monitoring the treatment. Hence antibody detection helps only for screening purpose of hepatitis C virus infection. RTPCR should be done in such cases to diagnose active hepatitis C virus infection. [8]

In the present study from the 763 HCV seropositive positive patients, 47.31% patients had shown HCV RNA confirming the Hepatitis C virus active infection and 48.23% patients were negative for HCV RNA. This is at par with established data of chronicity for HCV that ranges from 50-80% after acute infection. The similar findings is shown by a study by Qamar Z et al. [9] from Buner district in Pakistan showing 34.1% positivity. Another studies by Vannavada Sudha Rani et alfrom Telangana in dialysis

patients and by M S Agular in Venezuela showed positivity in 41.6% and 41% respectively.[10,11] However a very high positivity was demonstrated from different regions of India like in Kolkata and Secundarabad demonstrating 85.75%, 60.86% respectively.[12,13] High positivity for HCV RNA is demonstrated across globe. Various studies across globe showed high positivity of 59.6%, 62.5%, 79.5%, 74%, 75.9% in Rwanda, Khyber Pakhtunkhwa Province of Pakistan, Egypt, United States and Southern Italy respectively.[14–18]

Though overall burden of active infection is 47.31%, four different regions of Gujarat have shown variation in presence of active HCV infection that ranges from 40% to 79%. South Gujarat showed highest prevalence of 79.16%. This might be due to relatively lesser number of samples received and tested. Western Gujarat showed a burden of active infection in 48.2% cases however Jamnagar district in this region had a higher burden of 64.71% than other districts in western region. In Central Gujarat, highest cases were seen in Vadodara at 40.20% while Bharuch demonstrated a very low rate of 14.3%.district. North Gujarat had a prevalence of 47.15% with maximum burden in Patan (75%), this again could be due to small sample size. Mehsana, Ahmedabad and Gandhinagar had a prevalence rate of 75%, 51.41% and 28.3% respectively.

There is significant proportion of active infection in the study and regional variation is clearly visible in the study.This emphasizes the role of confirmation and assessment of active infection after serodiagnosis. Region wise distribution of disease helps to plan resource allocation, targeted intervention, monitoring trends and better management of patient.

Among 361 active infection cases 63.99% were males and 38.78% were females. Similar data is revealed by studies from Kolkata[12] 64.21% male and 35.79% female and Khyber Pakhtunkhwa Province, Pakistan[15] 57% male and 43% female. Study by Deepjyoti K et al.[19] also showed that males were more affected than females. In contrast, another study from Qamar Z et al.[9] from Buner district in Pakistan concluded that prevalence was more in female (51.93%) than male (48.06%). This also suggests the geographical variation and local practices.

In the present study, people in age group 41-60 years showed highest burden of active hepatitis C virus infection followed by age group 21-40 years, >60 years and 15-20 years. Studies from Rwanda[14] showed high prevalence in >55 years. Similar finding were reported by study Deepjyoti K et al.[19] which showed higher prevalence in 40-60 years of age group.Study by Alter MJ in U.S et al.[17] HCV infection showed a high prevalence in individuals aged 20-40 years. In Mardan, Pakistan[20] showed high prevalence 41-50 years in female and 31-40 in male. It might be due to greater exposure to various HCV risk factors and also due to late detection in adulthood as disease runs a silent course for many decades.

5. Conclusion

ELISA are commonly used for initial HCV screening because they're fast and cost-effective. However, these tests detect antibodies against HCV, which indicate past or present exposure, but not necessarily active infection. Significant number of seropositive individuals are not able to clear virus, have active infection despite appearance of antibodies and progress to chronicity and complication of disease. HCV RNA Testing by RTPCR directly detects the presence of viral RNA in the blood, signifying an active infection**.** It is a sensitive and specific test for the diagnosis of hepatitis C virus infection both in acute and chronic stage. Presence of HCV RNA makes the individual eligible for the treatment. It's an early predictor of liver damage risk in seropositive individuals. Early treatment with direct acting antiviral agent (DAA) is very effective as compared to previous regime and thus helps to reduce chronicity, malignancy and associated mortality and morbidity of hepatitis C virus infection. The sustained viral response after a successful treatment as informed by RTPCR demonstrates clearance of virus. Hence routine testing with RNA RTPCR following sero-positivity is the need of the hour and a must do diagnostic test.

6. Ethical Approval

This study was conducted after taking approval from the Institution Ethics Committee (Ref.: GMERSMCS/IEC/76/2020)

7. Source of Funding

None.

8. Conflict of Interest

None.

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