GEOGRAPHICAL DISTRIBUTION OF HEPATITIS C VIRUS GENOTYPES IN INDIA AND CURRENT RATIONAL FOR TESTING

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ABSTRACT

Infection with the hepatitis C virus (HCV), which has a wide geographic and genotypic distribution, is a serious public health problem in India. In this study, we explore the present justification for testing in this varied and dynamic environment and give an overview of the regional distribution of HCV genotypes in India. Geographical Distribution: India is a large and varied country, and various areas have distinct prevalence rates for HCV infection. In India, the regional distribution of HCV genotypes reveals a complicated pattern.The most frequent genotype is genotype 3, which is concentrated in the country's northern and eastern areas. Genotype 1 is more widespread in the country's western and southern regions. In India, genotype 2 and other less frequent genotypes are sporadically seen. This variety in genotypic distribution may influence treatment choices and emphasizes the importance of precise genotype testing prior to starting medication. The present justification for HCV testing in India is complex. The HCV genotype has a significant impact on the direct-acting antiviral (DAA) medication selection.While genotypes 2 and 3 require a distinct mix of DAAs, genotype 1 and genotype 4 are often treated with a single batch of DAAs. To choose the best treatment plan and avoid medication resistance, accurate genotype identification is essential. For public health initiatives, understanding the genotype distribution is crucial. It assists in monitoring the virus's transmission, identifying areas at high risk, and developing preventative measures.. Different genotypes transmit information at different rates. To avoid the spread of the virus through blood transfusions, blood banks and transfusion services must test donors for HCV. In this situation, genotype information is essential. Genotype testing is crucial to determining if resistance-associated variations are to blame in cases of treatment failure. The choice of alternative treatment choices is influenced by this knowledge.In conclusion, India has a broad and regionally distinct distribution of HCV genotypes. For the purpose of making treatment decisions, developing public health plans, preventing the spread of viruses, and tackling antiviral resistance, accurate genotyping testing is essential. To successfully reduce the prevalence of HCV infection in India, it is crucial to understand the significance of genotype-specific management.

Keywords: *Geographical, distribution, hepatitis c virus genotypes, India etc.*

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1. INTRODUCTION

Millions of people are affected globally. It is a blood-borne virus that mostly affects the liver and if ignored can lead to cirrhosis, chronic liver disease and potentially hepatocellular cancer. The genetic diversity of HCV is high, and there are many different genotypes and subtypes. It is important to understand the geographic distribution of HCV genotypes in India and the current rationale for testing because these genotypes have distinct clinical outcomes and geographic distribution. Geographic distribution of HCV genotypes in India: Despite having a large and diverse population, India is not an exception to the worldwide HCV burden [1]. HCV genotype distribution in India is regionally and heterogeneously distributed. The following are the most common HCV genotypes in several regions of India as of the knowledge cutoff date in September 2021: The most common genotype in India is 3, which is widely distributed across the country. It is very popular in the eastern and north-eastern states of India. Genotype 1 is also more prevalent in India, being more widespread in the north and west of the country. Compared to GT-3 and GT-1, genotype 2 is less common, although it is still found in many regions of India [2]. The less common genotype 4 is mostly restricted to specific areas. Although less common, GT-6 has been documented in rare cases in India. It is important to note that the epidemiology of HCV may change over time as a result of various circumstances, such as medical procedures, migration, and transmission dynamics. Therefore, accurate preventive and treatment plans depend on the current knowledge about the distribution of HCV genotypes in India. Current testing rationale[3]: The rationale for HCV testing in India is complex and influenced by several important factors, including: Early detection of HCV infection is essential as it can significantly increase the effectiveness of therapy. According to research, HCV infection can usually be cured with the use of direct-acting antiviral (DAA) drugs. Through testing, people can

get early treatment that can stop the spread of the disease and reduce the risk of transmission. The ideal treatment plan should be decided upon before learning the HCV genotype. Genotype information helps medical professionals choose the best course of therapy because different genotypes may respond differently to antiviral medications. The main way HCV is spread is through blood-to-blood contact. Identification of infected individuals can help prevent future transmission, especially in high-risk groups such as drug users and health care professionals who may come into contact with contaminated blood. For high-risk populations, such as those with a history of injection drug use, those who receive blood transfusions before adopting HCV screening, and those who are HIV-positive, targeted testing is often recommended because they may be more likely to have HCV. The risk of infection is higher. For the purpose of ensuring public health, the genotype distribution of HCV should be tested and tracked. This aids planning and implementation of efforts by health care authorities to prevent transmission of the virus, especially in areas with different genotype frequencies. Finally, it is important for effective HCV prevention, management, and public health measures to understand the geographic distribution of HCV. Genotype as well as current rationale of testing in India. To reduce the impact of HCV in India, regular updates on genotype distribution and continued initiatives to increase access to testing and treatment are necessary. Please note that the data used to generate the information was only accessible as of September 2021[5], and the situation may have changed after that.

2. LITERATURE REVIEW

In India, the prevalence of HCV infection is thought to be between 0.5% to 1.5%. India, with its large population and low HCV prevalence, contributes a large percentage of the worldwide HCV burden. The estimated HCV infection rate in India is between 12 and 18 million. The viral prevalence of approximately 0.68% results in an estimated virulence rate of approximately 80% [6]. In different Indian geographical regions, there has been significant variation in prevalence. However, the quality and availability of epidemiological data from India is not the best. Population-based research on HCV from India is scarce. The prevalence of HCV was determined to be 0.87% in a population-based study of West Bengal, which included 2973 people. [7] There was no difference in prevalence between men and women, with anti-HCV seroprevalence in people over 60 years of age. Was the highest. In Fatehabad district of Haryana, 150,000 people were tested anti-HCV positive, and a population prevalence of 1% was discovered. However, they also performed screening on a smaller group of 7114 individuals who were at high risk of contracting HCV (high-risk behavior, history of jaundice), and showed that 21% of these individuals had the infection. Another study involving 22,666 Indian Armed Forces recruits found that the point prevalence of anti-HCV seropositivity was 0.44%. This low incidence may be due to the exclusion of individuals who may be at risk of HCV infection from recruitment as military trainees.[8] Some studies conducted have shown the prevalence of anti-HCV positive among the Lambada tribe in the state to be 2.02%). According to screening data, anti-HCV prevalence is 0.29–1.85% in northern states, 0.08–1.4% in southern states, 0.27–1.17% in northeastern states, and 0.31–1.09% in eastern states. With the exception of a few studies with a high incidence of blood donors in India, data from western Indian states show a low prevalence of 0–0.9%. Blood donor screening generally underestimates the true prevalence of HCV in the community due to self-selection bias. In several studies, the prevalence of HCV antibodies in pregnant women has varied from 0.6% to 1.4% [9]. When compared to the general population, it is estimated that patients in high-risk patient groups, such as those receiving hemodialysis (HD), receiving frequent blood transfusions (such as those with thalassemia major), receiving intravenous Rates of HCV infection will be higher among people who use illicit drugs (IVDUs), and health care workers (HCWs). The frequency of HCV infection in patients with thalassemic multitransfusion syndrome is significant. [10] However, among individuals who received transfusions before 2001, when blood banks were required to perform anti-HCV testing, the prevalence rate declined from 22.5% after that year. The incidence has increased to 13.6%, especially among those receiving transfusions. In a study from North India, it was found that iatrogenic treatments were responsible for transmission of HCV in 83.3% of 54 anti-HCV positive patients, with blood transfusion alone responsible for 67% of the cases.[11] In a study from Delhi, 119 patients receiving HD were enrolled, and it was revealed that the frequency of HCV RNA positive was as high as 27.7%. According to reports, the frequency of HCV infection among kidney transplant recipients in India ranges from 26.2-55.9%. HCV infection has been found in 0% to 4% of HCWs, with the highest prevalence among HD unit staff. They used 1158 IVDUs for their investigation and found that anti-HCV positivity was extremely common (55%)[12]. According to published research, genotype 3 accounts for 54 to 80 percent of cases in India. Studies in the northern, western, and eastern regions of the country have consistently shown that genotype 3 predominates; However, in southern India, both genotype 1 and 3 HCV have been shown to be common. Genotype 4 HCV has been found in some instances in southern and western India [13].

3. RESEARCH METHODOLOGY

The geographic distribution of hepatitis C virus (HCV) genotypes varies from region to region in India, and the rationale for testing may change depending on the frequency of particular genotypes and other circumstances. I will

describe below the approach taken to research the regional distribution of HCV genotypes in India, as well as the current rationale for testing: Researchers often collect blood samples or serum samples from individuals in different regions of India to determine geographic distribution. Let's collect. HCV genotype. These samples should be typical of the entire population. Researchers must isolate HCV RNA from the samples obtained because HCV is an RNA virus [14]. Often, various molecular biology approaches are used for this. Genetic sequencing can be used to identify HCV genotypes. The genotype is determined using the genetic sequence of HCV RNA from the samples. This is often accomplished by amplifying particular HCV genome sections (such as the NS5B region) and then examining the sequences. Once the genotype is established, researchers can examine the distribution of the genotype in different regions of India. Map-making applications and geographic information systems (GIS) can be used to produce visual representations of this distribution. [15]: There may be statistically significant correlations between HCV genotype and specific geographic areas or other demographic variables. The rationale for HCV testing in India is complex and may vary depending on several factors: there may be regional variations in the geographical distribution of HCV genotypes in India, with certain areas having a higher incidence of particular genotypes. Public health planning requires knowledge of local spread and distribution, which testing can help with. Genotype may have an impact on the antiviral medication used to treat HCV. Specific antiviral drugs may have different effects on different genotypes. Therefore the best course of treatment for an affected individual must be determined through testing. [16] Understanding the distribution of HCV genotypes can help identify sources of transmission and take preventive measures. Targeted treatments can be created, for example, if a certain genotype is more prevalent in a certain area. HCV genotype testing is essential for epidemiological investigation and monitoring. It helps track the progress of the virus, evaluate the results of public health initiatives, and formulate intelligent policy choices. To maintain the safety of medical procedures and blood transfusions, HCV testing is especially important in blood banks and health care facilities. This reduces the risk of spreading infection. The geographical distribution of HCV genotypes in India should be known to choose treatment options. Among other things, planning for public health and conducting epidemiological research. Sample collection, RNA extraction, genotype determination, data processing and statistical analysis are all part of the methodology. HCV testing is required for effective disease management and control [17].

4. RESULTS AND DISCUSSION

Hepatitis C virus (HCV) genotypes are geographically dispersed in India, with variations in different parts of the country. As per my most recent information update in September 2021, India's HCV genotype distribution was as follows: According to reports, genotype 3 is most common in India, especially in its northern and northeastern parts. It was a significant contributor to HCV infections in the country. In India, genotype 1 had a strong presence in both the northern and southern parts of the country. Although less common, genotype 2 is still found in many areas of India. Reported less frequently and found mostly in western and northern regions, genotype 4 was less common. Rare reports of genotype 6 have been made, and little information is available. Although they were relatively uncommon, publications have also reported the existence of genotype 5 and other less prevalent genotypes in India. It is important to note that the distribution of HCV genotypes may change over time for various reasons, including population migration and changes in transmission risk factors [18]. Therefore, current knowledge of the distribution of HCV genotypes in India is important. The most accurate and up-to-date information can be obtained from local monitoring and research. Several justifications for HCV testing in India include the following factors: To initiate appropriate medical measures, early HCV diagnosis is essential. By knowing the exact genotype it is possible to customize treatment plans to optimize effectiveness and minimize negative effects. Understanding the HCV genotype of infected people can help understand transmission patterns. Implementing focused preventive and control efforts, particularly in high-risk populations, may benefit from this knowledge [19].

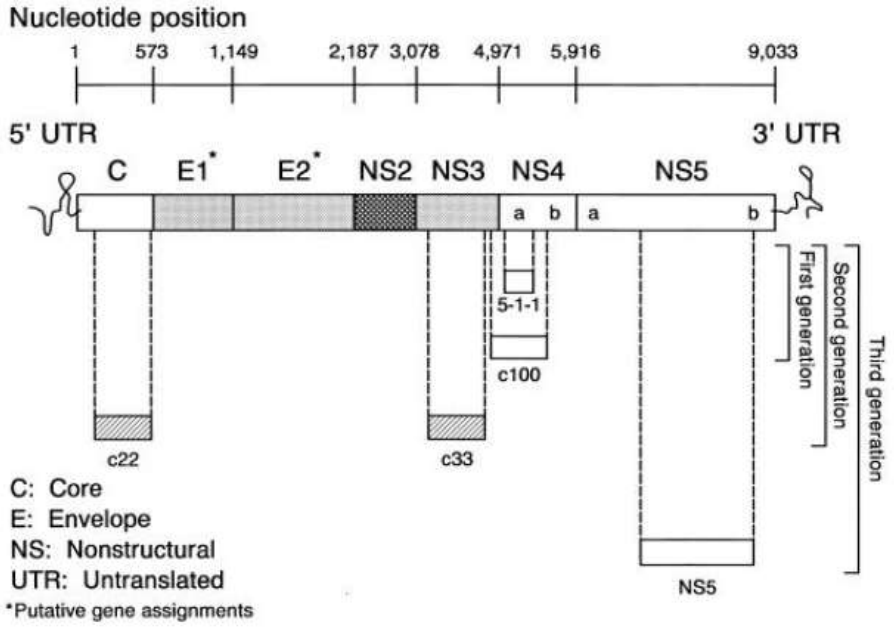

Figure 1.1: HCV genome organization. Serological tests to detect HCV antibodies are classified as first generation, second generation, and third generation.

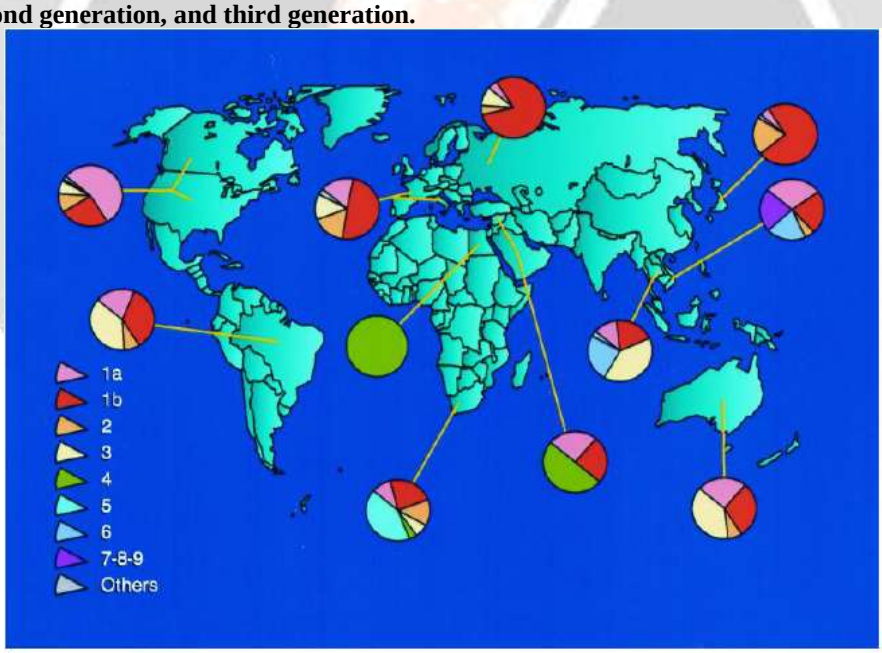

Figure 1.2: Geographic distribution of different HCV genotypes and subtypes. Unclassified sequences are represented by "other".

Antiviral treatment for HCV infection is often genotype-specific. It is important to know your genotype to choose the best treatment plan as different genotypes may respond differently to the available medications. For the purpose of allocating and planning resources for public health, it is important to monitor the distribution of HCV genotypes. For the purpose of allocating resources and directing activities, it can help identify new trends and areas with high prevalence of particular genotypes. For continued research into the creation of vaccines and novel treatments, it is essential to understand the distribution of HCV genotypes. [20] Researchers need this knowledge for focused efforts because different genotypes can present particular difficulties for vaccine development. Genotyping for HCV is also important to evaluate the success of public health initiatives and programs aimed at reducing HCV transmission and enhancing treatment outcomes. Testing and diagnosis of HCV infections in India is undertaken for several important reasons [21]: The most efficient treatment plan can be determined with the help of early diagnosis and genotype identification. Knowing the genotype is essential for treatment planning because different genotypes may respond

differently to antiviral treatments. To prevent the spread of HCV, it is important to identify people who are infected. This is especially important in health care settings and for those who are at greater risk, such as injecting drug users.[22] Testing is important for high-risk groups, such as those with screening requirements. Blood transfusions, health care professionals, and drug users who inject their substances prior to implementation. Serious liver conditions, including cirrhosis and hepatocellular carcinoma, can be brought on by HCV. The risk of developing the disease can be assessed by regular monitoring of HCV infection and genotype. Planning for public health, including the development of vaccines, access to treatment, and resource allocation, requires an understanding of the regional distribution of HCV genotypes. For example, advances in diagnostic technologies may result in point-of-care diagnostics becoming more widely available and accurate. This will make it possible to start treatment and diagnosis more quickly. To control HCV in India, it will be important to increase access to antiviral treatments, including novel direct-acting antiviral (DAA) drugs. [23] To reduce the impact of the disease, it is important to understand HCV, its transmission mechanisms, and the importance of testing and treatment. It is necessary to increase awareness about. Efforts to prevent HCV transmission should be strengthened, especially in high-risk populations, through harm reduction initiatives, safe injection techniques, and improved blood screening procedures. Ongoing research into genotype-specific therapies and novel drugs may lead to more effective and efficient treatment options. If HCV genotypes are continuously monitored and mapped in different regions of India, healthcare systems will be better able to adjust to changing trends and deal with particular difficulties.[24]

5. CONCLUSION

In India, the geographic distribution of HCV genotypes might differ greatly from one location to another. Numerous research have shed light on the frequency and distribution of HCV genotypes across the nation. The fact that this information is based on facts up to September 2021 should be noted because the situation may have changed since then. The most common HCV genotype in India is genotype 3.The northern and western regions, including Punjab and Gujarat, are most affected by it. The risk of exposure to contaminated water has been linked to this genotype and intravenous drug use, and it may also be connected to agricultural practices.Although genotype 1 is present throughout all of India, it is comparatively more common in the southern regions, particularly in the states of Tamil Nadu and Andhra Pradesh. Although genotype 2 is less frequent than genotypes 1 and 3, it has been documented in a number of locations in India, notably the northeastern states. Rare reports of genotype 4 and other uncommon genotypes come from India.For the following reasons, it is still vital that people in India get tested for HCV infection: In India, HCV is a serious public health issue. A sizeable section of the population is vulnerable, particularly in areas where the virus is prevalent. Early detection and management of cases, transmission reduction, and long-term problems are all made possible by timely testing.Testing is essential to identify the exact genotype and customize treatment approaches due to the variable prevalence of HCV genotypes in different regions of India. Treatments tailored to a patient's genotype work better. Due to variables like intravenous drug use, healthcare-related exposures, and unsafe injection practices, many people in India are at risk of contracting HCV. Testing assists in identifying those who are at risk and starting the right actions. In India, access to more modern, efficient HCV therapies has increased. The burden of the condition can be lessened by better treatment outcomes brought on by early detection through testing. A crucial element of HCV preventive initiatives is testing. Behavior changes, such as safe injection techniques and harm reduction, might result from the identification and counselling of at-risk persons.In India, there are a variety of HCV genotypes that are distributed geographically, with genotype 3 being the most common, particularly in the northern and western regions. Genetic testing is essential to guide therapy choices. Due to the high incidence of HCV, several risk factors, and better access to efficient therapies, testing is crucial in India.

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