International Journal of Clinical Trials
Rawat S et al. Int J Clin Trials. 2026 Aug;13(3):xxx-xxx
http://www.ijclinicaltrials.com
pISSN 2349-3240 | eISSN 2349-3259
DOI: https://dx.doi.org/10.18203/2349-3259.ijct20261466

Original Research Article

Demographics and trends of hepatocellular carcinoma: a prospective study in a tertiary care centre, central India

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Received: 31 March 2026
Accepted: 04 May 2026

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ABSTRACT

Background: Hepatocellular carcinoma (HCC), the most frequent primary liver malignancy, ranks as the sixth leading cause of incidence and the third leading cause of cancer-related mortality worldwide, with a heavy healthcare burden in Asian countries. Epidemiological data from India remain limited and are predominantly based on studies conducted in urban settings; therefore, we aimed to assess the demographic characteristics, analyze the etiological spectrum, and identify changing trends in the etiology of HCC in Central India.
Methods: A prospective analysis of patients presented with HCC from January 2022 to December 2024, conducted in the State Cancer Institute NSCB Medical College, Jabalpur, Madhya Pradesh, a tertiary cancer care centre in Central India. Patient data and details were collected and analysed prospectively.
Results: We conducted a study from January 2022 to December 2024, enrolling a total of 48 patients. The majority were male, with a mean age of 55-58 years. A substantial proportion had a history of alcohol consumption (42%) and tobacco use (46%). Overall, hepatitis B (HBV) (47.92%) emerged as the predominant etiological agent among cases with known risk factors. Most patients presented to our institute with advanced-stage disease (Stage III or IV). The advanced stage at presentation resulted in many patients being unsuitable for curative treatment.
Conclusions: The incidence of HCC is low among all cancers, but it carries a high mortality rate. Alcohol consumption and viral hepatitis were the most common causes. The disease is more common in individuals above 40 years of age, particularly in males.

Keywords: Hepatocellular carcinoma, Demographics, Hepatitis, Alcohol consumption, Etiology

INTRODUCTION

Hepatocellular carcinoma (HCC) is the most common type of primary liver cancer, accounting for 80-90% of all cases.[1] As per the Global Cancer Observatory (GLOBOCAN 2022), liver cancer is the sixth most diagnosed cancer and the third most common cause of cancer mortality worldwide.[2] This malignancy causes a serious health and economic burden globally, especially in Asia.[3] Over the past several decades, the prevalence of HCV has been increasing in many Asia-Pacific countries, including Australia, New Zealand, and India.[4] Incidence in India is relatively low by global standards (~2.15 per 100,000) but is increasing quickly.[5] As a reflection of geographical variations in India, there is significant variation in the prevalence and etiological factors of HCC. In contrast to previous studies reporting viral hepatitis as the most common etiology, recent data indicate a changing etiological pattern of cirrhosis and HCC, with alcohol and metabolic dysfunction-associated

steatotic liver disease (MASLD) emerging as the foremost cause.[6] Among Indians, the present incidence, prevalence, and mortality related to HCC are higher in males, while the annual rate of change is higher in females. The Northeastern states have higher incidence, prevalence, and mortality related to HCC, but the Western states of Gujarat, Maharashtra, Goa, and Kerala are emerging as newer hotspots with higher annual rates of change in incidence, prevalence, and mortality.[5] Thus, there was need to understand current changing epidemiology and etiological spectrum of HCC in India.

METHODS

We prospectively analysed patients diagnosed with HCC between January 2022 and December 2024 at the State Cancer Institute, NSCB Medical College, Jabalpur, Madhya Pradesh-a tertiary cancer care centre in Central India. Demographics, type of histopathology or cytology, tumour parameters, aetiology, and severity of cirrhosis were collected and analysed. The study was approved by the institutional ethical committee, and informed consent was taken from all the patients.

The etiology of the liver disease was categorized as infection with HBV, HCV, alcoholic liver disease, non-alcoholic fatty liver disease, hemochromatosis, autoimmune hepatitis, and primary biliary cirrhosis. No quantitative analysis of alcohol consumption was performed; assessment of habitual alcohol use was based on patient self-reporting of habitual drinking. The identification of hepatitis B and C infections was carried out using hepatitis B virus surface antigen, total hepatitis B core antibody, hepatitis B virus DNA, and anti-hepatitis C virus (HCV) antibody, as well as HCV RNA levels, respectively. The diagnosis of non-alcoholic steatohepatitis (NASH) was determined based on ultrasound evidence of fatty liver, with or without diabetes mellitus, after eliminating common causes like hepatitis B virus, HCV, and alcoholism. The diagnosis and severity of cirrhosis was established through a combination of clinical signs (jaundice, splenomegaly, ascites), laboratory findings (low platelet count, abnormal liver function tests: elevated bilirubin, decreased albumin, and coagulopathy), imaging results (ultrasound, fibroscan, CECT, and contrast-enhanced MRI indicating features suggestive of cirrhosis), and invasive assessments (upper gastrointestinal endoscopy revealing varices and liver biopsy demonstrating characteristics of cirrhosis). Patients were treated according to the Barcelona Clinic Liver Cancer (BCLC) staging system, which is based on tumor characteristics (size, number, vascular invasion, and metastasis), liver function (as assessed by the Child-Pugh score), and performance Status. The treatment response and outcomes were not included in our study protocol.

Inclusion criteria

Patients diagnosed with HCC based on radiological criteria and histopathology or cytology were included in the study.

Exclusion criteria

Exclusions were made for patients with ambiguous imaging results and those who did not undergo a biopsy. Liver cancers other than HCC.

Statistical analysis

Data analysis was carried out using excel sheet; the dataset was entered. Continuous data were expressed as descriptive statistics (mean, standard deviation, range), while categorical variables were shown as frequencies and percentages.

RESULTS

A total of 69 hepatobiliary cancer patients were registered at SCI, Jabalpur, during the study period. Among them, 48 patients were diagnosed with HCC.

Demographics

A total of 48 patients diagnosed with liver malignancy were included in analysis. The mean age was 55.83±9.46 years, with ages ranging broadly across middle and older adulthood. The youngest patient diagnosed at age 35 and oldest being at age 73 years. The study population demonstrated a male predominance, with 35 males (73%) and 13 females (27%). A significant majority of patients, 45 out of 48 (93.75%), belonged to rural areas, while only 6.25% were from urban settings. The baseline characteristics of patients with HCC (Table 1).

Table 1: Baseline demographic and etiological characteristics of patients with HCC (n=48).

Parameters	N (%)
Age (in years)	55.83±9.46
Sex	
Male	35 (73.0)
Female	13 (27.0)
Residence	
Urban	3 (6.25)
Rural	45 (93.75)
Addiction	
Tobacco chewing	26 (54.17)
Smoking	22 (45.83)
Alcohol	19 (39.58)
All three	8 (16.67)
Viral profile	
HBsAg	23 (47.92)
HCV	4 (8.33)

Etiology

Addiction profile

Substance use was highly prevalent among the study population. Tobacco chewing was the most frequently reported addiction in both males and females, present in 26 patients (54.17%). Smoking was reported in 22 patients (45.83%), and alcohol consumption in 19 patients (39.58%). Notably, 8 patients (16.67%) reported the combined use of tobacco, smoking, and alcohol. Nearly all patients had a history of chronic exposure to these substances. About 43 out of 48 patients had at least one form of addiction.

Viral profile

HBsAg positivity was recorded in 23 patients (47.92%), whereas HCV infection was identified in 4 patients (8.33%).

Clinical presentation

The majority of patients presented with one or another symptom. Abdominal pain was the most common presenting complaint, reported by 39 patients (81.25%). Other symptoms included abdominal distention in 35 (72.92%) and abdominal lump in 4 (6.25%). Weight loss and loss of appetite were present in 27 (56.25%), jaundice in 30 (62%). Pruritus was present in 8 (16.67%). Portal vein thrombosis was observed in 9 patients (18.75%), indicating substantial vascular involvement. Metastatic disease was identified in 5 patients (10.42%) at presentation, with the lungs and bone representing the most commonly involved metastatic sites.

Tumor characteristics

Patients were classified according to the number of lesions (single vs. multiple) and lesion size, with size categories defined as follows: <5 cm, 5-10 cm, and >10 cm for both groups. The frequency of single lesions <5 cm, 5-10 cm, and >10 cm was present in 8.33%, 22.92%, and 25%, respectively, and multiple lesions <5 cm in 8.33%, 5-10 cm in 20.83%, and >10 cm in 14.58% of patients, respectively (Table 2).

Liver function status

Assessment using the Child-Pugh scoring system revealed that 15 patients (31.25%) were categorized as Child-Pugh A, 19 patients (39.58%) as Child-Pugh B, and 14 (29.17%) as Child-Pugh C, indicating that a significant proportion had moderate to severe hepatic dysfunction at presentation.

Staging

Based on BCLC staging, the distribution was heavily skewed toward advanced disease. Stage C (advanced stage) accounted for 33 patients (68.75%), while Stage D (terminal stage) included 14 patients (29.17%). Only 1 patient (2.08%) was diagnosed in Stage B, and none were identified in Stage A, indicating very late-stage diagnosis in this population (Table 3).

Treatment modalities

The majority of patients, 41 out of 48 (85.42%), received oral Sorafenib therapy, reflecting its role as the primary systemic treatment for advanced liver cancer. Single-agent doxorubicin was administered to 3 patients (6.25%), and supportive care alone was provided to 4 patients (8.33%), likely due to advanced disease stage or poor performance status.

Table 2: Distribution of tumour burden according to lesion number and maximum diameter (n=48).

Lesion number	<5 cm	5-10 cm	>10 cm
Single	4 (8.3%)	11 (22.9%)	12 (25%)
Multiple	4 (8.3%)	10 (20.8%)	7 (14.6%)

*Values represent the number of patients (percentage of the total cohort).

Table 3: Liver function status (Child-Pugh) and BCLC stage at presentation (n=48).

Classification	N (%)
Child-Pugh class	
A (5-6 points)	15 (31.3)
B (7-9 points)	19 (39.6)
C (10-15 points)	14 (29.2)
BCLC stage	
Stage A (Early)	0 (0)
Stage B (Intermediate)	1 (2.1)
Stage C (Advanced)	33 (68.8)
Stage D (Terminal)	14 (29.2)

DISCUSSION

Globally, HCC is a leading cause of cancer mortality. At our center, HCC accounts for approximately 80% of all primary liver malignancies. Data on the incidence of HCC in India are limited. Earlier autopsy data published by Dhir et al reported an incidence of 0.2-1.9% for HCC, with a higher prevalence in the south-eastern states Yang et al in their study, noted that globally the incidence of HCC is higher in men than in women, with the male-to-female ratio ranging from 2:1 to 4:1, and the disparity being even greater in high-risk regions.[7,8] A clear male predominance was observed (73%), resulting in a male-to-female ratio of approximately 2.7:1. This aligns with previous studies from India and international cohorts, where male predominance is well documented and often attributed to greater exposure to risk factors such as alcohol, tobacco, and viral hepatitis.[9,10] The present study indicates a rising trend of HCC among males, while the trend in females appears static or declining during the

study period. Most Indian series report presentation in the middle-older adult group. In the present study, the highest incidence was seen in the age group 50-55 years. Most patients in our study were from rural areas, which may reflect disparities in healthcare access, delayed diagnosis, and limited availability of surveillance programs. Substance use, particularly tobacco chewing (54%), smoking (46%), and alcohol consumption (40%), was highly prevalent-higher than figures reported in several urban-based Indian studies. Chronic exposure to these hepatotoxic agents for a decade or more likely contributed to accelerated liver disease progression in the majority of patients. The underlying etiological profile in our study was dominated by cirrhosis (67%), followed by hepatitis B virus infection (47.9%). This is consistent with Indian evidence showing HBV as a major driver of HCC, although emerging global trends highlight an increasing contribution from MASLD and alcohol-related liver disease. The relatively lower rate of HCV infection (8.3%) mirrors national patterns, where HCV prevalence remains below that of high-risk regions such as Egypt or Japan. Historically, HBV/HCV were dominant causes; more recently, alcohol and MASLD/NAFLD are becoming major contributors in many regions (including trends observed in India).[11] Tumor characteristics in our study indicated a high burden of advanced disease. Nearly half of the patients presented with tumor sizes ≥5 cm, and 25% had lesions >10 cm. Multifocal disease was also common. These findings resemble reports from other low-surveillance regions, where limited screening leads to detection at a large tumor burden. Portal vein thrombosis was present in 18.75% of patients, consistent with the literature associating PVT with aggressive tumor biology and poor prognosis. Extrahepatic metastasis, seen in 10.4% of patients, was the most commonly involved site, which was the lung, with bone mets in one patient, similar to established global patterns. Larger tumour size correlates with worse prognosis and a higher likelihood of extrahepatic spread.[12,13] Symptomatic presentation dominated, particularly abdominal distention (73%) and pain/discomfort (81%), reflecting large tumor size and decompensated liver function. Only a small fraction presented with early or asymptomatic disease-a finding also noted in prior Indian studies. Liver functional status showed that most patients fell into Child-Pugh B (39.6%) or C (29.1%), indicating significant hepatic compromise at diagnosis. According to BCLC staging, no patients presented in the early stage (Stage A), and the overwhelming majority were in stage C (68.7%) or stage D (29.1%). This pattern mirrors the widely reported scenario in India, where over 70% of patients are diagnosed in advanced stages, limiting curative options.

CONCLUSION

The predominance of late-stage presentation, frequently accompanied by large tumor burden and impaired hepatic reserve, reflects persistent gaps in awareness, access to healthcare, and structured surveillance-particularly in rural and resource-limited settings. In parallel, a sustained and comprehensive hepatitis B vaccination drive, including improved coverage under national immunization programs and catch-up vaccination for high-risk adults, remains a cornerstone strategy for long-term HCC prevention. Strengthening vaccination efforts, alongside early diagnosis, antiviral therapy, and integrated liver disease management, is essential to reduce the future burden of HCC and improve treatment eligibility and outcomes.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Rawat S, Badgoliya A, Asati P, Nabiyal A, Kotwal E, Raju KVA, et al. Demographics and trends of hepatocellular carcinoma: a prospective study in a tertiary care centre, central India. Int J Clin Trials 2026;13(3):xxx-xx.