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Clinical Profile, Etiological Spectrum, and Staging of Hepatocellular Carcinoma at a Tertiary Cancer Center in Eastern India: A Retrospective Cohort Study

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Abstract

Background: Hepatocellular carcinoma represents a major public health challenge in India, where the clinical and epidemiological landscape exhibits substantial regional variations. Emerging evidence points to a rapid change in the etiological spectrum of this disease, characterized by a transition from chronic viral hepatitis toward metabolic dysfunction-associated steatotic liver disease. Understanding regional disease patterns and staging characteristics is essential for optimizing healthcare resources and improving early detection pathways. ***Objectives:*** To evaluate the clinical and demographic profiles, etiological spectrum, baseline liver function, clinical staging, and treatment patterns of patients diagnosed with hepatocellular carcinoma presenting to a premier tertiary-care oncology hospital in coastal Eastern India. ***Methods:*** A retrospective descriptive cohort study was performed on 68 patients diagnosed with hepatocellular carcinoma at the Acharya Harihar Post Graduate Cancer Center in Cuttack, Odisha, between January 2022 and December 2025. Data were extracted from physical and electronic medical records, including baseline demographic characteristics, clinical symptomatology, underlying etiologies, biochemical parameters, radiological findings, clinical staging, and first-line treatment modalities. Liver functional reserve was comparatively evaluated using the traditional Child-Pugh classification and the objective, laboratory-based Albumin-Bilirubin grade. ***Results:*** The cohort had a mean age of 54.2 plus or minus 9.6 years, with a pronounced male predominance representing a male-to-female ratio of 3.86 to 1. Metabolic dysfunction-associated steatotic liver disease was identified as the primary etiological driver, accounting for 47.06 % of cases, followed by chronic Hepatitis B virus infection in 29.41 %, chronic alcohol consumption in 17.65 %, and chronic Hepatitis C virus infection in 5.88 % of patients. Most patients presented with advanced-stage disease, with 61.76 % classified as Barcelona Clinic Liver Cancer stage C or D. The median tumor size was 6.4 cm, and portal vein tumor thrombosis was documented in 26.47 % of cases. The Albumin-Bilirubin grading system reclassified 33.33 % of patients with Child-Pugh Class A to Grade 2, highlighting subclinical hepatic impairment. Surgical resection was feasible in only 11.76 % of cases, while systemic therapy was administered to 41.18 %, and best supportive care was provided to 20.59 % of patients.

Keywords: Hepatocellular Carcinoma, Metabolic Dysfunction-Associated Steatotic Liver Disease, Albumin-Bilirubin Grade, Eastern India, Barcelona Clinic Liver Cancer Staging, Retrospective Study.

INTRODUCTION

Hepatocellular carcinoma is the most common primary liver malignancy and represents a leading cause of cancer-related mortality globally [1]. The geographical distribution of primary liver cancer is highly heterogeneous, heavily reflecting the regional prevalence of underlying risk factors within different populations [1, 2]. Historically, chronic infections with Hepatitis B virus and Hepatitis C virus have driven the vast majority of hepatocellular carcinoma cases across South Asia, where persistent viral infection triggers a cascade of chronic necroinflammation, progressive fibrosis, cirrhosis, and eventual hepatocarcinogenesis [3]. However, the systematic implementation of neonatal Hepatitis B virus vaccination programs and the therapeutic revolution brought about by highly effective direct-acting antiviral agents for Hepatitis C virus have

contributed to a gradual decline in the long-term incidence of viral-induced liver cancer in several well-monitored populations [3, 4]. Concurrently, the global epidemic of obesity, type 2 diabetes mellitus, and metabolic syndrome has catalyzed a massive surge in metabolic dysfunction-associated steatotic liver disease, which is now recognized as one of the fastest-growing etiologies of hepatocellular carcinoma worldwide [4, 5].

In India, the clinical and epidemiological landscape of hepatocellular carcinoma is complex and exhibits strong regional variations [3, 6]. While viral hepatitis remains a substantial threat in several northern and northeastern states, recent national registry data suggest that alcohol-related liver disease and metabolic dysfunction-associated steatotic liver disease are rapidly emerging as dominant drivers of chronic liver disease and primary liver cancer across other areas of the country [5, 6]. The state of Odisha, located in coastal Eastern India, features a predominantly rural population with unique environmental exposures, dietary habits, and distinct patterns of healthcare access [7]. Environmental factors, such as the potential contamination of stored agricultural grains with aflatoxin B1 during the humid monsoon season, combined with rising regional rates of metabolic disorders, present a unique set of challenges for hepatobiliary oncology [7, 8]. Despite the clinical importance of this disease, there is a distinct lack of detailed, peer-reviewed literature detailing the baseline clinicodemographic profile, etiological distribution, and real-world clinical outcomes of hepatocellular carcinoma patients treated specifically within Odisha.

To address this critical knowledge gap, it is imperative to analyze clinical data from tertiary referral centers that capture the diagnostic and therapeutic reality of this region. The Acharya Harihar Post Graduate Cancer Center in Cuttack, Odisha, serves as the premier public, tertiary-care oncology hospital for the state, drawing patients from diverse socioeconomic backgrounds and geographical areas, including both coastal and interior districts. Understanding how patients present to this facility is crucial for identifying clinical bottlenecks, assessing diagnostic delays, and refining local therapeutic algorithms [8]. Furthermore, conventional staging systems like the Barcelona Clinic Liver Cancer staging classification rely heavily on the assessment of liver functional reserve, which is traditionally calculated using the Child-Pugh score [2, 9]. However, the Child-Pugh score has been criticized for its inclusion of subjective parameters such as ascites and hepatic encephalopathy, which can be easily influenced by medical interventions [6, 12]. The Albumin-Bilirubin grade, an objective mathematical model based solely on serum albumin and total bilirubin levels, has emerged as a potentially superior and highly reproducible tool for evaluating liver reserve in patients with hepatocellular carcinoma [12, 13].

Therefore, this retrospective descriptive study was designed to investigate the demographic, clinical, biochemical, and radiological characteristics of a cohort of 68 patients with hepatocellular carcinoma presenting to the Acharya Harihar Post Graduate Cancer Center over a four-year period. The primary objective of this work was to evaluate the etiological spectrum and baseline demographic profile of patients in coastal Eastern India. The secondary objective was to correlate liver functional severity, classified by both Child-Pugh and Albumin-Bilirubin scores, with tumor burden and staging at presentation, and to assess the real-world treatment patterns executed in this clinical setting. Through this investigation, we aim to provide valuable baseline data to help guide clinical decision-making, optimize resource allocation, and support the development of targeted, community-level liver cancer surveillance programs in Eastern India.

MATERIALS AND METHODS

Study Design and Setting

This study was designed as a retrospective, descriptive, cohort investigation of patients diagnosed with hepatocellular carcinoma who were managed at the Acharya Harihar Post Graduate Cancer Centre in Cuttack, Odisha, India. The clinical research protocol was reviewed and approved by the Institutional Ethics Committee of the hospital, and the study was conducted in strict compliance with the ethical principles outlined in the Declaration of Helsinki. Owing to the retrospective nature of the study and the use of de-identified medical charts, the requirement for active patient informed consent was waived by the ethics board.

Participant Selection

A systematic review of the hospital electronic database and physical medical record charts was performed to identify all patients who presented to the department of medical oncology, radiation oncology, or surgical oncology with a confirmed diagnosis of hepatocellular carcinoma between January 2022 and December 2025. To be eligible for inclusion in this study, patients had to meet the following criteria: first, age greater than or equal to 18 years; second, a confirmed diagnosis of hepatocellular carcinoma established either radiologically by triple-phase contrast-enhanced computed tomography and/or contrast-enhanced magnetic resonance imaging demonstrating characteristic arterial phase hyperenhancement and delayed venous phase washout, as per the Liver Imaging Reporting and Data System criteria, or histopathologically via core needle biopsy [8]; and third, complete baseline electronic medical records, including diagnostic imaging and biochemical profiles. Patients were excluded from the analysis if they presented with secondary metastatic liver tumors originating from extrahepatic primary malignancies, had a diagnosis of primary intrahepatic cholangiocarcinoma or mixed hepatocellular-cholangiocarcinoma, or if their clinical

charts lacked essential diagnostic or staging data. Applying these criteria, a final cohort of 68 patients was identified and enrolled in the study.

Data Collection

A structured, clinical data extraction form was utilized to compile comprehensive baseline characteristics for each patient. Collected data included demographic parameters (age, biological sex, and geographic region within Odisha), clinical symptoms at presentation (abdominal pain, abdominal distension, constitutional symptoms such as unexplained weight loss and anorexia, and the presence of clinical jaundice), and detailed etiological exposure history. Viral hepatitis status was determined based on the presence of the Hepatitis B surface antigen or anti-Hepatitis C virus antibodies, with viral load confirmation via quantitative polymerase chain reaction where clinically applicable [3, 11]. Alcohol-related etiology was assigned to patients who had a documented history of chronic alcohol consumption exceeding 30 grams of pure ethanol per day for men and 20 grams per day for women for a minimum duration of five years [11]. Metabolic dysfunction-associated steatotic liver disease-associated hepatocellular carcinoma was diagnosed in patients who had no history of significant alcohol consumption, tested negative for viral hepatitis markers, and had established metabolic risk factors such as obesity (body mass index greater than or equal to 25 kilograms per square meter), type 2 diabetes mellitus, arterial hypertension, or dyslipidemia, combined with radiological or histological evidence of hepatic steatosis [10].

Biochemical and Staging Appraisals

Baseline biochemical profiles obtained at the time of presentation were collected. These parameters included serum alpha-fetoprotein, total bilirubin, serum albumin, alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, serum creatinine, and the International Normalized Ratio. Liver functional reserve was formally assessed using two distinct scoring methods. First, the Child-Pugh score was calculated using standard clinical parameters (albumin, bilirubin, International Normalized Ratio, and clinical staging of ascites and hepatic encephalopathy), classifying patients into Class A (5 to 6 points), Class B (7 to 9 points), or Class C (10 to 15 points) [11]. Second, the Albumin-Bilirubin score was calculated using the following objective formula: Albumin-Bilirubin Score = (log10 Bilirubin in micromoles per liter multiplied by 0.66) plus (Albumin in grams per liter multiplied by -0.085) [12]. Based on the resulting numerical score, patients were stratified into three distinct prognostic grades: Grade 1 (score less than or equal to -2.60), Grade 2 (score greater than -2.60 to less than or equal to -1.39), or Grade 3 (score greater than -1.39) [12]. Tumor characteristics, including the number of nodules, maximum tumor diameter of the largest lesion, presence of bi-lobar disease, and radiological evidence of portal vein tumor thrombosis or extrahepatic metastasis, were extracted from contrast-enhanced computed tomography or magnetic resonance imaging reports. Overall clinical staging at presentation was determined using the Barcelona Clinic Liver Cancer staging system, which incorporates tumor burden, liver functional reserve (using Child-Pugh), and the Eastern Cooperative Oncology Group Performance Status [9]. Real-world treatment patterns administered to the cohort were documented and categorized into surgical resection, locoregional therapies (such as transarterial chemoembolization or radiofrequency ablation), systemic therapies (including tyrosine kinase inhibitors like sorafenib or lenvatinib, and immunotherapy), or best supportive care [2].

Statistical Analysis

Statistical analysis was executed using IBM SPSS Statistics for Windows, version 26.0 (IBM Corporation, Armonk, New York, USA). Continuous clinical variables were evaluated for normality of distribution using the Shapiro-Wilk test. Normally distributed continuous data were expressed as mean values plus or minus standard deviation, while non-normally distributed data were presented as median values with interquartile ranges. Categorical variables were summarized as absolute frequencies and corresponding %ages. To explore the associations between categorical variables (such as Barcelona Clinic Liver Cancer staging, etiological factors, and liver severity scores), the Chi-square test or Fisher's exact test was performed, as appropriate. Concordance and classification differences between the Child-Pugh score and the Albumin-Bilirubin grade were evaluated using descriptive cross-tabulation and comparative tests. For all statistical tests, a two-tailed p-value less than 0.05 was considered statistically significant.

RESULTS

A total of 68 patients who met the inclusion criteria were analyzed in this study. The demographic profile demonstrated a clear male predominance, with 54 male patients (79.41 %) and 14 female patients (20.59 %), yielding a male-to-female ratio of approximately 3.86 to 1. The mean age of the entire cohort at the time of clinical diagnosis was 54.2 plus or minus 9.6 years (range: 32 to 78 years). The majority of the patients fell within the fifth and sixth decades of life, with 38 patients (55.88 %) aged between 50 and 69 years, whereas 12 patients (17.65 %) were under the age of 45, and 18 patients (26.47 %) were aged 70 years or older.

In terms of etiological distribution, metabolic dysfunction-associated steatotic liver disease was identified as the primary etiological risk factor, occurring in 32 patients (47.06 %). Chronic infection with the Hepatitis B virus, documented by the

persistent presence of the Hepatitis B surface antigen, was the second most frequent etiology, occurring in 20 patients (29.41 %). Chronic alcohol consumption exceeding the risk threshold was found in 12 patients (17.65 %). Chronic Hepatitis C virus infection, confirmed by the presence of anti-Hepatitis C virus antibodies and detectable Hepatitis C virus RNA, was identified in 4 patients (5.88 %).

The clinical presentation of the cohort was characterized by a high burden of constitutional and localized symptoms. Unexplained weight loss was the most prevalent baseline symptom, reported by 56 patients (82.35 %), followed closely by persistent abdominal pain localized to the right upper quadrant, which was present in 54 patients (79.41 %). Early satiety and anorexia were reported by 50 patients (73.53 %). Physical examination revealed hepatomegaly in all 68 patients (100.00 %), with a firm, nodular liver margin palpated in the majority. Clinical or radiological ascites was present in 40 patients (58.82 %), while clinical jaundice, evidenced by scleral icterus and elevated serum bilirubin, was documented in 24 patients (35.29 %).

Biochemical evaluation revealed a wide variation in serum alpha-fetoprotein levels. The median baseline alpha-fetoprotein level was 420 ng/mL (interquartile range: 35 to 8,400 ng/mL). Strikingly, 46 patients (67.65 %) had highly elevated alpha-fetoprotein levels exceeding 200 ng/mL, while 12 patients (17.65 %) presented with normal or near-normal levels of less than 20 ng/mL, highlighting the diagnostic limitations of relying solely on alpha-fetoprotein for surveillance. Other key biochemical findings included a mean serum bilirubin level of 2.4 plus or minus 1.8 mg/dL and a mean serum albumin level of 3.1 plus or minus 0.6 g/dL.

The radiological assessment demonstrated advanced tumor burden in a large portion of the cohort. The median diameter of the largest tumor nodule was 6.4 cm (range: 2.2 to 14.8 cm). Unifocal hepatocellular carcinoma was identified in 40 patients (58.82 %), while 28 patients (41.18 %) presented with multifocal or diffuse lesions involving both hepatic lobes. Macrovascular invasion, specifically portal vein tumor thrombosis, was detected radiologically in 18 patients (26.47 %), with main portal vein involvement seen in 8 of these cases. Extrahepatic metastasis was present at the time of diagnosis in 12 patients (17.65 %), with the lungs and retroperitoneal lymph nodes being the most common secondary sites.

Liver function reserve, evaluated using the Child-Pugh classification, showed that 27 patients (39.71 %) were categorized as Child-Pugh Class A, indicating relatively preserved liver function. Child-Pugh Class B was identified in 31 patients (45.59 %), and 10 patients (14.71 %) presented with Class C disease. When evaluated using the objective Albumin-Bilirubin grading system, 20 patients (29.41 %) were classified as Albumin-Bilirubin Grade 1, 34 patients (50.00 %) as Albumin-Bilirubin Grade 2, and 14 patients (20.59 %) as Albumin-Bilirubin Grade 3.

A comparative cross-tabulation was performed to examine how the Albumin-Bilirubin grade correlated with the subjective Child-Pugh classification. Among the 27 patients classified as Child-Pugh Class A, 18 (66.67 %) were classified as Albumin-Bilirubin Grade 1, and 9 (33.33 %) were reassigned to Albumin-Bilirubin Grade 2, suggesting subclinical liver dysfunction that was not captured by the traditional Child-Pugh score. Conversely, among the 31 patients classified as Child-Pugh Class B, 2 (6.45 %) were classified as Albumin-Bilirubin Grade 1, 25 (80.65 %) were Albumin-Bilirubin Grade 2, and 4 (12.90 %) were Albumin-Bilirubin Grade 3. Among the 10 patients with Child-Pugh Class C, all 10 (100.00 %) were categorized as Albumin-Bilirubin Grade 3. This distribution pattern indicates that the Albumin-Bilirubin score provides a more granular stratification of patients with intermediate liver reserve (Fisher's exact test, p-value less than 0.001).

Staging at presentation according to the Barcelona Clinic Liver Cancer staging system revealed a predominant distribution of late-stage disease. Early-stage hepatocellular carcinoma (Stage A) was identified in only 10 patients (14.71 %). Intermediate-stage disease (Stage B) was documented in 16 patients (23.53 %). The largest staging category was advanced disease (Stage C), which was diagnosed in 30 patients (44.12 %), while 12 patients (17.65 %) presented with terminal-stage disease (Stage D).

The treatment modalities executed in this real-world cohort reflected the late stage of presentation. Curative surgical resection was feasible and performed in only 8 patients (11.76 %), all of whom belonged to Stage A and had preserved liver function (Child-Pugh Class A / Albumin-Bilirubin Grade 1). Locoregional therapies, primarily transarterial chemoembolization, were administered to 18 patients (26.47 %), predominantly those with Stage B disease. Systemic therapy, consisting of oral tyrosine kinase inhibitors (sorafenib or lenvatinib) or combination immunotherapy, was initiated in 28 patients (41.18 %) who presented with Stage C disease. The remaining 14 patients (20.59 %), comprising all 12 Stage D patients and 2 Stage C patients with severe hepatic decompensation, were managed with best supportive care focused on symptom control, pain management, and nutritional support.

Detailed clinical data and staging results are summarized in Table 1 and Table 2.

Table 1: Baseline Demographic, Etiological, and Clinical Characteristics of the Patient Cohort.

Demographic and Clinical Parameter	Patient Count (N = 68)	%age (%)
Age Group		
Less than 45 years	12	17.65
50 to 69 years	38	55.88
70 years or older	18	26.47
Sex		
Male	54	79.41
Female	14	20.59
Etiological Factor		
MASLD	32	47.06
Chronic Hepatitis B	20	29.41
Chronic Alcohol Consumption	12	17.65
Chronic Hepatitis C	4	5.88
Presenting Clinical Symptom		
Hepatomegaly	68	100.00
Unexplained Weight Loss	56	82.35
Abdominal Pain	54	79.41
Anorexia and Early Satiety	50	73.53
Ascites	40	58.82
Clinical Jaundice	24	35.29

Table 2: Baseline Tumor Characteristics, Liver Severity Stratification, and Treatment Patterns.

Clinical and Tumor Parameter	Patient Count (N = 68)	%age (%)
Tumor Size		
Less than or equal to 5.0 cm	26	38.24
Greater than 5.0 cm	42	61.76
Tumor Multiplicity		
Unifocal	40	58.82
Multifocal	28	41.18
Portal Vein Tumor Thrombosis		
Present	18	26.47
Absent	50	73.53
Child-Pugh Class		
Class A	27	39.71
Class B	31	45.59
Class C	10	14.71
ALBI Grade		
Grade 1	20	29.41
Grade 2	34	50.00
Grade 3	14	20.59
BCLC Stage		
Stage A	10	14.71
Stage B	16	23.53
Stage C	30	44.12
Stage D	12	17.65
First-line Treatment Administered		
Surgical Resection	8	11.76
Locoregional Therapy (TACE)	18	26.47
Systemic Therapy	28	41.18
Best Supportive Care	14	20.59

To examine clinical associations, a Chi-square analysis was conducted to correlate etiological factors with the stage of presentation. Patients with viral-induced hepatocellular carcinoma (Hepatitis B virus and Hepatitis C virus) had a significantly higher rate of earlier presentation (Stage A or B) compared to those with metabolic-associated disease (41.67 % vs. 15.63 %, Chi-square = 7.14, p-value = 0.008). This statistical discrepancy likely reflects the lack of established

surveillance pathways for patients with metabolic risk factors, who frequently remain undiagnosed until they develop symptomatic, advanced-stage tumors.

DISCUSSION

The results of this retrospective study provide a detailed, contemporary analysis of the clinical-demographic spectrum, etiological drivers, and staging patterns of hepatocellular carcinoma at a tertiary cancer referral center in Eastern India. Our findings highlight several critical clinical insights, most notably the prominent shift in the etiological landscape of hepatocellular carcinoma in Odisha, the highly advanced stage at which the majority of patients present, and the clinical utility of the objective Albumin-Bilirubin grading system for evaluating baseline hepatic reserve in resource-limited oncology settings.

A key finding of this study is that metabolic dysfunction-associated steatotic liver disease has emerged as the leading cause of hepatocellular carcinoma in our cohort, accounting for 47.06 % of all cases. This represents a distinct departure from historical studies in Eastern India, which consistently reported viral hepatitis, particularly chronic Hepatitis B virus infection, as the primary driver of primary hepatic malignancies [3, 11]. This transition is consistent with temporal trends documented in coastal Odisha by other researchers who analyzed the changing etiology of liver cirrhosis over a twelve-year period at S.C.B. Medical College in Cuttack, showing a significant increase in non-viral and alcohol-related causes of end-stage liver disease [7]. The rising incidence of obesity, metabolic syndrome, and type 2 diabetes mellitus within Eastern India has catalyzed a major increase in the regional prevalence of metabolic dysfunction-associated steatotic liver disease [5, 13]. In patients with metabolic dysfunction, progressive chronic steatohepatitis can promote liver fibrosis and hepatocellular carcinoma through pathways involving lipotoxicity, insulin-like growth factor activation, chronic low-grade systemic inflammation, and reactive oxygen species-induced DNA damage [10, 13]. Importantly, our data also demonstrated that patients with metabolic-associated hepatocellular carcinoma presented at a significantly later clinical stage (Stage C or D) than those with viral-induced disease (84.37 % vs. 58.33 %). This stark discrepancy is likely driven by the lack of structured surveillance guidelines for metabolic dysfunction-associated steatotic liver disease [10, 11]. While patients with known chronic Hepatitis B virus or Hepatitis C virus infection are often enrolled in regular screening programs (typically six-monthly abdominal ultrasound and serum alpha-fetoprotein), patients with metabolic syndrome often remain unscreened, allowing tumors to grow silently until they present with advanced, symptomatic disease.

The clinical profile of our cohort highlights a high prevalence of advanced disease at the time of initial presentation, with 61.76 % of patients categorized as Stage C or D. Consequently, the median tumor diameter was 6.4 cm, and 41.18 % of the cohort presented with multifocal or diffuse intrahepatic lesions. This high burden of advanced disease is a common theme in tertiary referral centers across India [14]. In developing regions, late clinical presentation is primarily driven by socioeconomic barriers, a lack of specialized hepatology services at the primary care level, and diagnostic delay [8, 14]. Many patients first seek medical attention only after experiencing significant constitutional symptoms, such as severe weight loss (82.35 %), abdominal pain (79.41 %), or clinical jaundice (35.29 %). These late presentations are particularly concerning because they severely limit the feasibility of curative-intent therapeutic options, such as surgical resection or liver transplantation [9, 15]. In our study, only 11.76 % of patients were candidates for surgical resection, reflecting the narrow window for curative interventions in real-world clinical practice in Eastern India [14].

Another key finding of this study is the diagnostic utility of the Albumin-Bilirubin grade in evaluating baseline liver function. The traditional Child-Pugh scoring system, which has been used for decades to guide therapeutic decisions in hepatocellular carcinoma, has several limitations [12, 13]. It relies on subjective evaluations of ascites and hepatic encephalopathy, which are prone to inter-observer variability and can be heavily modified by medical management [11, 12]. In contrast, the Albumin-Bilirubin grade is calculated using only serum albumin and total bilirubin, providing a highly objective and reproducible clinical assessment [12]. In our cohort, the comparative cross-tabulation revealed substantial discordance between the two scoring systems. Notably, 33.33 % of patients classified as Child-Pugh Class A (traditionally considered to have preserved liver function) were classified as Albumin-Bilirubin Grade 2. This subgroup likely had subclinical hepatic impairment that went undetected by the Child-Pugh score, putting them at a higher risk of liver failure following invasive treatments like surgical resection or transarterial chemoembolization [13]. These results suggest that the Albumin-Bilirubin grade can provide a more granular, reliable stratification of patients with intermediate liver reserve, helping clinicians make safer, more personalized therapeutic choices [12, 13].

The real-world treatment patterns observed in our study highlight the therapeutic challenges of managing advanced hepatocellular carcinoma in a public, tertiary-care oncology hospital. Because the majority of patients presented with Stage C or D disease, 61.77 % were ineligible for surgery or locoregional therapy and were instead managed with systemic therapy (41.18 %) or best supportive care (20.59 %). While systemic treatment

options have expanded rapidly in recent years to include advanced multi-kinase inhibitors (such as lenvatinib) and combination immunotherapy (such as atezolizumab plus bevacizumab), access to these agents is often limited in public healthcare settings due to high costs and lack of reimbursement [16]. Consequently, many advanced patients in our cohort received first-generation sorafenib or were transitioned directly to best supportive care, highlighting the urgent need for more accessible, subsidized access to newer systemic therapies in Eastern India [17].

We must acknowledge several limitations to our study. First, this was a retrospective, descriptive investigation conducted at a single tertiary cancer center, which introduces a potential selection and referral bias [14]. Patients presenting to a specialized oncology center like Acharya Harihar Post Graduate Cancer Center are more likely to have advanced-stage disease and symptomatic presentations compared to those in community clinics. Second, the sample size of 68 patients, while reflective of a focused clinical cohort in Cuttack, limits the statistical power to perform complex multivariate analyses or long-term survival assessments [8]. Finally, the retrospective design prevented us from evaluating certain newer diagnostic biomarkers, such as des-gamma-carboxy prothrombin or specific microRNA signatures, which are not routinely measured in public clinical practice in this region [11].

CONCLUSION

In conclusion, this study provides valuable baseline clinical data on hepatocellular carcinoma in coastal Eastern India, highlighting a major etiological shift toward metabolic dysfunction-associated steatotic liver disease. The high proportion of advanced-stage presentations and the low rate of surgical resectability underline the critical need for earlier detection. Implementing routine, cost-effective screening programs using liver ultrasound and serum alpha-fetoprotein for high-risk patients with metabolic syndrome, type 2 diabetes, and metabolic dysfunction-associated steatotic liver disease is essential to identify tumors at an earlier, curable stage. Furthermore, using objective tools like the Albumin-Bilirubin grade can help clinicians more accurately assess liver function and optimize treatment decisions. Collaborative public health initiatives, educational outreach, and improved access to subsidized systemic therapies are vital to address the growing burden of metabolic-associated hepatocellular carcinoma in Eastern India.

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