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Prognostic factors and survival outcomes in patients with hepatocellular carcinoma: a retrospective monocentric study

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Abstract

Background

Hepatocellular carcinoma (HCC) is the most common primary liver cancer and remains a leading cause of cancer-related mortality worldwide. Prognosis is largely determined by tumor stage at diagnosis and the severity of underlying liver disease. Real-world data are essential to better characterize disease presentation, management, and prognostic factors.

Methods

We conducted a descriptive, analytical, retrospective, single-center study including patients diagnosed with HCC between January 2020 and January 2025. Diagnosis was established according to European Association for the Study of the Liver imaging criteria or histology when indicated. Demographic, clinical, radiological, and therapeutic data were collected. Overall survival was analyzed using the Kaplan–Meier method. Prognostic factors associated with survival were assessed using univariate and multivariate analyses.

Results

Seventy-four patients were included, with a mean age of 69.5 years and a marked male predominance. Cirrhosis was present in 97.3% of cases, mainly related to hepatitis C virus infection. Most patients were diagnosed at intermediate or advanced stages according to the Barcelona Clinic Liver Cancer classification. Treatment was predominantly palliative. Median overall survival was 10 months. In multivariate analysis, Child–Pugh C status, portal vein invasion, and the presence of extrahepatic metastases were independently associated with reduced survival.

Conclusion

Hepatocellular carcinoma was frequently diagnosed at an advanced stage and associated with poor survival. Liver function and tumor-related factors were the main determinants of prognosis. These findings highlight the need for improved surveillance strategies to enable earlier diagnosis and increase access to curative treatment options

1. Introduction

Hepatocellular carcinoma (HCC) is the most common primary liver cancer and remains a leading cause of cancer-related mortality worldwide. Its prognosis is largely influenced by late diagnosis and the frequent presence of advanced chronic liver disease, which limits therapeutic options.

HCC most commonly arises in the setting of cirrhosis, with chronic hepatitis B and C infections representing the main etiological factors globally. However, the epidemiology of HCC is evolving, with an increasing contribution of metabolic-associated steatotic liver disease and alcohol-related liver disease. The severity of underlying liver dysfunction is a key determinant of both treatment eligibility and survival.

Curative treatment options are available for early-stage HCC, but many patients are diagnosed at intermediate or advanced stages, when management is primarily palliative. The Barcelona Clinic Liver Cancer staging system remains the cornerstone for prognostic assessment and therapeutic decision-making, integrating tumor burden and liver function.

Real-world data from tertiary care centers are essential to better characterize disease presentation, treatment patterns, and prognostic factors, particularly in regions where epidemiological data are limited. The aim of this study was to describe the clinical and radiological characteristics, management strategies, and survival outcomes of patients with hepatocellular carcinoma and to identify factors associated with reduced survival.

2. Materials and Methods

This was a descriptive, analytical, retrospective, single-center study conducted in the Department of Gastroenterology I at Mohammed V Military Hospital in Rabat, Morocco. The study included patients diagnosed with hepatocellular carcinoma (HCC) over a five-year period, from January 2020 to January 2025.

A total of 74 patients were enrolled. The diagnosis of HCC was established according to the non-invasive radiological criteria of the European Association for the Study of the Liver (EASL), based on the identification of a focal liver lesion showing arterial phase hyperenhancement followed by portal or delayed phase washout on contrast-enhanced computed tomography or magnetic resonance imaging. Histological confirmation was performed in cases with atypical imaging features or when HCC occurred in the absence of underlying cirrhosis. Patients with incomplete medical records or missing essential clinical, radiological, or follow-up data were excluded from the study.

Clinical, biological, and radiological data were retrospectively collected from medical records and the hospital electronic database. Demographic characteristics, including age and sex, were recorded for all patients. The etiology of chronic liver disease was documented. The presence or absence of cirrhosis was assessed based on clinical findings, laboratory parameters, and imaging features. Liver disease severity was evaluated using the Child–Pugh score.

Tumor characteristics were assessed using imaging. Tumor stage at diagnosis was determined according to the Barcelona Clinic Liver Cancer (BCLC) staging system. Therapeutic management was classified as

curative, including surgical resection and local ablative therapies, or palliative, depending on tumor stage and liver function.

Overall survival was defined as the time interval between the date of HCC diagnosis and death or the last follow-up. Statistical analysis was performed using Jamovi software. Qualitative variables were expressed as frequencies and percentages, while quantitative variables were presented as mean ± standard deviation or as median with interquartile range, depending on data distribution. Survival analysis was conducted using the Kaplan–Meier method. Prognostic factors associated with survival were evaluated using univariate and multivariate logistic regression analyses, with results expressed as odds ratios and 95% confidence intervals. A p-value of less than 0.05 was considered statistically significant.

3. Results

A total of seventy-four patients diagnosed with hepatocellular carcinoma between January 2020 and January 2025 were included in the study.

Demographic characteristics

The mean age of the study population was 69.5 ± 8.7 years. The age distribution showed a predominance of elderly patients, with those aged between 70 and 79 years representing 45.9% of cases. Patients aged 60–69 years accounted for 27.0%, while those aged 50–59 years represented 13.5%. Patients aged 80 years and older constituted 10.8% of the cohort. There was a marked male predominance.

Liver disease characteristics and etiology

Underlying liver cirrhosis was present in 97.3% of patients, whereas hepatocellular carcinoma developed on a non-cirrhotic liver in 2.7% of cases. Hepatitis C virus infection was the most common etiology of chronic liver disease, accounting for 45.9% of cases. Hepatitis B virus infection was identified in 29.7% of patients. Other etiologies, including metabolic-associated steatotic liver disease and alcohol-related liver disease, represented 24.4% of cases.

Liver function assessment

Assessment of liver function using the Child–Pugh classification revealed that 27.1% of patients were classified as Child–Pugh A, 40.5% as Child–Pugh B, and 32.4% as Child–Pugh C.

Tumor characteristics

Radiological evaluation showed that more than three hepatic nodules were present in 54.1% of patients. Tumor size exceeded 5 cm in 51.4% of cases. Portal vein invasion was observed in 43.2% of patients, while extrahepatic metastases were identified in 29.7% of cases.

BCLC stage at diagnosis

According to the Barcelona Clinic Liver Cancer staging system, 8.1% of patients were classified as stage A, 29.7% as stage B, 37.8% as stage C, and 24.3% as stage D at the time of diagnosis.

Treatment modalities

Therapeutic management was predominantly palliative, administered in 89.1% of patients. Curative treatment strategies, including surgical resection or local ablative therapies, were performed in only 10.9% of cases.

Survival outcomes

The median overall survival of the study population was 10 months.

Prognostic factors associated with survival

Univariate analysis demonstrated that impaired liver function and advanced tumor stage were significantly associated with reduced survival. Patients classified as Child–Pugh C had a significantly higher risk of mortality compared with those classified as Child–Pugh A or B, with an odds ratio (OR) of 3.65 (95% confidence interval 1.19–11.3; p = 0.033). Advanced disease according to the BCLC classification (stages C and D) was also associated with poorer survival outcomes (OR; 95% CI 1.31–12.7; p = 0.017). Tumor burden was a significant prognostic factor, as patients presenting with more than three nodules had an increased risk of mortality (OR 4.04; 95% IC 1.18–13.8; p = 0.029). Similarly, portal vein invasion was associated with reduced survival (OR 3.60; 95% CI 1.17–11.1; p = 0.021). The presence of extrahepatic metastases was significantly associated with poor prognosis (OR 0.09; 95% CI 0.01–0.79; p = 0.009). In addition, the absence of curative treatment was strongly associated with increased mortality (OR 7.11; 95% CI 2.16–15.3; p = 0.002).

Multivariate analysis identified three independent predictors of reduced survival. Child–Pugh C status remained significantly associated with mortality after adjustment (OR 1.31; 95% CI 1.31–1.85; p = 0.014). Portal vein invasion was independently associated with poor survival (OR 5.75; 95% CI 0.20–13.28; p = 0.026), as was the presence of extrahepatic metastases (OR 3.42; 95% CI 1.48–5.89; p = 0.020). Tumor size greater than 5 cm and alpha-fetoprotein levels above 400 ng/mL were not independently associated with survival.

The results of the univariate and multivariate analyses are summarized in Table 1.

4. Discussion

In this retrospective monocentric study including 74 patients with hepatocellular carcinoma, we observed a predominance of advanced-stage disease at diagnosis, a high proportion of palliative treatment strategies, and poor overall survival. These findings are consistent with the well-documented global burden of hepatocellular carcinoma, which remains one of the leading causes of cancer-related mortality worldwide due to late diagnosis and limited access to curative therapies in many settings [1].

In our cohort, hepatocellular carcinoma developed almost exclusively in patients with underlying cirrhosis, confirming the strong association between chronic liver disease and hepatocarcinogenesis. Cirrhosis is not only a major risk factor for HCC development but also a critical determinant of prognosis, as it limits therapeutic options and increases the risk of liver-related mortality. Previous studies have consistently demonstrated that impaired liver function, particularly advanced Child–Pugh class, is

associated with significantly reduced survival in patients with HCC [2,3]. In line with these data, Child–Pugh C status emerged as an independent predictor of poor survival in our multivariate analysis.

Tumor burden and vascular invasion are key prognostic factors in hepatocellular carcinoma. The Barcelona Clinic Liver Cancer staging system integrates tumor characteristics, liver function, and performance status to guide treatment allocation and prognostic stratification [4]. In our study, the majority of patients were diagnosed at intermediate or advanced BCLC stages, and advanced BCLC stage was significantly associated with reduced survival. Portal vein invasion, which reflects aggressive tumor biology and advanced disease, was also independently associated with poor prognosis, in accordance with previous large cohort studies [5,6].

Extrahepatic metastases were identified as another independent predictor of mortality in our cohort. The presence of metastatic disease reflects systemic tumor dissemination and has been consistently associated with poor outcomes in patients with hepatocellular carcinoma [7]. These findings further emphasize the importance of early diagnosis before vascular invasion or metastatic spread occurs.

Therapeutic management in our cohort was predominantly palliative, with only a small proportion of patients eligible for curative treatment. This pattern largely reflects the advanced disease stage at diagnosis and impaired liver function. Curative strategies, including surgical resection, liver transplantation, and local ablative therapies, are associated with significantly improved long-term survival when applied at early stages, with five-year survival rates exceeding 70% in selected patients [8]. The limited use of curative therapies in our population highlights the need for improved surveillance programs in patients with chronic liver disease, particularly those with cirrhosis.

The findings of this study underscore the multifactorial nature of prognosis in hepatocellular carcinoma, in which both tumor-related factors and liver function play central roles. Our results support current guideline recommendations advocating for integrated assessment using validated staging systems to guide management decisions and optimize patient outcomes [4,9].

Several limitations should be acknowledged. The retrospective design and single-center nature of the study may limit the generalizability of the results. In addition, the impact of recently introduced systemic therapies, such as immune checkpoint inhibitors, was not evaluated and may influence survival outcomes in more recent cohorts. Nevertheless, this study provides valuable real-world data reflecting routine clinical practice and highlights key prognostic determinants of survival in patients with hepatocellular carcinoma.

5. Conclusion

In this retrospective monocentric study, hepatocellular carcinoma was predominantly diagnosed at an advanced stage and was associated with poor overall survival. Impaired liver function, advanced tumor stage, portal vein invasion, and the presence of extrahepatic metastases were identified as key prognostic factors. The predominance of palliative treatment strategies reflects delayed diagnosis and limited eligibility for curative therapies. These findings underscore the importance of early detection through effective surveillance programs in patients with chronic liver disease, as well as comprehensive assessment

integrating liver function and tumor characteristics to optimize management and improve outcomes in patients with hepatocellular carcinoma.

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Table 1. Univariate and multivariate analyses of prognostic factors associated with overall survival in patients with hepatocellular carcinoma

Variable	Univariate analysis OR (95% CI)	p value	Multivariate analysis OR (95% CI)	p value
Child–Pugh C	3.65 (1.19–11.3)	0.033	1.31 (1.31–1.85)	0.014
BCLC stage C or D	4.09 (1.31–12.7)	0.017	—	—
Number of nodules ≥ 3	4.04 (1.18–13.8)	0.029	—	—
Portal vein invasion	3.60 (1.17–11.1)	0.021	5.75 (0.20–13.28)	0.026
Presence of metastases	0.09 (0.01–0.79)	0.009	3.42 (1.48–5.89)	0.020
Absence of curative treatment	7.11 (2.16–15.3)	0.002	—	—

OR: odds ratio; CI: confidence interval. Variables with $p < 0.05$ in univariate analysis were included in the multivariate model.