

# Indications and Outcomes of Surgical Treatment for Hepatocellular Carcinoma: A Bicentric Study at HALD and HMO in Dakar

Mohamadou Lamine Gueye, Ghada Zairi, Balla Diop, Yacine Seye, Omar Sow, Alpha Oumar Toure, Pape Mamadou Faye, Ousmane Thiam, Mamadou Seck, Madieng Dieng

Service de Chirurgie Générale, Hôpital Aristide Le Dantec, Avenue Pasteur, Dakar, Sénégal  
Email: [laminegueye269@gmail.com](mailto:laminegueye269@gmail.com)

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## Abstract

**Objective:** To report the indications and outcomes of surgical treatment for hepatocellular carcinoma (HCC) in a series of operated patients. **Patients and Methods:** This was a retrospective descriptive study conducted from January 2022 to September 2023 in the General Surgery departments of Aristide Le Dantec hospital and Military Ouakam hospital. All patients who underwent hepatectomy for HCC were included. Patients who underwent tumorectomy were excluded. Diagnostic and therapeutic aspects were analyzed. **Results:** Thirteen out of 61 patients were included, with a sex ratio of 1.6 and a mean age of 38.7 years. Computed tomography (CT) demonstrated a wash-in and wash-out enhancement pattern in 9 cases, with a mean tumor size of  $111.6 \pm 36.5$  mm. MRI revealed lesions evoking HCC in 4 of 7 cases. The mean AFP level was 788.9 ng/mL. Eleven patients were classified as BCLC stage A. Exploration through a Makuuchi incision ( $n = 11$ ) revealed a micronodular liver in 4 cases. Eight major hepatectomies were performed, including 5 right hepatectomies. Intermittent total vascular clamping was used in 10 cases. Four morbidity events were recorded, including three biliary fistulas and one ischemic stroke. Three deaths and one recurrence were noted. Causes of death were liver failure ( $n = 2$ ) and hemorrhagic shock ( $n = 1$ ). **Conclusion:** In our setting, HCC predominantly affects middle-aged adults with a male predominance, and hepatitis B virus infection is the leading risk factor. Hepatic resection remains the cornerstone of curative treatment in our context.

## Keywords

Hepatocellular Carcinoma, Hepatectomy, Hepatitis B Virus, Surgery, Senegal

## 1. Introduction

Hepatocellular carcinoma (HCC) is the most common primary liver cancer in adults. It is the fifth most common cancer in men and the ninth in women worldwide and represents the second leading cause of cancer-related mortality globally [1] [2]. HCC exhibits marked epidemiological variability, largely related to the underlying causes of chronic liver disease, which constitute the principal risk factors for this malignancy [3]. Among these causes, chronic hepatitis B virus infection plays a central role in African countries, particularly in Senegal [1] [4] [5].

In Western countries, systematic screening of at-risk populations enables early detection and significantly increases the likelihood of curative treatment. In contrast, such screening programmes are often lacking in developing countries, particularly in Africa, where diagnosis is most frequently made at an advanced stage, thereby substantially limiting therapeutic options [6]. Among the available treatment modalities, liver transplantation represents the optimal therapeutic approach, as it addresses both hepatocellular carcinoma and the underlying chronic liver disease.

In Senegal, as in many African countries, surgical resection remains the cornerstone of curative treatment for HCC, despite the low proportion of patients eligible for surgery, largely due to diagnosis at an advanced stage. The aim of this study was to evaluate the indications and outcomes of surgical management in patients with hepatocellular carcinoma eligible for hepatic resection.

## 2. Methods

This was a retrospective descriptive study conducted from January 2022 to September 2023 in the Departments of General Surgery of Aristide Le Dantec hospital and Military Ouakam hospital. All patients who underwent hepatic resection for hepatocellular carcinoma were included. Patients who underwent tumorectomy were excluded.

The following parameters were analysed:

- Sociodemographic characteristics (age, sex);
- Diagnostic data (clinical presentation, paraclinical findings, disease stage);
- Therapeutic data (surgical approach, intraoperative findings, type of procedure performed);
- Treatment outcomes (postoperative morbidity: Clavier Dindo classification, mortality, and tumor recurrence).

## 3. Results

During the study period, 61 patients with hepatocellular carcinoma (HCC) were managed in our department, of whom 40 were considered unresectable. Following surgical exploration, 13 patients were considered eligible for hepatic resection and were therefore included in the present study. The mean age of the patients was 38.7 years (range: 24 - 74 years), with a median age of 35 years. Five patients were

under 30 years of age. The study population consisted of 8 men and 5 women, yielding a male-to-female ratio of 1.6. Three patients were being followed up for chronic hepatitis B infection and were receiving tenofovir-based antiviral therapy (**Table 1**).

**Table 1.** Etiological risk factors among patients with hepatocellular carcinoma (N = 13).

Risk factor	n	%
HBV	3	23.07
HCV	0	0
Alcohol	1	7.7
NAFLD	-	-
Cirrhosis	4	30.7

### 3.1. Clinical and Diagnostic Findings

Diagnosis was established during follow-up for chronic hepatitis B-related liver disease in two patients, based on clinical symptoms in seven patients, and in the context of an acute abdomen, (hemoperitoneum associated with cardiovascular collapse), in one patient. Patients were classified according to the World Health Organization (WHO) performance status: seven patients had a WHO PS of 1, three had a PS of 2, and three had a PS of 0. Abdominal pain was reported in nine patients. Jaundice was observed in one patient, and cardiovascular collapse occurred in one case. Hepatomegaly was present in six patients, with a mean liver span of 14 cm (range: 10 - 18 cm). No abdominal collateral venous circulation or clinical ascites was observed. Diffuse abdominal guarding and dullness were noted in two patients. Regarding laboratory findings, three patients presented with hepatic cytolysis, with serum aminotransferase (ALT and AST) levels exceeding eight times the upper limit of normal in two patients and four times the upper limit of normal in one patient. Biochemical cholestasis was observed in five patients. In addition, elevated total bilirubin levels were noted in four patients, and prothrombin time below 70% was recorded in two patients. Serum albumin was measured in 12 patients, with a mean level of 32.7 g/L. The distribution of patients according to albumin levels is presented in **Table 2**. The mean platelet count was  $259.4 \times 10^3/\text{mm}^3$ . Thrombocytopenia was observed in two patients, while thrombocytosis was observed in two patients. The mean haemoglobin level was 11.2 g/dL, and preoperative anaemia was observed in four patients. The mean prothrombin time (PT) was 76.6%, with two patients having a PT below 67%. The distribution of patients according to alpha-fetoprotein (AFP) levels is presented in **Table 3**. Abdominal ultrasound was performed in nine patients and suggested hepatocellular carcinoma in seven cases. In two patients, ultrasound findings were suggestive of a hepatic abscess and a hepatic haemangioma, respectively. Thora-coabdominopelvic computed tomography (CT) was performed in all patients and revealed abnormalities in all 13 cases. A characteristic arterial wash-in and portal

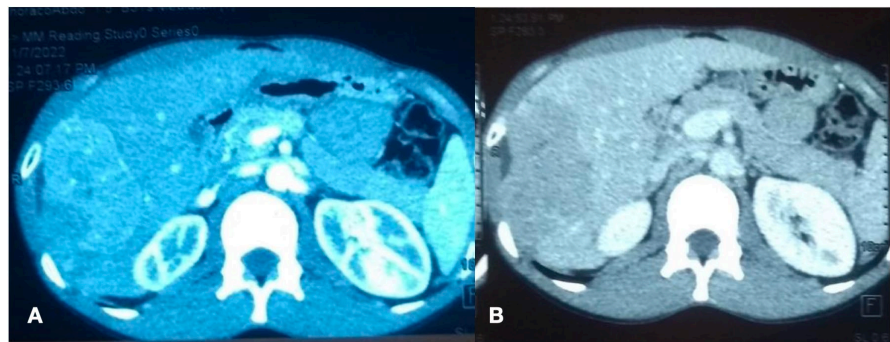
venous wash-out enhancement pattern, suggestive of hepatocellular carcinoma, was observed in nine patients (**Figure 1**). The mean tumor size on CT was  $111.6 \pm 36.5$  mm. CT staging demonstrated no evidence of extrahepatic spread in any of the 13 patients. Magnetic resonance imaging (MRI) was performed in seven patients and demonstrated a typical arterial wash-in and portal venous wash-out enhancement pattern, consistent with hepatocellular carcinoma, in four cases (**Figure 2**). In two other patients, MRI revealed nodular lesions with non-specific enhancement patterns. In one patient, left segmental portal vein thrombosis was identified. No metastatic lesions were detected in the contralateral liver, and no signs of clinically significant portal hypertension were observed. Patients were systematically classified according to the Child-Pugh score and the Barcelona Clinic Liver Cancer (BCLC) classification, as illustrated in **Figure 3** and **Figure 4**, respectively.

**Table 2.** Patient distribution according to serum albumin levels.

Albuminemia level	<28	28 - 35	>35
Number of patients	2	6	4

**Table 3.** Patient distribution according to Afp levels.

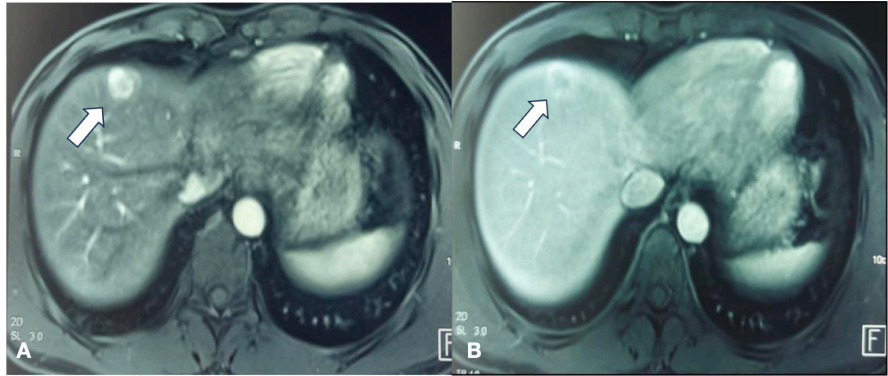
Afp level (ng/ml)	<25	25 - 250	>2500
Number of patients	7	2	2



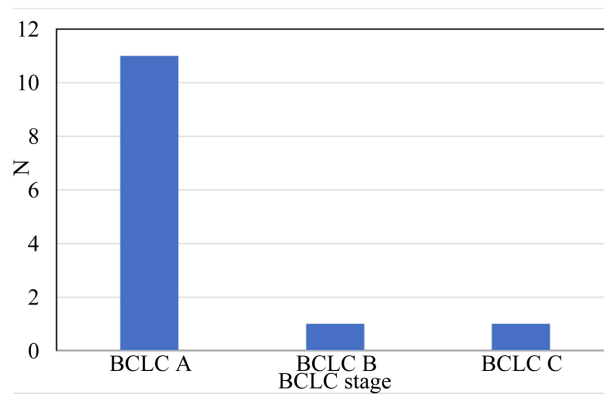
**Figure 1.** Axial contrast-enhanced abdominal computed tomography (CT) images illustrating characteristic imaging features of hepatocellular carcinoma (HCC). (A) Arterial phase demonstrating a hypervascular hepatic lesion with intense heterogeneous enhancement relative to the surrounding liver parenchyma; (B) Portal venous phase showing wash-out appearance of the lesion, which becomes hypodense compared to the adjacent enhanced liver tissue.

In summary, preoperative liver assessment included liver function tests, prothrombin time, and abdominal imaging. Portal hypertension was assessed clinically and through endoscopy and CT imaging. When major hepatectomy was planned, the future liver remnant was evaluated using CT-based estimation. Resectability was defined by the feasibility of achieving curative hepatic resection

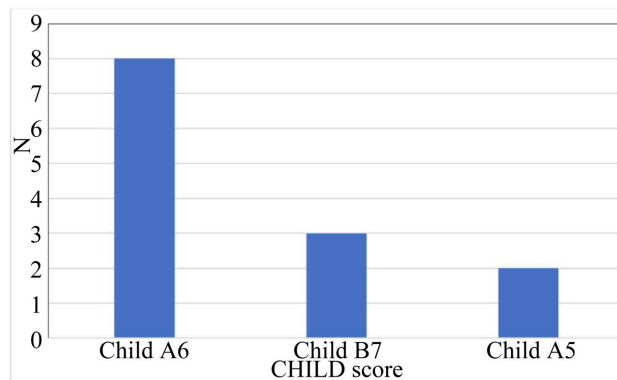
while preserving more than 40% of functional liver parenchyma in patients with Child-Pugh A5-B7 liver function, in the absence of extrahepatic metastasis and clinically significant portal hypertension.



**Figure 2.** Axial contrast-enhanced magnetic resonance imaging (MRI) of the liver demonstrating typical imaging characteristics of hepatocellular carcinoma (HCC). (A) Arterial phase showing a well-defined hypervascular lesion in the right hepatic lobe (arrow) with intense enhancement relative to the surrounding liver parenchyma; (B) Portal/late phase revealing washout appearance of the lesion (arrow), which becomes hypointense compared to the adjacent enhanced hepatic tissue.



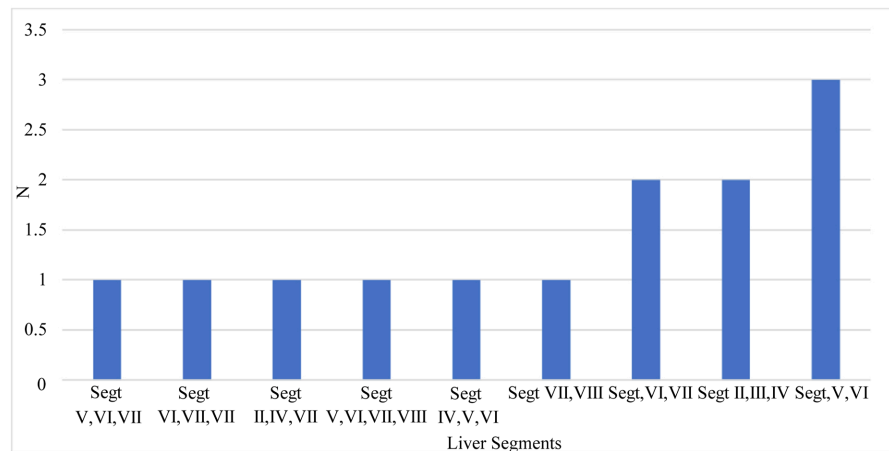
**Figure 3.** Distribution of HCC patients according to BCLC stage.



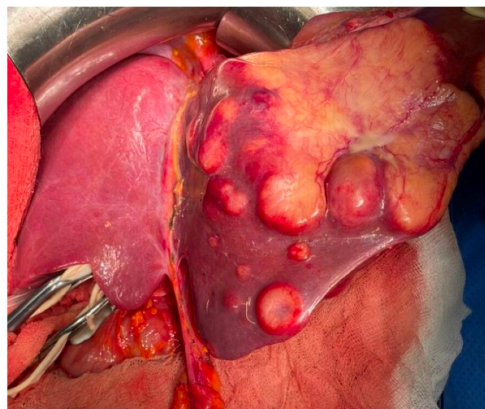
**Figure 4.** Distribution of hepatocellular carcinoma patients according to child-pugh classification.

### 3.2. Surgical Management and Outcomes

The surgical approaches included a Makuuchi incision in ten patients, a midline laparotomy in two patients, and a bilateral subcostal laparotomy in one patient. The distribution of tumour location by hepatic segment is illustrated in **Figure 5**. The liver appeared micronodular and cirrhotic in four cases and macroscopically normal in nine cases (**Figure 6**). Two types of vascular clamping were performed: pedicular clamping and selective clamping.



**Figure 5.** Distribution of HCC according to liver segment involvement.



**Figure 6.** Gross surgical view of multifocal hepatocellular carcinoma involving the left liver.

Pedicular clamping ( $n = 10$ ) was performed intermittently, with clamping and unclamping periods of 15 and 5 minutes, respectively. The mean cumulative clamping duration was 59.4 minutes (range: 15 - 48 minutes), and the mean intraoperative blood loss was 1200 mL. Selective clamping ( $n = 3$ ) was performed continuously and consisted of right Glissonian clamping in two patients and left hilar clamping in one patient. Two patients required concomitant infrahepatic inferior vena cava (IVC) clamping, with a mean duration of 10 minutes. In one case, IVC clamping was combined with a Pringle manoeuvre, while in the other it was combined with right Glissonian pedicle clamping. The indication for IVC clamp-

ing was uncontrolled bleeding secondary to injury to the middle hepatic vein in one patient and the right hepatic vein in another.

The performed surgical procedures were: a right hepatectomy (n = 5), a left hepatectomy (n = 3), a bisegmentectomy (n = 3), a right lobectomy (n = 1), and a segmentectomy (n = 1).

The mean duration of hepatectomy was  $192 \pm 45$  minutes. The mean length of hospital stay was 8 days (range: 4 - 15 days).

Four postoperative morbidity events (Dindo Clavier III) were recorded, including:

- Biliary fistula (n = 3), among which one high-output fistula resolved on postoperative day 20 in a 74-year-old patient who had also experienced an ischemic stroke on postoperative day 3;
- Postoperative bleeding from the transection surface, requiring reoperation on postoperative day 1 (n = 1).

Three postoperative deaths were recorded. The first was due to hemorrhagic shock secondary to inferior vena cava bleeding on postoperative day 2. The other two deaths were related to post-hepatectomy liver failure, occurring on postoperative days 4 and 35, respectively. In the latter patient, a CT scan performed on postoperative day 30 demonstrated extensive inferior vena cava thrombosis and tumoral lesions in the remnant liver. The 30-day postoperative mortality rate was 23.01%. Histopathological analysis confirmed hepatocellular carcinoma in 12 patients and combined hepatocellular-cholangiocarcinoma in one patient. Surgical margins were negative (R0) in all cases. Microvascular invasion was not reported. Background cirrhosis was identified in four specimens. Patients were followed every three months with clinical examination, liver function tests, and abdominal ultrasound or CT scan then by 6 months. The median follow-up duration was 22 months. Patients were monitored with periodic CT scans to detect recurrence. One tumor recurrence was observed among the 13 patients after a 9-month follow-up. This occurred in a patient who had undergone bisegmentectomy (segments VI - VII) for hepatocellular carcinoma initially localized to segments VI and VII.

## 4. Discussion

### 4.1. Discussion of Diagnostic Findings

A study conducted in Senegal in 2020 at Principal hospital of Dakar demonstrated that hepatocellular carcinoma (HCC) is frequently diagnosed at an advanced stage. Clinically, tumour-related hepatomegaly is a common presenting feature, as reported in sub-Saharan Africa, where it is observed in 69% to 100% of cases [7]. In our series, nearly 50% of patients presented with hepatomegaly. Similarly, a study conducted in The Gambia reported hepatomegaly in 93% of cases, abdominal pain in 94%, and jaundice in 22% of patients [8]. These diagnostic circumstances contrast sharply with the situation in Western countries, where the majority of patients are diagnosed at an asymptomatic stage through structured

surveillance programmes [9]. This underscores the crucial role of early screening in at-risk populations in improving prognosis [9]. With regard to imaging, computed tomography (CT) was systematically performed in our series, and typical radiological features of hepatocellular carcinoma were identified in nine patients. This finding confirms the high diagnostic sensitivity of triphasic CT—including arterial, portal venous, and delayed phases—in the evaluation of HCC [10]. The characteristic arterial wash-in and portal venous wash-out enhancement pattern is highly suggestive of HCC; however, false-negative results may occur, particularly in cases of extensive tumor necrosis [11]. Magnetic resonance imaging (MRI) is superior to computed tomography in terms of sensitivity for the detection and characterisation of hepatic nodules, allowing reliable differentiation between regenerative and tumoral nodules [12]. In our study, MRI was performed in seven patients and confirmed the diagnosis of hepatocellular carcinoma in four cases by demonstrating the typical arterial wash-in and portal venous wash-out enhancement pattern. In addition, diffusion-weighted imaging enables a more accurate assessment of intrahepatic tumor spread. However, owing to its high cost and limited availability, MRI is mainly reserved in our setting for equivocal cases and for the characterisation of small hepatic lesions. The selection of candidates for surgical resection must be rigorous and should include a comprehensive assessment of liver function, portal hypertension, and future liver remnant volume [11]. Functional tests, such as indocyanine green clearance, have demonstrated their clinical utility; however, in routine practice, evaluation of the non-tumoral liver parenchyma is often incomplete owing to financial constraints and the limited availability of specialised investigations in our setting [11]. In our study, 76.8% of patients were classified as Child-Pugh class A. In the series reported by Yang *et al.*, the distribution of Child-Pugh classes in sub-Saharan Africa was 7%, 66%, and 27% for classes A, B, and C, respectively, whereas in Egypt the corresponding distribution was 36%, 66%, and 2% [13]. Similarly, the Barcelona Clinic Liver Cancer (BCLC) classification was applied to all patients and identified 11 patients (84.6%) at stage A and 2 patients (15.4%) at stage B.

#### 4.2. Discussion of Therapeutic Strategies and Outcomes

In our series, 13 patients underwent hepatic resection, among 61 cases of hepatocellular carcinoma managed during the study period, resulting in an overall resectability rate of approximately 21.3%. Although this rate is lower than those reported in Western and Asian series, it remains acceptable in our context, which is characterised by late-stage diagnosis and a low proportion of operable patients. Indeed, two series reported in Dakar from gastroenterology departments showed markedly lower resectability rates of 5.2% and 0.1%, respectively [7]. This discrepancy can be explained by a clear selection bias, as patients in our study were recruited from a surgical department, with presumed resectability assessed by referring physicians prior to referral. An Egyptian study reported curative treatment in 35% of patients with hepatocellular carcinoma, including 10 cases of liver trans-

plantation [13]. In Western series, the implementation of early surveillance programmes accounts for higher rates of curative treatment [14]. Accordingly, in the BRIDGE study, curative treatment was administered in 38% of cases in North America and 48% in Europe, highlighting the impact of organized screening strategies on treatment eligibility and outcomes [14]. With regard to the surgical procedures performed in our study, eight major hepatectomies were carried out among the 13 included patients, representing a substantial proportion. Hepatocellular carcinoma most often develops in the setting of chronic liver disease, which carries a significant risk of post-hepatectomy liver failure following extensive resection. In our series, two patients developed postoperative liver failure, resulting in death on postoperative days 4 and 35, respectively. This complication could potentially be reduced through stricter patient selection and improved preoperative optimization of the future liver remnant. A total of four morbidity events were recorded, including biliary fistula ( $n = 3$ ) and ischemic stroke ( $n = 1$ ). Biliary fistulas are a common complication following hepatectomy and may be prevented by the systematic use of the methylene blue test, which allows identification of bile leakage from the transection surface and facilitates effective biliary control. Three postoperative deaths were recorded, including two early deaths occurring on postoperative days 1 and 4, and one late death on postoperative day 35. The causes of death were hemorrhagic shock in one patient and post-hepatectomy liver failure in two patients. A study evaluating predictive factors of mortality after hepatic resection for hepatocellular carcinoma identified advanced age, chronic kidney disease, extent of resection, Child-Pugh score, and vascular invasion as significant risk factors. However, in the study by Yang *et al.*, one-year survival in sub-Saharan Africa was only 1.1%, whereas it exceeded 50% in Western countries, where five-year survival rates can surpass 50% [15]. Similarly, in the BRIDGE study, the five-year survival rate was 57.3% in Europe, 55.4% in North America, and 52.2% in China [15].

## 5. Conclusion

Hepatocellular carcinoma in our setting remains a disease predominantly diagnosed at a delayed stage, often outside structured surveillance programmes. Despite these constraints, careful preoperative selection allowed hepatic resection in a limited but meaningful proportion of patients, with the majority classified as Child-Pugh class A and BCLC stage A. However, the proportion of major hepatectomies performed, combined with underlying chronic liver disease, was associated with significant postoperative morbidity and mortality, particularly post-hepatectomy liver failure and hemorrhagic complications. These findings highlight the critical importance of rigorous patient selection, meticulous intraoperative technique, and optimisation of the future liver remnant to improve surgical outcomes. In our context, improving prognosis in hepatocellular carcinoma depends on surgical expertise but also on the implementation of effective screening strategies in high-risk populations, particularly patients with chronic hepatitis B.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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