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Review Article

Surgical Resection of Hepatocellular Carcinoma in Compensated Cirrhotic Liver: The Benefits and Selection Criteria

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Abstract

Background: Hepatocellular carcinoma (HCC) represents a fifth of common malignancies, with an annual diagnosis of 750,000 new cases. It is the third cause of cancer deaths worldwide. The cirrhotic liver is a leading cause of HCC with the annual conversion rate to HCC in the range of 2–6 %. The underlying liver cirrhosis limits certain treatment modalities that potentially further aggravates liver dysfunction. Over the past decade, there were substantial improvements in the HCC resection techniques that has resulted in the reduction of operative mortality. This allowed doing major hepatectomy in cirrhotic patients who are suitable for liver transplantation but lacking availability of cadaveric or living donors. Also, patients who have multi-focal HCC underlying cirrhosis which render them unsuitable for liver transplantation due to its extension beyond Milan criteria.

Objective: The objective of this study was to assess the benefits and selection criteria of HCC surgical resection within child–Turcotte–Pugh score (CTP) A and B liver cirrhosis to achieve the best surgical outcomes.

Methods: We performed a literature search within English written trials using PubMed and MEDLINE reviews databases from 1986 to 2017. One hundred fifty studies are included in this review evaluating various parameters including HCC and compensated cirrhosis prevalence, pathogenesis, clinical presentation, and diagnostic methods. Furthermore, we have compared oncological hepatic resection with other modalities like transarterial chemoembolization, liver transplantation, embolization of the portal vein, laparoscopic hepatic resection, and ALPPS technique. Principles of surgical hepatectomy and postoperative complications are also presented in this review.

Conclusion: This review has demonstrated that hepatic cirrhosis complicated by portal hypertension is not an absolute contraindication for HCC resection. Furthermore, elective surgery must not be directed exclusively to CTP A cirrhosis but it can be applied to highly selected patients who had suffered from advanced hepatic cirrhosis. If multifocal HCC underlying hepatic cirrhosis was unsuitable for liver transplantation, hepatectomy can be carried out to increase the tumor cure chances, prevent it's recurrences, and lead to significant survival rate improvement. The degree of cirrhosis significantly affects the decision of primary hepatic carcinoma treatment and it's prognosis. The interdisciplinary assessment of liver function by surgeons, hepatologists, anesthesiologists, and specialists of critical care are essential for maximum critical stabilization of the patients.

Keywords: Child-Turcotte-Pugh score; hepatocellular carcinoma; hepatectomy; liver cirrhosis; portal hypertension

1. Introduction

A significant increase in CTP A and CTP B cirrhotic patients complicated by portal hypertension who requiring surgical resection was observed. This is due to several reasons. First, cirrhosis is relatively common. During 2012, more than three million and 14.1 million new cases were diagnosed in Europe and globally respectively [1]. Over the past decades, significant progress in liver disease management was obtained but liver cirrhosis is still a major health disease belong to annually about 14-26 per 100,000 suffered from cirrhosis of which 170,000 died of its complications [2, 3]. Second, liver cirrhosis is a leading cause of hepatocellular carcinoma (HCC) [4, 5]. Finally, liver cirrhosis and HCC share certain risk factors such as alcohol abuse, smoking and metabolic diseases [6–9].

2. Methods

2.1. The pathogenesis of HCC in underlying cirrhotic liver

Liver cirrhosis represents a wound healing response to chronic liver injury and shows a prevalence of 250 patients per 100,000 persons [10, 11]. It's characterized by liver parenchymal distortion and is associated with nodular formation, fibrous septae and blood flow alterations [12]. The fibrosis natural course starts with a long-lasting asymptomatic compensated phase followed by rapidly progressive decompensated cirrhotic phase characterized by liver function impairment [13, 14]. The median survival time of decompensated cirrhosis is significantly shorter than compensated cirrhosis (2 years vs >12 years) [13, 15]. In cirrhotic patients, about 5-30% develop HCC within a cumulative five years [16, 17]. The annual conversion rate to HCC arising in cirrhotic patients is two to six percent [18]. HCC represents the third cause of cancer deaths worldwide and the fifth common malignancy with an annual diagnosis of 750,000 new cases. In Asia, the risk is 35-117 per 100,000 annually, where in the USA the risk is only 7 per 100,000 persons per year [19]. In addition, 75-80% of HCC cases were due to infection by long-term hepatitis B virus (50-55%) or hepatitis C virus (25-30%) [20–23]. Primary biliary

cirrhosis, hereditary hemochromatosis, chronic alcohol abuse, diabetes and obesity were also recognized as important risk factors [24–29].

2.2. Clinical presentation of compensated liver cirrhosis and HCC

Compensated cirrhosis defined as detection of clinical hepatic complications without a possibility to be reversed in patients not having symptoms that indicate cirrhosis. These complications include HCC, portal hypertension, esophageal varices, ascites, jaundice and hepatic encephalopathy. It can be discovered clinically through hepatomegaly, palpable left liver lobe and the enlarged spleen [30–33]. HCC prevalence was found to be dominated by males within all etiologies, with an average age of 50 years. Symptoms of HCC appear in the form of vague right hypochondrial pain, unidentified fever origin, lethargy, anorexia, weight loss and nausea. Clinically HCC related signs are obstructive jaundice and hepatomegaly [24–29, 34].

2.3. Diagnosis of compensated liver cirrhosis and HCC

Nowadays, the continuous improvements of diagnostic techniques using laboratory tests in combination with radiological images, permits early diagnosis of liver cirrhosis prior to the development of portal hypertension and HCC [35]. The laboratory findings which help in the diagnosis of compensated cirrhosis are bilirubin >1.1 mg/dL, elevated AST/ALT ratio, serum albumin <2.5 g/dL, platelet count <150,000/L, prothrombin time <100% and increased alkaline phosphatase level [33]. OGD must be done to assess the size and severity of esophageal varices and prevent their bleeding in future [32]. Furthermore, HCC diagnosis often depends on serological tumor marker alpha-fetoprotein (AFP) which is sensitive by 25% in a malignant lesion less than 3 cm in diameter to fifty percent for tumors more than 3 cm as shown by radiological images [36]. In suspected patients with cirrhosis, abdominal ultrasound shows the nodular surface of the liver and the portal vein mean velocity less than 12 cm/second. Other signs which suggest cirrhosis are left lobe with caudate hypertrophy, segment IV atrophy, gallbladder fossa expansion, the presence of portosystemic collaterals, perihepatic minimal ascites, dilated portal vein above or equal to 13 mm, dilated splenic vein and superior mesenteric vein above or equal to 11 mm and enlarged splenic diameter above 12 cm. Moreover, because abdominal ultrasound is associated with low sensitivity, these signs cannot allow a full exclusion of cirrhosis in patients with chronic compensated liver disease [37, 38]. Fibroscan (elastography) is another test which helps in the assessment

of hepatic stiffness and exclusion of cirrhosis caused by multiple different causes. A score of more than 12.5 kPa has an accuracy of more than 90% to diagnose liver cirrhosis [39, 40]. The previously mentioned ultrasound signs of hepatic cirrhosis can be revealed by cross-sectional imaging including contrast-enhanced computed tomography scan (CT) in portal venous phase and magnetic resonance imaging (MRI) which are precise in the diagnosis of cirrhosis with a variable success rate [41, 42]. Also, imaging studies are requested for planning oncological treatment and follow-up of metastatic recurrence [43]. American Association for the Study of Liver Disease (AASLD) and European Association for the Study of Liver (EASL) guidelines recommend abdominal ultrasound as surveillance study. If the ultrasound image shows suspicious nodules in cirrhotic liver below 1 cm then these nodules are re-examined two times per year. In the absence of nodular changes over two years, annual surveillance was recommended [44, 45]. Some authors recommended that a screening strategy of combined abdominal ultrasound and serum alfa-fetoprotein measurement every 6-months reduced HCC mortality rate by forty percent [46]. If HCC with a size between 1-2 cm discovered in hepatic cirrhosis by enhanced CT or MRI, images will show a high arterial contrast uptake followed by rapid washout in the late stage (Figures 1, 2) [47].

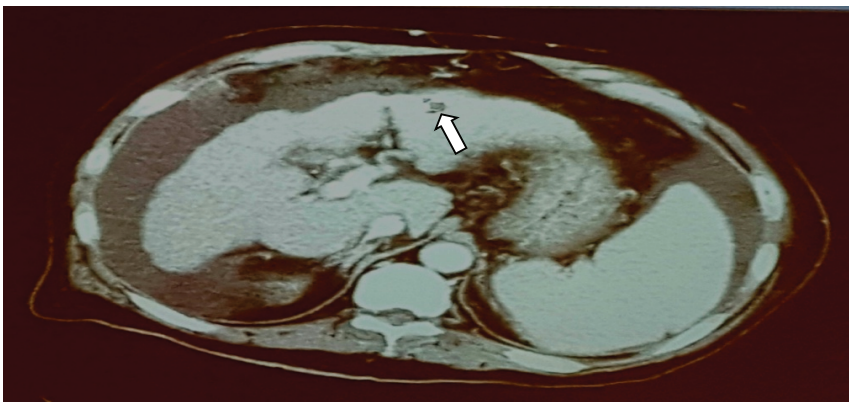

Figure 1: Contrast-enhanced CT scan image of small HCC nodule in cirrhotic liver.

Currently, the HCC diagnosis often depends on cross-sectional imaging rather than angiography [48]. The EASL recommended histological biopsy is not mandatory in HCC diagnosis if HCC nodule on MRI or CT angiography is found to be more than 2 cm in diameter with AFP elevation in sequential measurements or more than 400 ng/mL [45, 49]. On the other hand, liver biopsy is commonly requested for hepatic cirrhosis of unknown etiology [50]. In the early diagnostic phase of HCC, the positron emitting tomography (PET) scan is not suitable except in suspicion of extra-hepatic metastases that are not seen on CT or MRI images [51].

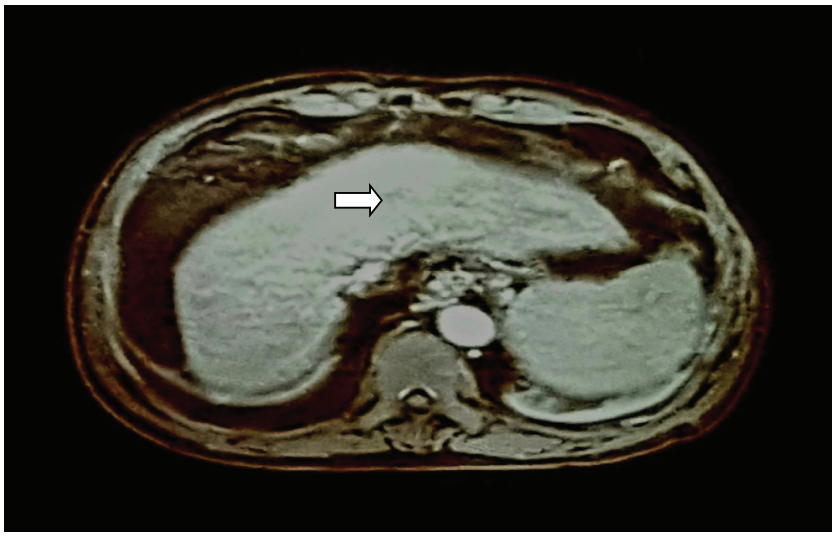

Figure 2: MRI image of small HCC nodule in hepatic cirrhosis.

2.4. Surgical management of HCC in a compensated cirrhotic liver

2.4.1. Management overview

The nature of underlying liver cirrhosis limits certain treatment modalities. Hence, the oncological staging of HCC must include cancer prognosis and liver function values when selecting patients for surgical resection [52, 53]. Currently, the American and European Liver Associations use the Barcelona Clinic Liver Cancer (BCLC) staging system [28]. In the 1980s, Surgical removal of HCC within cirrhosis was a major surgery with a mortality rate of 15-30% and was limited largely to segmental or sub-segmental hepatectomy [54, 55]. Later, the operative mortality rate declined to 15% due to improvements in major hepatectomy techniques [56–58].

2.4.2. Benefits of oncological hepatic resection

HCC resection aimed at radical removal of the tumor and morbidity reduction. Therefore, patient selection is crucial [13]. After hepatic resection, operative mortality range between three to eight percent and the five years survival rate reached thirty to fifty percent [59]. In a large series of 22800 of hepatectomy cases, 22% were free from HCC recurrence over ten years [60].

Hepatic resection for HCC has several advantages:

1. Compared to liver transplantation it requires no waiting time and is performed in any well prepared medical centers.

2. The resectioned tumor can be diagnosed histopathologically. Hence, it determines the prognosis [61].

3. Hepatic resection can be performed as rescue therapy for HCC recurrence and/or liver failure while waiting for future liver transplantation [62–64].

A current study of 2046 hepatectomy patients performed in ten large liver centers, revealed that 50% of operated patients had BCLC stage A without portal hypertension, while 36% and 14% had hepatectomy in BCLC stage B and C, respectively [65]. The overall 5-years survival post-hepatectomy in BCLC stages including A, B and C cirrhosis were 61%, 57% and 38% and five years free of recurrence were 21%, 27% and 18% respectively. Thus, HCC resection had reasonable long-term outcome in advanced cirrhotic stages [66, 67].

2.4.3. Selection of candidates for oncological hepatic resection

Hepatectomy is frequently performed within cirrhosis in presence or absence of portal hypertension in spite of metastatic risk reduction by cirrhosis [68, 69]. Hepatectomy has been indicated for non-portal hypertensive patients with single tumor nodule and normal bilirubin measurement according to EASL and AASLD HCC guidelines treatment [70]. Furthermore, BCLC suggests HCC curative hepatectomy only in non-portal hypertensive CTP A cirrhosis and in tumor in early stages [76]. In contrast, multiple publications worldwide revealed that hepatectomy for HCC within cirrhotic liver with portal hypertension can give a good life span expectancy [67, 71, 72]. Torzilli et al. showed that about 50% of hepatectomies with cirrhotic liver done beyond BCLC criteria is associated with overall five years survival of 57% and 38% for stage B and stage C patients respectively [65]. Also, gives an excellent long-term survival rate compared to transarterial chemoembolization (TACE) and HCC resection can be offered to cases beyond BCLC criteria [73–76]. Yin et al. revealed in a study of 173 patients that suffered from HCC beyond the Milan criteria, liver resection patients have a significant better long-term survival rate of 51.5% for three years, vs 18.1% when compared to TACE. Hence, complicated liver cirrhosis with portal hypertension must not be denied HCC hepatectomy [76]. Furthermore, neoadjuvant TACE therapy has been failed in improvement of survival rate for HCC underlying cirrhotic cases despite its initial promising results [77]. Ishizawa et al. showed excellent predictors of HCC resectability in spite of portal hypertension depending on a combination of bilirubin, ascites and indocyanine green clearance [71].

The followings are the criteria for selecting the candidates for liver resection:

1. Rule out of extrahepatic metastases

   The performance of chest CT scan prior to resection is desirable, due to lymph nodes, lungs or bone metastasis [78].

2. Evaluation of HCC extent

   HCC site, size, account and proximity to major vessels all influence the respectability. CTP A cirrhotic patients may tolerate major hepatic resection, while CTP B patients tolerate a safe minor resections. Tumor size precisely may not indicate safe hepatectomy and some authors reported that tumors above ten centimeters had more than 45% five years survival [79]. HCC invasion of a biliary tree or main vessels might be a contraindication for resection, except portal vein involvement or hepatic segmental thrombosis [80]. Multinodular tumors have a poor prognostic ratio, reoccur within 80–100% of patients and thirty percent of them survive for five years. If hepatic transplantation is not feasible multinodular tumors might be respectable [81, 82].

3. The liver functional reserve estimation

   - *Determining of functional residual liver volume after oncological resection*

     The least residual hepatic volume in non-chronic liver disease patients needed for the avoidance of advanced hepatic dysfunction postoperatively was twenty to thirty percent [82]. In the 1990s, very few studies analyzed cirrhotic patients for the role of future remnant hepatic volume prognosis. Shirabe et al. have studied chronic liver disease in 80 patients and fifty percent of them suffered from cirrhosis did a major hepatectomy and revealed that liver failure deaths happened when a remnant hepatic volume less than 250 mL/m^2 body surface and concluded that safe limit of major hepatectomy depending on functioning residual volume of the liver. Currently, highly resolution CT volumetry scan can measure residual volume that is accepted for safe hepatectomy which is 30% in non-cirrhotic liver disease and 40% in CTP A cirrhosis not complicated by portal hypertension [83, 84]. In 2012, the associating liver partition and portal vein ligation for staged hepatectomy (ALPPS) technique was first published for raising the resection chances of inoperable HCC through rapid hypertrophy of the future liver remnant (FLR) which reduces postoperative liver failure risk. This technique was indicated when FLR reached up to 30% or 40 % in case of chemotherapy complicated by hepatic injury, colorectal liver metastases,

hilar cholangiocarcinoma, gallbladder cancer, primary hepatic lymphoma and 18% of surgeons suggested this technique for CTP A cirrhotic patients. The disadvantages of ALPPS technique are perioperative morbidity is 68% and postoperative mortality is 12% at 6 months. Biliary fistula and adhesions can complicate the ALPPS first stage. Moreover, it was contraindicated in extra-hepatic distant metastases, patients beyond 75 years old, macrovesicular steatosis above 50% and CTP B or C cirrhosis is considered as an absolute contraindication especially if combined with HCC as chronic liver damage has less cellular regeneration [85].

- *Assessment of liver function*

For more than forty years the Child-Turcotte-Pugh score known as a gold standard grading system for the liver function to select candidates for hepatectomy and predict prognosis after surgeries for portal hypertension like portocaval shunt and transection of the esophagus in cirrhotic patients. There is general agreement that surgical resection can be performed safely and should be considered as a beginning treatment for solitary tumors within CTP A cirrhosis [85–88]. Alternative therapies including liver transplantation must be sought for CTP B or C hepatic cirrhosis not suitable for major hepatectomy [89–91]. Hence, according to the BCLC algorithm current version, HCC treatment depends on the underlying cirrhotic severity graded by CTP classes [28, 92]. The original score was slightly modified later using the INR, serum bilirubin, serum albumin, hepatic encephalopathy and ascites which classifies the patients into compensated CTP A, mild CTP B and severely decompensated CTP C cirrhosis. The survival rate of one year for CTP A is 95%, CTP B is 80% and CTP C account forty-four percent [13, 93]. The model for end-stage liver disease (MELD) score has been established for candidates selection into liver transplantation and survival prediction of transjugular intrahepatic portosystemic shunt (TIPS) patients. It's measured from bilirubin, INR and creatinine [89, 94]. Currently, it is correlated with postoperative resection outcomes and hepatectomy candidates selection. If the score was more than nine, this generally was associated with higher postoperative liver failure rates [89, 91]. Other studies revealed if the score is equal or less than ten, this means patients are suitable for partial hepatectomy [87, 95, 96]. In Asia, the clearance test of indocyanine green (ICG) is an acceptable test for the liver function. After intravenous dye injection, the rate of retention at 15 minutes (ICGR15) for the normal liver function is 10%. Safe major hepatectomy is

allowed when ICGR15 is equal to or less than fourteen percent [57]. The cut-off ICGR15 for minor hepatectomy is 22% and ICGR15 values up to 40% were suitable for limited resection [97–99]. Sixty-five percent of patients with CTP B showed an ICGR15 less than twenty-two percent. This test is most applicable to a small hepatectomy; therefore, it is perfect for patients with CTP B who require segmental hepatectomy. A recent study compared the prognosis of MELD score with ICGR15 in 395 patients suffering from cirrhosis did not have surgery revealed the ICGR15 was more precise in survival prediction [100]. Furthermore, the Japanese HCC clinical guidelines recently recommended a preoperative ICGR15 usage for evaluation of the liver function [101].

- *Assessment of portal hypertension*

  Portal hypertension clinical signs reflect a deterioration of liver disease following hepatectomy, and also poor long-term outcome. In other words, portal hypertension determines the success rate of surgical resection. The BCLC guidelines had recommended hepatectomy only for non-clinical significant portal hypertension patients which can be assessed by hepatic vein-portal gradient (HVPG) less than 10 mmHg [28]. This invasive direct method may not be available everywhere. Also, the BCLC determines portal hypertension signs clinically by many indirect clinical tests: endoscopic esophageal varices or enlarged spleen described as more than 12 cm in diameter with platelets count less than 100,000/mm^3. Some authors recommended that hepatectomy was contraindicated if these signs appear [92, 102]. Currently, portal hypertension must not be considered as an absolute contraindication for hepatectomy within well-compensated CTP A cirrhosis or MELD score below ten [67, 103]. Complications of portal hypertension like variceal rupture bleeding and hemostatic disorders due to thrombocytopenia can safely be treated [104, 105].

4. Comorbidities of other organs

   Severe comorbidity like congestive cardiac failure and chronic renal failure must be considered as contraindications for surgical removal of HCC. Diabetes mellitus is common in patients that suffer from cirrhosis and recently a report showed post-hepatectomy morbidity and mortality in these patients [106, 107].

   Hence, the guidelines in western countries currently recommend resection exclusively for cirrhotic cases have well-preserved liver function determined by normal bilirubin levels in serum associated with HVPG $\leq$10 mmHg or platelets number $\geq$100×109 per liter. By following these strict criteria, the liver resection can be

applied only in 5–10% of all patients with HCC [108]. Moreover, patients who had liver resection with normal serum bilirubin levels and non-clinical significant portal hypertension (CSPH) can reach 70% of five years survival, while those with CSPH reach about fifty percent. Prognosis is worse in CSPH patients who have elevated bilirubin [71, 109].

2.4.4. Preoperative therapy of oncological hepatic resection

1. Antiviral therapy of chronic hepatitis B virus (HBV)-related HCC patients:

   The preoperative antiviral therapy of chronic hepatitis B virus-related HCC patients is essential, leading to improved liver function and reduce progression chances into cirrhosis. It decreased HCC incidence in these patients, prolonging overall survival after curative and palliative modalities which delay HCC recurrence in patients treated for 3 years (1.5% vs 4.0%) and 5 years (5.1% vs 12%) rather than those without treatment [110]. If HBV-DNA was detected, then 1-3 months preoperative therapy must begin. Entecavir and tenofovir disoproxil are recommended as first-line anti-HBV drugs with high efficacy. Also, a combination of α-interferon and ribavirin had reduced occurrence of HCC significantly. Administration of lamivudine, dipivoxil or entecavir postoperatively had a significant reduction in HCC death and it's recurrence with an improvement of hepatic function six months later [110].

2. Embolization of the portal vein (EPV):

   Before hepatic resection EPV is helpful in increasing residual volume of the liver when extended hepatectomy is mandatory and when liver remnant volume is inadequate [111–112]. Prospective studies revealed that an early outcome improvement in patients who had right HCC hepatectomy with portal vein embolization preoperatively. The complication rate of EPV is 10–20% and accelerated portal hypertension can appear in 1% of cirrhotic patients [112–113]. EPV is relatively contraindicated if there are segmental portal occlusion/invasion, biliary obstruction, coagulopathy and renal failure [114, 115].

2.4.5. Principles of surgical hepatectomy

Intraoperative bleeding is a major risk that determines the perioperative mortality.

The following are some points on the principles of surgical resection:

1. Cooperative work with the anesthetic staff is mandatory throughout hepatectomy. During parenchymal dissection, the blood loss is risky and is controlled by reduction of central venous pressure up to 5 mmHg by options including diuretics, volume restriction, positive end-expiratory pressure, decreased tidal volume and reverse Trendelenburg position [116, 117].

2. The hepatic hilar vascular occlusion (Pringle maneuver) may not be recommended in cirrhosis. However, it is urgently used for prevention of extensive bleeding during parenchymal dissection by intermittent occlusion for fifteen minutes then five minutes of releasing (Figures 3, 4) [118, 121].

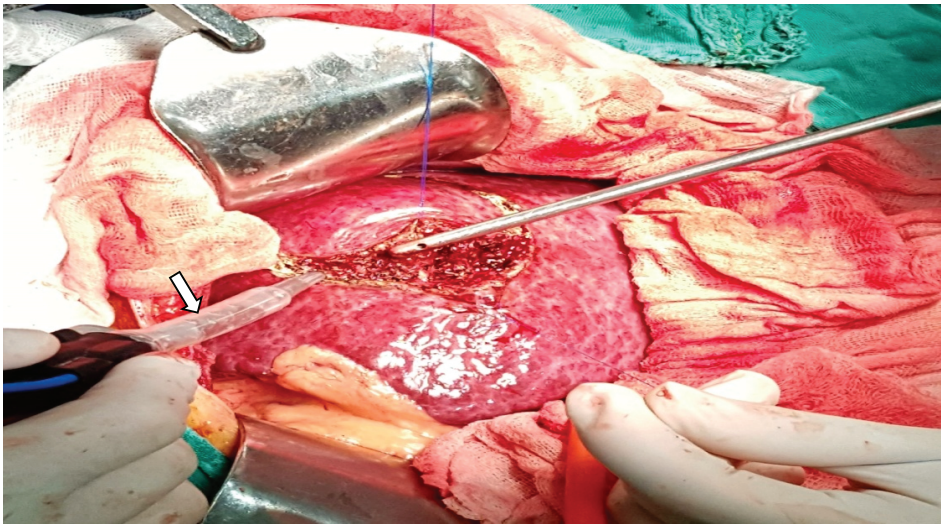

Figure 3: Intraoperative CUSA circumferential HCC resection in cirrhotic liver using intermittent hilar vascular occlusion.

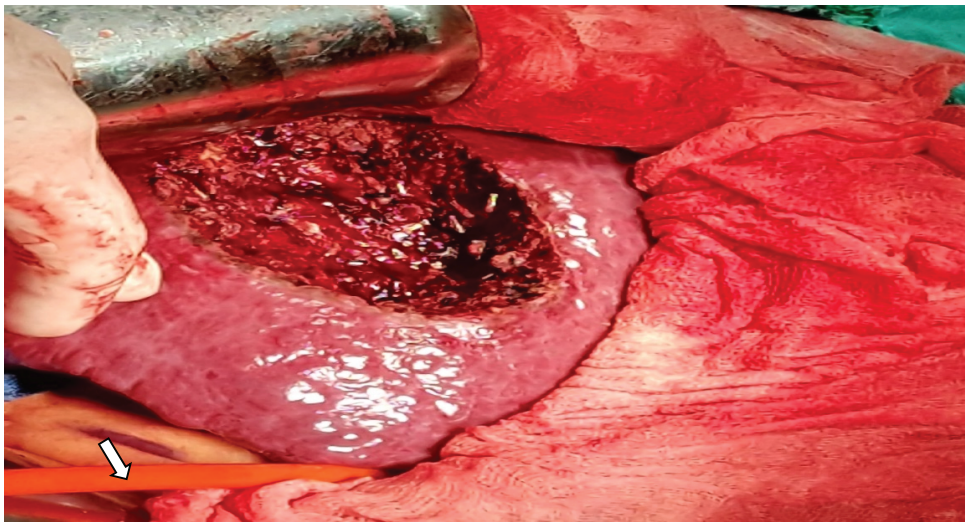

Figure 4: Adequate HCC resection margins within the cirrhotic liver using intermittent hilar vascular occlusion.

3. Hepatectomy that depends on anatomic Couinaud segments is not important, but high care should be given to vascularized parenchyma preservation for prevention of postoperative liver failure [122]. In particular, this maneuver might be useful in cases with mild portal hypertension and advanced CTP B cirrhosis [123].

4. One centimeter wide margin is generally adequate. However, two centimeters wide margin produces greater survival rate (Figures 5, 6) [122, 124, 125].

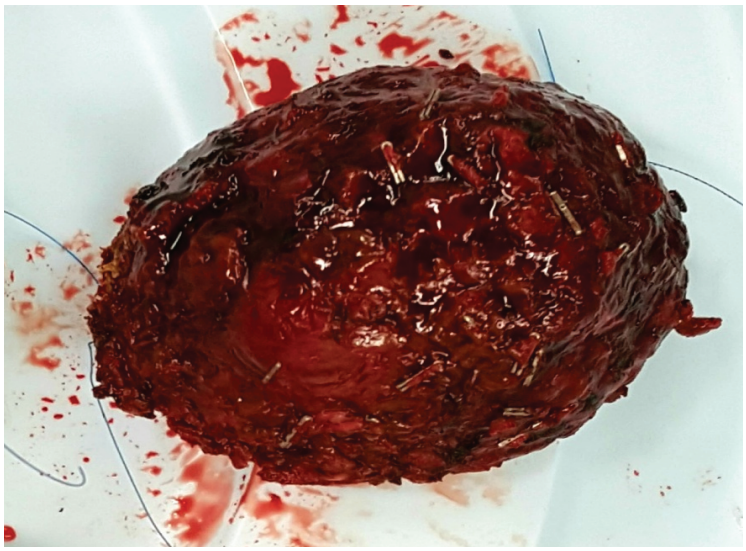

Figure 5: Postoperative circular hepatic tissue contained HCC mass.

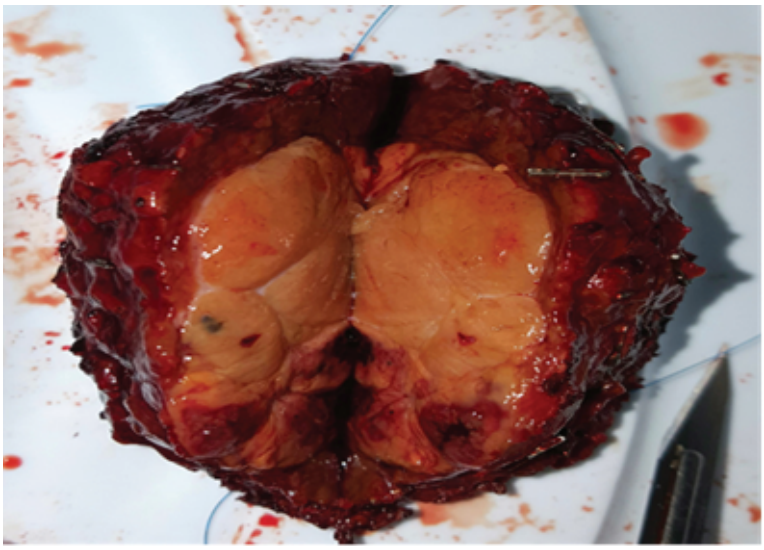

Figure 6: Postoperative adequate resection margins of HCC mass.

5. Liver transection maneuvers that depend on a high tissue resistance discrimination of bile ducts and blood vessels compared to the liver tissues include crushing dissector instrument, water jet dissection, stapler dissection and cavitary ultrasound suction aspirator (CUSA) (Figure 3) [126–129].

6. The anterior approach may be beneficial in large tumors, where caval vein mobilization may need traction or pressure on the tumor has a capability to cause bleeding, rupture and tumor cells dissemination [130, 131]. This technique has been helped by the hanging maneuver through blunt dissection to pass a band between the right and middle hepatic veins and in front of the inferior vena cava. Band traction makes a straight transection with bleeding control in its depths [132, 133]. Furthermore, fibrin glue application following hepatic resection is not beneficial in controlling of blood loss and in a reduction of blood transfusion requirements [134].

7. Current standards of liver resection describe 2-3% mortality rate and five-year survival rate around sixty percent [135].

When comparing open hepatic resection and laparoscopic resection, 90% of laparoscopic resections were minor resections [136]. Because of the underlying liver disease, post-HCC hepatectomy complications occur in fifty percent of cases [137]. Laparoscopic hepatectomy advantages are minimal peritoneal dissection, less aggressive technique, reduced ascitic fluid and liver failure [138, 139]. Furthermore, reduced laparoscopic postoperative adhesions help in future liver transplantation salvage with less morbidity when compared to open hepatectomy [140]. Major disadvantages which reduce widespread of laparoscopic liver resection are difficulties in the transection of parenchyma and tissue mobilization that may be associated with massive bleeding risk. In addition to greater difficulty in performing anatomical resections and wide margin resection [141, 142].

2.4.6. Postoperative complications of oncological hepatic resection in compensated cirrhosis

The hepatic resection in cirrhotic portal hypertension showed increased morbidity with a range from twenty-two percent to fifty percent [67, 71, 72, 143]. These complications arranged in the following points:

1. Postoperative life-threatening liver failure, which can be managed by remnant liver optimal perfusion, prophylactic antibiotics and intensive care of electrolytes, fluid balance, renal function, and coagulation [144, 145].

2. Ascites reduced after 5-7 days with the support of fluid volume restriction, diuretics and albumin infusion. Ascitic fluid persistence needs microbiological test, early detection and treatment of any infections [146].

3. Suspected postoperative infection, mainly from chest pneumonia. Also, superinfected ascites can be treated by third generation cephalosporins like ceftriaxone or cefotaxime, or carbapenems alternatively. Furthermore, sampling and microbiologic culture of ascitic fluid is advised before the start of antibiotic treatment [147–149].

4. Disorders of wound healing noticed rather commonly due to malnutrition and for postoperative ascites. A running suture during abdominal closure gives protection against wound dehiscence. Also, a drainage system prevents fluid accumulation with reduction of intra-abdominal pressure which leads to wound healing improvement [150].

5. Postoperative hemorrhage in cirrhotic patients may include superficial wound bleeding, resection site bleeding and gastrointestinal bleeding. Therapies that include coagulation products supplementation are highly important [150].

In conclusion, this review has demonstrated that hepatic cirrhosis complicated by portal hypertension is not an absolute contraindication for HCC resection. Furthermore, elective surgery must not be directed exclusively to CTP A cirrhosis but it can be applied to highly selected patients who had suffered from advanced hepatic cirrhosis. If multifocal HCC underlying hepatic cirrhosis was unsuitable for liver transplantation, hepatectomy can be carried out to increase the tumor cure chances, prevent its recurrences and lead to significant survival rate improvement. The degree of cirrhosis significantly affects the decision of primary hepatic carcinoma treatment and it's prognosis. The interdisciplinary assessment of liver function by surgeons, hepatologists, anesthesiologists and specialists of critical care are essential for maximum critical stabilization of the patients.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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