

Current management of patients with hepatocellular carcinoma

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Abstract

The current management therapies for hepatocellular carcinoma (HCC) patients are discussed in this review. Despite the development of new therapies, HCC remains a "difficult to treat" cancer because HCC typically occurs in advanced liver disease or hepatic cirrhosis. The progression of multistep and multicentric HCC hampers the prevention of the recurrence of HCC. Many HCC patients are treated with surgical resection and radiofrequency ablation (RFA), although these modalities should be considered in only selected cases with a certain HCC number and size. Although there is a shortage of grafts, liver transplantation has the highest survival rates for HCC. Several modalities are salvage treatments; however, intensive care in combination with other modalities or in combination with surgical resection or RFA might offer a better prognosis. Sorafenib is useful for patients with advanced HCC. In the near future, HCC treatment will include stronger molecular targeted drugs, which will have greater potency and fewer adverse events. Further studies will be ongoing.

Key words: Hepatocellular carcinoma; Living donor liver transplantation; Radiofrequency ablation; Surgical resection

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Core tip: Liver transplantation is the first-line treatment of hepatocellular carcinoma (HCC). Surgical resection and radiofrequency ablation (RFA) are second-line HCC treatments. Surgical resection and RFA should only be considered for selected cases. Sorafenib administration, transarterial chemoembolization, stereotactic body radiation treatments, or proton or carbon ion treatments

are available as salvage treatments for HCC. Laparoscopic liver resection appears to offer at least a short-term benefit in selected HCC patients. These HCC treatments should be carefully selected or combined in clinical practice.

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HEPATOCELLULAR CARCINOMA

Globally, hepatocellular carcinoma (HCC) is a common malignancy with a poor prognosis worldwide, and the incidence of HCC is increasing in the United States^[1,2]. In Asian countries, HCC is caused by hepatitis B virus (HBV) or hepatitis C virus (HCV) infection^[3-6]. Despite the ongoing development of new therapies, HCC remains a "difficult to treat" cancer^[7] because the malignancy typically occurs in advanced liver disease or hepatic cirrhosis. In HCC treatments, such as surgical resection or percutaneous local ablation therapy, the liver function should always be considered^[8-12]. The recurrence of HCC within 5 years after primary resection is as high as 70% because multistep and multicentric HCC develops most frequently after a resection or ablation treatment in patients with chronic liver disease^[13,14].

CURRENT MANAGEMENT OF HCC

Surgical resection for HCC

The tumor status and liver function reserve of HCC patients determine whether a hepatectomy should be performed^[9] (Figure 1A). Careful attention should be focused on the selection of appropriate candidates. Makuuchi's criteria for the selection of the operative procedures in patients with HCC and liver cirrhosis are available in Japan^[8,15]. The criteria comprise the existence of ascites, the serum total bilirubin and indocyanine green (ICG) clearance rates. In patients without ascites and with total bilirubin levels < 2 mg/dL, a hepatectomy could be safely performed. Serum total bilirubin levels (< 1 mg/dL) and a normal range (10%-19%, 20%-29%, or \geq 30%) of ICG retention at 15 min suggest a trisegmentectomy or right hepatectomy, left hepatectomy or right segmentectomy, subsegmentectomy, or limited resection, respectively. Patients with serum total bilirubin levels of 1.1-1.9 mg/dL could receive a limited liver resection safely. Small HCC is a clinical entity with a high surgical cure rate^[9]. Yamazaki *et al.*^[9] reported that the 5-year survival following a hepatectomy is 53%, with 26% morbidity and 0% mortality in patients within the Makuuchi's criteria; however, they reported that the 5-year survival in HCC patients in major institutions worldwide is 37%-53% following a hepatectomy, with

11%-45% morbidity and 0%-10% mortality. A hepatic venous pressure gradient \geq 10 mmHg as a direct measurement of relevant portal hypertension could be useful^[16,17] because the concept of portal hypertension as a prognostic factor in patients undergoing resection has been validated^[18]. An accepted application to measure and quantitate the liver reserve is debatable, and further studies are required.

The prognosis of patients with a portal vein tumor thrombus, which typically is poor, might be improved by surgical resection with or without pre-operative transarterial chemoembolization (TACE)^[19,20]. A combination of aggressive surgical treatment and effective preoperative TACE for HCC with major vascular tumor invasion including invasion of the main trunk, the first-order branch of the portal vein, or the inferior vena cava might be beneficial for certain patients^[19,21]. Because chemotherapy or antiviral treatment could be administered, a concomitant splenectomy and hepatectomy might extend the criteria for surgery in "selected" HCC patients with hypersplenism^[22].

Percutaneous local ablation therapy: Ebara *et al.*^[23] reported that following percutaneous ethanol injection (PEI) therapy, the 1-, 2-, 3-, 4- and 5-year survival rates of 95 patients with an HCC smaller than 3 cm were 93%, 81%, 65%, 52% and 28%, respectively. This treatment could be performed for patients with Child's A as well as Child's B or C disease, although the survival rates of patients with Child's A or B status was higher than those in Child's C patients^[23]. In cases of HCC recurrence, PEI was easily repeated^[23], although a repeated hepatic resection was reported in selected patients^[9]. Additionally, Shiina *et al.*^[10] reported that with a median follow-up of 51.6 mo, the 5-, 10- and 20-year survival rates of 2147 HCC-patients, were 49%, 18% and 7.2%, respectively. There were 45 complications (2.1%) and two deaths (0.1%)^[10].

Radiofrequency ablation (RFA), instead of PEI (Figure 1A), is widely performed for HCC. Shiina *et al.*^[11] reported that the 5-, and 10-year survival rates of 1170 HCC-patients with a median follow-up of 38.2 mo were 60% and 27%, respectively. In that study, the survival rates of RFA were found to be superior to those of PEI^[10,11], although it was not a head-to-head comparison. One death (0.03%) and 67 complications (2.2%) occurred^[11], and the HCC was controlled by RFA. A randomized controlled trial of surgery vs RFA for small HCC has begun in Japan^[24]. Additionally, it was reported that adjuvant RFA might provide palliative care for patients with metastatic cancer^[25]. Further studies are required. The meta-analysis of the four randomized controlled trials demonstrated a significant improvement in the 3-year survival rate and that RFA was more effective than PEI^[26].

Liver transplantation for HCC

Liver transplantation offers additional benefits for HCC patients because additional cancers might be

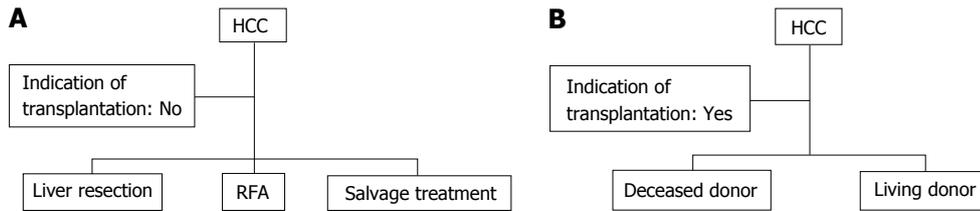


Figure 1 Treatment algorithm for hepatocellular carcinoma. A: In patients for which liver transplantation is unavailable. If possible, the patients should select surgical resection or radiofrequency ablation (RFA). Otherwise, other salvage treatments should be selected; B: In patients in which deceased-donor or living-donor liver transplantation is available. HCC: Hepatocellular carcinoma.

incidentally found during the examination of the explanted liver; additional cancers attribute to high HCC recurrence rates after primary surgical resection^[27]. The criteria for liver transplantation have improved over many years^[28-32]. According to the Milan criteria, patients are eligible for liver transplantation if they have a single HCC less than 5 cm in diameter or no more than three tumors less than 3 cm in diameter^[30]. Liver transplantation is the first-line treatment option for these patients^[16]. Mazzaferro *et al.*^[30] studied 48 patients within the Milan criteria; they reported an overall mortality rate of 17% after 4 years and that the actual survival rate and recurrence-free survival rate were 75% and 83%, respectively. Additionally, they reported that in 35 patients meeting the predetermined criteria for small HCCs in the pathology examination of the explanted liver, the overall and recurrence-free survival rates at four years were 85% and 92%, respectively^[30]. These results suggest that liver transplantation is an effective treatment for small, unresectable HCCs in patients with cirrhosis. An excellent 5-year survival rate has been reported in cases in which the restrictive Milan criteria are used to select transplant candidates. HCC is a good indication for orthotopic liver transplantation, and cadaveric liver transplantation/deceased-donor liver transplantation is an excellent treatment for early HCC (Figure 1B). Additionally, living-donor liver transplantation is an excellent treatment for early HCC because deceased-donor liver transplantation is limited by the shortage of grafts^[33,34]. In Japan and other Asian countries, living-donor liver transplantation will continue to be a mainstay treatment of HCC in cirrhotic patients^[35,36].

HCC frequently occurs in cirrhotic liver patients infected with HBV or HCV. Although the viral infections are eradicated or controlled^[37-45], the risk of developing HCC persists in patients with advanced liver disease. Elder patients tend to have more advanced fibrosis than younger patients^[46-52]. Regardless of the liver function, in cases in which the restrictive Milan criteria are used to select transplant candidates, liver transplantation in patients within the criteria has a better prognosis. However, many difficulties exist, including a shortage of donors and whether a patient is eligible for transplantation because of age. Elderly patients with an increased risk for postoperative complications should be excluded from living donor liver transplantation,

at least; previous published studies have shown that age is not a contraindication for deceased donor liver transplantation^[53,54].

Down-staging the policies for HCCs exceeding the conventional criteria could not be recommended^[16], and prospective studies should be conducted to explore the issue of expanded criteria for orthotopic liver transplantation, down staging and bridge therapies.

OTHER MODALITIES FOR HCC

Sorafenib

Treatment with sorafenib prolongs progression-free survival in patients with advanced clear-cell renal-cell carcinoma in whom previous therapy has failed; the treatment is associated with increased toxic effects^[55]. Similarly, in 602 patients with advanced HCC (299 in the sorafenib group; 303 in the placebo group), overall survival (OS) was significantly longer in the sorafenib group compared with the placebo group (OS of 10.7 mo vs 7.9 mo, respectively; hazard ratio in the sorafenib group, 0.69; 95%CI: 0.55-0.87; $P < 0.001$)^[56]. Another study from the Asia-Pacific region^[57] showed that sorafenib is effective for advanced HCC treatment in Child's A patients. Common adverse events such as hand-foot skin reactions, diarrhea and fatigue were observed in the study^[57]. Molecular targeted therapy against HCCs is being developed and will augment the treatment of advanced HCC^[58,59].

TACE: A Japanese prospective cohort study in 8510 patients with unresectable HCC showed a 5-year survival rate of 26%^[60]. Superselective TACE for HCC showed overall median and 5-year survival rates of 3.3 years and 34%, respectively^[61]. TACE showed higher survival rates in patients with fewer tumor numbers, smaller tumor size, and better liver function (Child's A or B). In Asian countries, TACE is the main therapeutic modality in advanced HCC-patients, and the overall therapeutic outcomes depend on the tumor size^[62]. TACE has a long history in the treatment of unresectable HCC cases^[63,64]. TACE, in combination with surgery or local ablation therapy, is frequently used in clinical practice. The timing and number of treatment sessions of TACE are not uniform for each patient, although new devices and treatments, including drug-eluting bead TACE and trans-arterial radio-embolization, have been

Table 1 Comparison of treatment modalities for hepatocellular carcinoma^[84]

Modalities	Indication of the features of HCC
Surgical resection	Performance status 0, Child-Pugh A, single < 3 cm Normal bilirubin/normal portal pressure Associated diseases, no
RFA	Performance status 0, Child-Pugh A-B, single or 3 nodule ≤ 3 cm Slightly increased bilirubin/increased portal pressure Associated diseases, yes or no
Liver transplantation	Performance status 0, single or 3 nodule ≤ 3 cm Increased bilirubin/increased portal pressure Associated diseases, no
Sorafenib	Performance status 1-2, Child-Pugh A-B, Advanced stage (portal invasion), node classification 1, metastasis classification 1
TACE	Performance status 0, Child-Pugh A-B, Intermediate stage (multi nodular)

RFA: Radiofrequency ablation; TACE: Transarterial chemoembolization; HCC: Hepatocellular carcinoma.

developed and continue to develop^[65,66].

Stereotactic body radiation therapy/stererotactic ablative radiotherapy: Stereotactic body radiation therapy (SBRT) for HCC has been documented in several recent studies^[67-70]. Use of a cyberknife is an SBRT system that allows for real-time tracking of a tumor. The system affords good local tumor control and higher overall survival rates than other historical controls such as best supportive care or sorafenib therapy^[70]. SBRT is a salvage treatment for unresectable HCC patients who failed or were unsuitable for TACE^[71] or for patients with an unresectable massive HCC for whom standard treatment care is unsuitable^[72]. Repeated stereotactic ablative radiotherapy in selected HCC patients might be feasible, if toxicity levels are acceptable^[73].

Other therapies: Proton and carbon ion therapies for 343 HCC-patients showed that the 5-year local control and overall survival rates were 91% and 38%, respectively^[74]. These therapies might be alternatives to conventional local therapies for HCC^[74-77]. Additionally, laparoscopic liver resection appears to offer at least short-term benefits in selected HCC patients^[78,79] whereas it is a widely employed alternative to open surgery in well-selected candidates. Standardization of surgical techniques might facilitate the performance of safe procedures^[79].

FOLLOW-UP

After a curative treatment such as surgical resection or RFA, antiviral therapies should be considered in patients infected with chronic HBV and/or HCV^[38,49,50,80,81]. In HCV-infected individuals, interferon-free regimens might be beneficial^[82]. Hepatic resection was recommended in non-B and non-C patients^[83] because unknown causes of HCC might be present in these patients, and particularly careful follow-up is needed.

CONCLUSION

Many reviews on this topic have been published in the

last few years, and most prestigious scientific societies worldwide provide practical treatment guidelines that are regularly updated, including HCC treatment algorithms (Table 1)^[16,84-87]. Liver transplantation and surgical resections are regarded as the only curative treatments; however, they have different indications. Although liver transplantation has not received priority over surgical resection, the most reliable therapy for HCC patients, presently, appears to be liver transplantation because its survival rate is superior to that of the other treatments. On this point, this review might differ from other practical guidelines or treatment algorithms. Deceased-donor liver-transplantation is limited by the shortage of grafts, and living-donor liver-transplantation should be discussed. If it is impossible for an HCC patient to undergo liver transplantation, then surgical resection or RFA, should be considered, in accordance with the liver function of the patient. We expect that stronger molecular targeted drugs will be used in the treatment of HCC patients and that these treatments will have more potency and fewer adverse events than are observed with sorafenib treatment. In the near future, methods of promoting hepatic regeneration might be improved. Further studies are ongoing.

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