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Multidisciplinary approach for hepatocellular carcinoma patients: current evidence and future perspectives

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Management of hepatocellular carcinoma (HCC) is challenging due to the complex relationship between underlying liver disease, tumor burden, and liver function. HCC is also notorious for its high recurrence rate even after curative treatment for early-stage tumor. Liver transplantation can substantially alter patient prognosis, but donor availability varies by each patient which further complicates treatment decision. Recent advancements in HCC treatments have introduced numerous potentially efficacious treatment modalities. However, high level evidence comparing the risks and benefits of these options is limited. In this complex situation, multidisciplinary approach or multidisciplinary team care has been suggested as a valuable strategy to help cope with escalating complexity in HCC management. Multidisciplinary approach involves collaboration among medical and health care professionals from various academic disciplines to provide comprehensive care. Although evidence suggests that multidisciplinary care can enhance outcomes of HCC patients, robust data from randomized controlled trials are currently lacking. Moreover, the implementation of a multidisciplinary approach necessitates increased medical resources compared to conventional cancer care. This review summarizes the current evidence on the role of multidisciplinary approach in HCC management and explores potential future directions. **(J Liver Cancer 2024;24:47-56)**

Keywords: Carcinoma, hepatocellular; Liver neoplasms; Multidisciplinary; Management

INTRODUCTION

Diagnosis and management of hepatocellular carcinoma (HCC) is complex and challenging. In certain clinical conditions, the diagnosis of HCC can be done using imaging techniques without the need for histologic confirmation.[1,2] This requires collaborated efforts from specialists in pathology, radiology, and hepatology for the diagnosis of HCC.[3] Selecting the most appropriate treatment modality for HCC is also complex. Nowadays, multiple treatment options are available. Liver transplantation (LT), liver resection, local ablation, transarterial therapy, radiation therapy and systemic therapy are key treatment options.[2] In more detail, living-donor LT, deceased donor LT, open surgical resection, laparoscopic surgical resection, robotic surgical resection, radiofrequency ablation (RFA), microwave ablation, cryoablation, ethanol injection, conventional transarterial chemoembolization (TACE), drug-eluting bead TACE, radioembolization, external beam radiation therapy, proton beam therapy, carbon ion radiation therapy, and multiple efficacious systemic therapeutic regimens are available.[2,4] Choosing the best treatment option for each patient requires collaboration from various experts including hepatologists, gastroenterologists, surgeons, radiologists, interventional radiologists, oncologists, radiation oncologists, pathologists, and other related medical practitioners.[2] A multidisciplinary team (MDT) approach involving experts from diverse clinical fields allows active communication with one another.[5] MDT approach can be a strategy to help cope with

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escalating complexity in HCC management. Many international guidelines on HCC management endorse MDT approach, highlighting its importance in ensuring a holistic and individualized treatment plan for each patient.[6-9] This collaborative strategy covers all aspects of patient care from initial diagnosis and tumor staging to the development of treatment plans.[10] MDT approach usually need participation from multiple academic disciplines including hepatologists, transplant surgeons, radiologists, interventional radiologists, radiation oncologists, pathologists, nurses, and palliative care specialists. MDT approach can create personalized treatment plans through consensus (Fig. 1).[7] Research indicates that patients managed by MDTs tend to have higher survival rates and are more likely to receive curative treatments. This improved outcome is attributed to the efficient exchange of clinical information among team members, which helps in reducing treatment delays and ensures adherence to up-to-date treatment protocols.[8,11] However, the operational details of MDT such as identifying the patient groups that benefit most, identifying the ideal composition of the team, and precisely understanding the clinical outcomes, are not yet fully established. This review aims to synthesize the existing knowledge on the operational setting of MDT in HCC management, evaluate its impact on clinical outcomes, and identify areas for future research.

Figure 1. Multidisciplinary approach. Multidisciplinary approach requires experts from various academic disciplines, place and time for active communication which requires increased medical resources. HBV, hepatitis B virus; DNA, deoxyribonucleic acid.

CURRENT RECOMMENDATIONS OF MDT IN HCC MANAGEMENT IN INTERNATIONAL GUIDELINES

International guidelines on HCC consistently underline the significance of MDT approach. The Barcelona Clinic Liver Cancer (BCLC) and American Association for the Study of Liver Diseases (AASLD) guidelines emphasize the importance of such teams for evaluating specific liver lesions and in conducting thorough patient evaluation.[7,9] Similarly, the European Association for the Study of the Liver (EASL) recommends multidisciplinary discussions, especially in managing smaller lesions and in formulating surgical strategies.[6] The Korean Liver Cancer Association and National Cancer Center (KLCA-NCC) also emphasizes on the importance of including diverse medical experts for improving patient survival and quality of life.[8] These guidelines collectively endorse the creation of individualized treatment plans via MDT. This consensus on the necessity of MDT approach is crucial for effective HCC management, ensuring that care is both personalized and comprehensive, as summarized in Table 1.

THE ROLE AND EFFICACY OF MDT IN HCC MANAGEMENT

Several clinical studies have investigated the effects of MDT in HCC (Table 2). These studies, predominantly retrospective cohort studies conducted in Western countries, largely focused on HCC cases primarily caused by hepatitis C virus (HCV). The stages of HCC in these studies ranged from BCLC 0 to 4, with BCLC A and B stages being more common. Decisions made by a single specialist may vary from those made by an MDT. Zhang et al.[12] evaluated the impact of MDT discussions on patient care and showed that MDT consultations lead to changes in imaging interpretation for 18% of patients and biopsy reinterpretation for 10%. Referrals to the MDT led to a diagnostic change in 8% of cases and modifications in the management plan for 42% of patients. However, it is important to note that even decisions made by MDT can sometimes be different from pathology findings. Wiggans et al.[13] observed a 9.6% discrepancy between MDT diagnostic decisions and post-surgical histology results. This discrepancy was notably higher in patients initially diagnosed with HCC (30%) and cholangiocarcinoma of a major duct (25%). This highlights the potential of MDTs to improve decision-making compared to an individual specialist; however, it also acknowledges that MDT conclusions may not always represent the most accurate diagnosis in every case. Therefore, it is essential to carefully consider MDT

Table 1. Summary of the role and effectiveness of multidisciplinary treatment approaches in current international guidelines of HCC

Study societies	EASL[6] (2018)	BCLC[7] (2022)	KLCA-NCC[8] (2022)	AASLD[9] (2023)
Diagnosis and staging	Recommends local multidisciplinary board discussion for tiny typical lesions	Multidisciplinary approach is key from diagnosis to treatment strategy	For probable HCC, consider follow-up imaging or biopsy within 3 months Multidisciplinary discussion for treatment plan	Advises multidisciplinary discussion for optimal follow-up of LR-4 observation and consideration of biopsies for LR-4 and LR-5 Emphasizes multidisciplinary tumor board for tumor staging
Team composition	Implies involvement of various specialties	Includes expert radiologists, interventional radiologists, radiation oncologists, pathologists, nurses, clinicians, surgeons, palliative care specialists, and social workers	Includes hepatologists, gastroenterologists, surgeons, radiologists, oncologists, and other medical practitioners	Includes hepatologists, radiologists, pathologists, surgeons, oncologists, nurses, social workers, and palliative care providers
Treatment	Multidisciplinary teams for tailored treatment options	Multidisciplinary discussions for best treatment option due to heterogeneity	Multidisciplinary approach key to improving satisfaction, reducing progression, prolonging survival	Managed in multidisciplinary care setting
Specific treatment Considerations	Stage migration strategy pending multidisciplinary decision No single surgical modality suits all HCC presentations A multidisciplinary approach is essential TACE should be considered for patients with segmental portal vein tumor invasion in multidisciplinary team sessions The use of SIRT vs. sorafenib in advanced HCC should be determined after multidisciplinary board discussion due to unproven survival benefits	Not specifically addressed	Multidisciplinary approach with palliative care for pain management	Oncologic outcomes vs. liver decompensation requires multidisciplinary assessment Extended surgical resection indications and down staging to Milan criteria after multidisciplinary discussion; systemic therapy decisions best performed multidisciplinary

HCC, hepatocellular carcinoma; EASL, European Association for the Study of the Liver; BCLC, Barcelona Clinic Liver Cancer; KLCA-NCC, Korean Liver Cancer Association-National Cancer Center; AASLD, American Association for the Study of Liver Diseases; LR, liver imaging-reporting and data system; TACE, transarterial chemoembolization; SIRT, selective internal radiation therapy.

Table 2. Characteristics of studies investigating the MDT in HCC patients

Study	Country	Study design	Sample size	Intervention	Specialized department convened	Topic discussed	Frequency
Chang et al.[14] (2008)	USA	Retrospective	121	MDT	Hepatologists, oncologists, radiologists, and surgeons	Imagining and pathology interpretation, diagnosis, management	N/A
Wiggans et al.[13] (2013)	UK	Retrospective	438	MDT	Radiologists, oncologists, surgeons, and physicians	Radiological, pathological diagnosis differ	1 week
Yopp et al.[15] (2014)	USA	Retrospective	355	MDT	Physicians from surgical oncology, transplant hepatology, interventional radiology, diagnostic radiology, radiation oncology, medical oncology	Imagining and pathology interpretation, diagnosis, management	1 week
Zhang et al.[12] (2013)	USA	Retrospective	343	MDT	Surgical oncologist, medical oncologist, radiation oncologist, radiologist, pathologist, interventional radiologist, hepatologist, and transplant surgeon	Imaging and pathology interpretation, diagnosis, and management plan	Occasionally
Gashin et al.[18] (2014)	USA	Retrospective	137	MDT	Five hepatologists, three oncologists, one radiation oncologist, three interventional radiologists, one pathologist, three surgeons, three radiologists, and five mid-level staff including nurses, nurse practitioners and physician assistants	Imaging and pathology interpretation, diagnosis, and management plan	1 week
Chirikov et al.[20] (2015)	USA	Retrospective	3,588	Multispecialty (3 or more specialists)	Surgeons, radiology oncologist, intervention radiologist, hematologist/medical oncologist, gastroenterologist, and generalist	Imaging and pathology interpretation, diagnosis, and management plan	N/A
Charriere et al.[31] (2017)	France	Retrospective	387	MDT	Senior physicians, specialized in hepatology, oncology, hepatobiliary surgery, transplantation, and radiology	Treatment	1 week
Agarwal et al.[33] (2017)	USA	Retrospective	655	MDT	Transplant hepatologists, medical oncologists, hepatobiliary and transplant surgeons, pathologists, diagnostic, and interventional radiologists	Imaging and pathology interpretation, diagnosis, and management plan	1 week
Serper et al.[23] (2017)	USA	Retrospective	3,988	MDT	Hepatologists, gastroenterologists, surgeons, oncologists	Treatment	N/A
Kaplan et al.[16] (2018)	USA	Retrospective	3,188	MDT	Hepatologists, gastroenterologists, surgeons, oncologists	N/A	N/A
Duininck et al.[32] (2019)	USA	Retrospective	204	MDT	Surgical oncologist, interventional radiologist, hepatologist, medical oncologists, radiation oncologists, and internal medicine physicians	Imaging and pathology interpretation, diagnosis, and management plan	N/A
Sinn et al.[17] (2019)	Korea	Retrospective	6,619	MDT	Hepatologists, surgeons, diagnostic radiologists, interventional radiologists specialized at local ablation therapies, interventional radiologists specialized at transarterial embolotherapies, radiation oncologists, medical oncologists, pathologists and coordinators	Imaging and pathology interpretation, diagnosis, and management plan	1 week
Tseng et al.[21] (2023)	Taiwan	Retrospective	32,784	MDT	Integrated medical staff in each category	N/A	N/A

MDT, multidisciplinary team; HCC, hepatocellular carcinoma; USA, United States of America; N/A, not assessed; UK, United Kingdom.

Table 3. Outcomes of MDT care in HCC management

Study	Etiology	Stage	Sample size (MDT vs. non-MDT)	Control	Follow-up periods (months)	Outcome (treatment)	Outcome (mortality)	Who benefits the most?
Chang et al.[14] (2008)	HCV (69%)	AJCC stage I-IV	183 (121 vs. 62)	Pre-MDT (previous 3 years)	9.5 vs. 4.5	Receiving curative treatment (19% vs. 6%, *P*<0.001)	Survival rate during follow-up periods (65% vs. 21%, *P*<0.001)	AJCC stage II and IV
Yopp et al.[15] (2014)	HCV (60%)	BCLC A-D	355 (105 vs. 250)	Pre-MDT (previous 4 years)	7.9 vs. 4.2	Receiving curative treatment (21% vs. 10%, *P*=0.006)	Adjusted HR 2.5 (2-3) for overall survival	BCLC B, C, and D
Gashin et al.[18] (2014)	HCV (62%)	N/A	137 (N/A)	Non-adherence to MDT decision	N/A	Receiving liver transplantation (25.6% vs. 14.4%, *P*=0.10)	1 year survival rate (61.7% vs. 56.7%, *P*=0.29)	N/A
Chirikov et al.[20] (2015)	HCV	Cancer stage 1- 4	3,588 (1,434 vs. 811)	One discipline	N/A	Higher rate of liver-directed, radiation, and transplant, and low rate of resection and chemotherapy (*P*<0.001)	Adjusted HR 0.90 (*P*=0.04)	Chemotherapy recipients
Charriere et al.[31] (2017)	Alcohol (40%)	BCLC 0-D	387 (255 vs. 132)	Not following MDT decision	27.5	N/A	Adjusted HR 0.39 (95% CI, 0.27-0.54)	MELD <10
Agarwal et al.[33] (2017)	N/A	T2 stage (36%)	655 (306 vs. 349)	Not managed through MDT	N/A	Receiving any treatment (OR, 2.80; 95% CI, 1.71-4.59)	Adjusted HR 0.72 (95% CI, 0.55-0.94)	T2 tumor stage
Serper et al.[23] (2017)	HCV and alcohol (39%)	BCLC 0-D	3,988 (1,366 vs. 2,622)	Not managed through MDT	1.1*	Receiving active HCC therapy (OR, 1.19; 95% CI, 0.98-1.46)	Adjusted HR 0.83 (95% CI, 0.77-0.90)	N/A
Kaplan et al.[16] (2018)	HCV and alcohol (39%)	BCLC 0-D	3,188 (2,062 vs. 1,121)	Not managed through MDT	N/A	N/A	Mean survival (597.4 vs. 471.9 days)	N/A
Duininck et al.[32] (2019)	HCV	BCLC 1-4	204 (134 vs. 70)	Pre-MDT	N/A	Receiving surgery (49% vs. 30%, *P*=0.02)	Adjusted HR 0.62 (95% CI, 0.40-0.98)	N/A
Sinn et al.[17] (2019)	HBV (76.3%)	BCLC 0-D	6,619 (738 vs. 5,881)	Pre-MDT	3.5*	Receiving curative treatment (48.1% vs. 55.9%)	Adjusted HR 0.47 (95% CI, 0.41-0.53)	ALBI grade 2, 3 BCLC B, C High AFP ≥200 ng/mL
Tseng et al.[21] (2023)	HBV or HCV	BCLC 0-D	32,784 (10,928 vs. 21,856)	Not managed through MDT	N/A	N/A	Adjusted HR 0.88 (95% CI, 0.84-0.92)	BCLC B, C

MDT, multidisciplinary team; HCC, hepatocellular carcinoma; HCV, hepatitis C virus; AJCC, American Joint Committee on Cancer; BCLC, Barcelona Clinic Liver Cancer; HR, hazard ratio; N/A, not assessed; MELD, model for end-stage liver disease; OR, odds ratio; CI, confidence interval; ALBI, albumin-bilirubin; AFP, alpha-fetoprotein.
*years.

recommendations before finalizing decisions in HCC management.

Studies examining the effects of MDTs often compare outcomes of HCC patients before MDT implementation or with those who did not receive MDT care (Table 3). Chang et al.[14] found that 19% of patients in MDT care received curative treatment (hepatic resection, ablation, and transplantation) compared to only 6% in the non-MDT group, with a significant survival rate difference during follow-up (65% vs. 21%, $P<0.001$). Similarly, Yopp et al.[15] reported that 21% of MDT patients received curative treatment against 10% in the comparison group. Patients in MDT care were more likely to undergo curative treatment, although there were discrepancies in results from several studies. When reviewing the studies, the observed rates of curative treatment ranged from 19% to 49%, compared to 6% to 55.9% in those not under MDT care. Additionally, MDT care patients often received liver-directed therapy and any form of treatment (odds ratio [OR], 1.19-2.80). LT occurred at a higher rate in the MDT cohort (25.6%) compared to the non-MDT group (14.4%), yet this difference did not reach statistical significance ($P=0.10$).

In the majority of studies, overall survival (OS) was better in the MDT group. The adjusted hazard ratio (HR) for mortality in MDT patients was found to be between 0.39-0.83, with statistical significance in most studies. Kaplan et al.[16] noted a median survival of 597.4 days for MDT patients, which was significantly longer than 471.9 days for patients who were not in MDT care. Sinn et al.[17] reported a higher 5-year survival rate for those managed via MDT at 71.4% compared to 58.7% in non-MDT patients ($P<0.001$). However, Gashin et al.[18] showed a one-year survival rate of 61.7% in patients given MDT care compared to 56.7% in other patients, although this did not reach statistical significance ($P=0.29$). Although the MDT group presented with lower tumor stages compared to the non-MDT group in most studies, multivariate analysis consistently confirmed that MDT was an independent protective factor for OS (Table 3). Additionally, a comprehensive meta-analysis of 12 studies including 15,365 HCC patients suggested that MDT is associated with improved OS, with a HR of 0.63 (95% confidence interval [CI], 0.45-0.88), highlighting the potential benefits of MDT in managing HCC.[19] Nonetheless, the direct association between MDT care and an increased chance of receiving curative treatments was not statistically significant (risk ratio, 1.60; 95% CI, 0.89-2.89). It is important to note that the study was limited by high heterogeneity and potential referral bias. These limitations underscore the necessity for more in-depth investigations. To date, it remains uncertain which patient demographics are most likely to benefit from multidisciplinary care, the ideal composition of such teams, the specific topics that should be prioritized during discussions, and the optimal frequency of these collaborative meetings.

It is important to consider potential biases inherent in interpreting these outcomes. Many of these studies found that patients in MDT groups tended to have earlier stages of HCC and were younger. Furthermore, it is possible that in those studies patients in MDT received more advanced and higher quality therapies. The non-MDT comparative groups were from periods prior to MDT implementation suggesting that MDT patients could have benefited from the latest technological advancements in treatment modalities. The temporal difference between the pre-MDT and post-MDT eras can be a significant confounding factor, potentially leading to overestimation of the impact of MDT.

IDENTIFYING BENEFICIAL PATIENT DEMOGRAPHICS FOR MDT IN HCC

Determining which patient groups benefit most from MDT is an ongoing area of research. Several studies have conducted subgroup analyses based on the stages of HCC. For instance, Chang et al.[14] found that patients with American Joint Committee on Cancer (AJCC) stage II HCC benefited the most from MDT, demonstrating an OR of 15.50 for improved survival following MDT intervention. Yopp et al.[15] examined the effects of MDT care on HCC patients, focusing on survival across different disease stages. Subgroup analysis revealed no significant differences in median survival for patients with BCLC stage A disease. However, for patients with BCLC stages B, C, and D, significant survival benefits were observed, demonstrating a significant impact of MDT care on intermediate- to advanced-stage HCC. Chirikov et al.[20] observed that HCC patients who received multi-specialist care, particularly those who underwent chemotherapy, experienced a significant 28% reduction in mortality ($P=0.002$). In addition, Tseng et al.[21] found that after adjusting for all variables, patients with BCLC B HCC who received MDT care had 10% higher survival rate, and those with BCLC C had 18% higher survival compared to those who did not receive MDT care. Collectively, these studies suggest that MDT care can be important for enhancing survival outcomes for patients with intermediate to advanced stages of HCC. The consistent observation of improved survival rates and reduced mortality from various studies highlights the role of MDT for managing the complexities of HCC treatment, particularly for those in advanced disease stages.

COMPOSITION AND PARTICIPANT ROLES IN MDT FOR HCC

Studies on MDTs in HCC generally report a weekly frequency for meetings.[22] Core participants in these meetings often include hepatologists, diagnostic and interventional radiologists, and surgeons. Other regular attendees are medical oncologists, gastroenterologists, pathologists, and nurse coordinators.

Serper et al.[23] conducted an interesting study analyzing mortality HRs based on the type of specialist overseeing patients' diagnosis and treatment. They discovered varying HRs: hepatologists had a HR of 0.70 (95% CI, 0.63-0.78), medical oncology had 0.82 (95% CI, 0.74-0.91), surgery had 0.79 (95% CI, 0.71-0.89), and multidisciplinary care had 0.83 (95% CI, 0.77-0.90). Conversely, gastroenterology had a HR of 1.02 (95% CI, 0.93-1.13), palliative care had a HR 2.10 (95% CI, 1.87-2.36), and cases without a specialist had a HR of 0.89 (95% CI, 0.65-1.21). There is no specific protocol regarding the minimum number of specialists required for a functional MDT. However, Chirikov et al.[20] noted that meeting with two specialists did not significantly impact overall survival (adjusted HR, 0.99; P=0.80), whereas a notable difference was observed when at least three different specialties were involved (adjusted HR, 0.86; P<0.002) compared with one discipline. This suggests the importance of having an MDT comprising of at least three distinct medical disciplines for effective HCC management.

To date, no study has directly examined the impact of patient involvement in MDT meetings for HCC. There is a gap in the literature on patients' perspective. Additionally, the specific role of healthcare coordinators within MDTs requires further investigation. Yang et al.[24] demonstrated the role of coordinators in providing comprehensive support to HCC patients post-surgery. By assembling a diverse team of specialists including surgeons, nutritionists, rehabilitation physicians, psychiatrists, and nursing staff, MDT care provides a holistic approach to patient care. This strategy significantly contributed to improving quality of life and reducing anxiety and depression. This indicates a potentially vital role for coordinators in providing overall patient well-being, quality of life, and emotional health.

In the dynamics of HCC management, the role of MDTs extends beyond traditional clinical expertise, evolving with the integration of innovative technologies. Artificial Intelligence (AI) is increasingly used in HCC research, particularly for improving imaging techniques and predicting patient outcomes.[25] AI, especially deep learning models, has shown promise in enhancing ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI) analyses. For instance, AI algorithms have been demonstrated to have a diagnostic accuracy area under the receiver operating characteristic curve of 0.92 for ultrasound-based HCC detection, which surpasses the diagnostic accuracy of experienced radiologists, is comparable to that of CT and is only slightly inferior to contrast-enhanced MRI.[26,27] Recent studies have demonstrated that deep learning models using CT or MRI images with clinical data show promise in accurately distinguishing between HCC and non-HCC lesions, potentially reducing the need for invasive biopsies and multiple imaging studies.[28] In histopathology, the precise analysis using AI aids in tumor type classification and molecular change predictions. Additionally, AI has the potential to help the full spectrum of HCC clinical care by providing improved HCC risk prediction, diagnosis, and prognostication/response to treatment assessment.[29] Despite its potential, AI in HCC care is still an emerging field and requires further validation and clinical trials.

In terms of medical knowledge, ChatGPT, an advanced language model developed by OpenAI, has passed the US medical licensing examination but failed the American College of Gastroenterology self-assessment tests. The scores were 65.1% for ChatGPT-3 and 62.4% for ChatGPT-4, both of which were below the required 70% pass mark.[30] Specifically in liver-related topics, ChatGPT-3 and ChatGPT-4 scored 60.26% and 57.89%, respectively. Although AI-generated responses can provide valuable insights, the direct application of these methods in medical practice, especially in gastroenterology, is not currently recommended.

DISCUSSION TOPICS IN MDT FOR TREATING HCC

MDTs in HCC management incorporate various specialties to cover the entire spectrum of patient care. These teams can discuss assessment of liver masses pre-HCC diagnosis to finalizing the diagnosis and treatment plans. As indicated in most studies (Table 2), typical MDT discussions revolve around interpreting imaging and pathology results, formulating diagnoses, and devising management strategies. The advantage of these comprehensive discussions lies in the collective expertise of the team, often leading to different, potentially more effective conclusions than those reached by an individual specialist.

CHALLENGES AND CONSIDERATIONS IN IMPLEMENTING MDT FOR HCC

Organizing MDT meetings is challenging due to the demanding schedules of specialists in outpatient departments, surgeries, and interventions. Even when MDTs are successfully convened, not all

patients may follow the decisions proposed by MDT. Charriere et al.[31] compared the outcomes of patients who adhered to MDT decisions versus those who did not and found that adherence to MDT decisions was associated with better patient outcomes (HR, 0.39; 95% CI, 0.27-0.54). Among the 132 patients who did not receive the planned treatment, the main reasons included HCC progression or patient death (44%), discovery of contraindications such as other cancers or serious cardiovascular conditions (32%), and patient refusal of the planned treatment (particularly in the LT subgroup, 17%). For those unable to follow MDT decision, palliative care options like sorafenib, TACE, or best supportive care were most common. Only a minority (22%) received an alternate curative treatment, with resection in 3% and RFA or percutaneous ethanol injection in 19% of cases. Factors that were predictive of adherence to MDT decisions were model for end-stage liver disease score <10 and a timeframe <60 days between MDT and the first treatment. Conversely, low blood platelet levels and a decision for LT were significantly associated with non-compliance. Another concern was the potential delay in diagnosis and treatment. A study by Tseng et al.[21] based on the nationwide population of patients with HCC who received MDT care showed a longer diagnosis-to-treatment interval (DTI) for MDT cases (22 days for MDT vs. 20 days for non-MDT, P<0.05). After controlling for the relevant variables, DTI increased by 1.24 times for HCC patients with MDT care than for those without MDT care (OR, 1.24; 95% CI, 1.18-1.32). That study also noted that DTI tended to be shorter for patients without comorbidities or cirrhosis and those with larger or more advanced tumors. However, DTI was longer for patients treated at medical centers and public hospitals. Additionally, the cost-effectiveness of MDTs is not well-established. Kaplan et al.[16] investigated healthcare costs associated with MDT for patients with HCC in the United States of America and found a higher mean 3-year total cost for MDT (MDT $180,313 vs. no MDT $141,899, P<0.0001). This indicates that further investigation into the cost-effectiveness of MDT is necessary. Lastly, MDTs are not typically focused on disease prevention. As they are designed for further diagnosis and treatment of existing conditions, MDT does not significantly contribute to early disease prevention or screening. For instance, Duninck et al.[32] compared the prognosis of HCC patients and HCV screening rates in a safety-net hospital before and after MDT implementation. The formation of an MDT did not influence the screening rates within 1 year of diagnosis for patients with HCV. The percentage of patients screened for HCC using ultrasonography, MRI, or CT scans remained unchanged at 23% before and after MDT implementation (P=1.00). This finding suggests that while screening within a year of diagnosis can lead to earlier detection of HCC, the establishment of an MDT did not affect the likelihood of undergoing such screening among HCV positive patients in the safety-net hospital setting. Greater attention is needed for disease prevention within the framework of MDTs to ensure that the potential for early detection and screening, particularly in vulnerable populations.

FUTURE RESEARCH DIRECTIONS IN MDT APPROACH FOR HCC

While MDTs are promising in yielding more accurate diagnoses, improved management plans, and potential survival benefits for patients with HCC, there are several critical areas that require further research. Firstly, there is a pressing need to establish the most effective protocols for MDT operations. This includes determining the optimal frequency of meetings and the ideal composition of the team to ensure the most efficient and effective collaborative decision-making process. Further research is also required to refine the criteria for patient selection to ensure that those who are most likely to benefit from MDT care are accurately identified and prioritized. Additionally, the organization and functionality of MDTs must take into account the cost and time effectiveness. This is crucial for developing a sustainable model of care that balances high-quality treatment with the practicalities of healthcare economics. Investigating these aspects will provide valuable insights into how MDTs can be structured and managed to maximize patient outcome while maintaining efficiency and cost-effectiveness in the healthcare system.

MDTs play a crucial role in the comprehensive management of HCC, offering significant benefits in patient diagnosis, treatment planning, and overall survival outcomes. The involvement of diverse medical experts in MDTs contributes to more nuanced and potentially more effective patient care strategies. However, the implementation of MDTs is challenging because it involves coordination among specialists, patient adherence to MDT decisions, and ensuring cost-effectiveness. Moreover, the role of MDTs in disease prevention and early screening requires further investigation. As the field evolves, ongoing research is essential to refine MDT protocols, enhance the cost-effectiveness of MDT-based care, and maximize the benefits of this collaborative approach in HCC management.

Conflicts of Interest

Dong Hyun Sinn is an editorial board member of Journal of Liver Cancer, and was not involved in the review process of this article. Otherwise, the authors have no conflicts of interest to disclose.

Ethics Statement

This review article is fully based on articles which have already been published and did not involve additional patient participants. Therefore, IRB approval is not necessary.

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