


Adherence to Tumor Board Recommendations in the Treatment of Patients with Hepatocellular Carcinoma

Yueming Cao ¹, Catherine Mezzacappa^{1,2}, Ariel Jaffe^{1,2}, Mario Strazzabosco^{1,2}, Tamar H Taddei^{1,2}

¹Department of Internal Medicine, Yale School of Medicine, New Haven, CT, USA; ²Department of Internal Medicine Digestive Disease Section, Yale School of Medicine, New Haven, CT, USA

Correspondence: Tamar H Taddei, Department of Internal Medicine, Yale School of Medicine, PO Box 208019, New Haven, CT, 06520-8019, USA, Tel +1 203-785-7312, Fax +1 203-785-7273, Email tamar.taddei@yale.edu

Background: Hepatocellular carcinoma (HCC) is a heterogeneous disease that typically arises in the setting of chronic liver disease, making treatment selection complex. Multidisciplinary liver tumor boards (MDLTB) have been shown to improve outcomes in patients with HCC. However, in many cases, patients evaluated by MDLTBs ultimately do not receive the board's recommended treatment.

Purpose: This study aims to assess adherence to MDLTB recommendations for the treatment of HCC, the reasons for non-adherence, and the survival of Barcelona Clinic Liver Cancer (BCLC) Stage A patients treated with curative treatment compared to palliative locoregional therapy.

Patients and Methods: A single-site, retrospective cohort study was conducted of all patients with treatment-naïve HCC who were evaluated by an MDLTB at a tertiary care center in Connecticut between 2013 and 2016, of which 225 patients met inclusion criteria. Investigators conducted a chart review and recorded adherence to the MDLTB's recommendations, and in cases of discordance, evaluated and recorded the underlying cause; investigators assessed MDLTB recommendations' compliance with BCLC guidelines. Survival data was accrued through February 1st of 2022 and analyzed via Kaplan–Meier analysis and multivariate Cox regression.

Results: Treatment adherent to MDLTB recommendations occurred in 85.3% of patients (n=192). The majority of non-adherence occurred in the management of BCLC Stage A disease. In cases where adherence was possible but the recommendation was not followed, most discrepancies were whether to treat with curative or palliative intent (20/24), with almost all discrepancies occurring in patients (19/20) with BCLC Stage A disease. For patients with Stage A unifocal HCC, those who received curative therapy lived significantly longer than patients who received palliative locoregional therapy (5.55 years vs 4.26 years, p=0.037).

Conclusion: Most forms of non-adherence to MDLTB recommendations were unavoidable; however, treatment discordance in the management of patients with BCLC Stage A unifocal disease may present an opportunity for clinically significant quality improvement.

Keywords: compliance, multidisciplinary liver tumor board, HCC, treatment guidelines

Introduction

Liver cancer is the 6th most common cancer in both sexes and the 5th leading cause of cancer death in the United States.¹ Hepatocellular carcinoma (HCC), which most often arises in the setting of chronic liver disease, comprises 75–85% of primary liver cancers.²

As HCC includes heterogeneous tumors that arise in patients with a variety of pre-existing chronic liver disease, its management is complex and nuanced.³ There are several classification systems for staging HCC. The system most commonly used for treatment purposes is the Barcelona Clinic Liver Cancer (BCLC) classification system, which incorporates liver function, performance status, and tumor burden to recommend specific treatments by stage.⁴ Very early (<2 cm), early (within Milan Criteria), and intermediate (multinodular tumors without vascular invasion or extrahepatic metastasis) stages require preserved liver function and an Eastern Cooperative Oncology Group (ECOG) performance status (PS) of 0. Tumors with vascular invasion or extrahepatic metastasis are deemed “advanced” and not “terminal” in patients with preserved liver function and ECOG PS ≤ 2, while “terminal” refers to any tumor burden in

a patient with liver dysfunction or poor performance status (ECOG PS > 2). However, recognizing treatment advances and nuances in liver cancer management, the recently published 2022 BCLC classification encourages a more personalized approach.⁵

While surgical resection is curative, the risk of surgery varies with the severity of underlying liver disease (eg, the presence or absence of cirrhosis and degree of portal hypertension). Locoregional (ablation, embolization) and systemic therapies for HCC can also lead to clinical decompensation in patients with cirrhosis. Therefore, comprehensive staging that accounts for the severity of underlying liver disease as outlined in the BCLC classification is required to formulate individualized treatment plans. Multidisciplinary liver tumor boards (MDLTBs) utilize published guidelines to recommend treatments and have been shown to improve outcomes for patients with HCC.^{6,7} However, MDLTBs also take into account the patient's full clinical picture, such as feasibility of the treatment and the patient's goals of care.⁸ As a result, MDLTB recommendations can deviate from these guidelines.

MDLTBs have become the standard of care for HCC management. However, few studies have described treatment adherence to MDLTB recommendations and the consistency of these recommendations with published guidelines. This study investigates whether MDLTB recommendations are concordant with the guidance offered by the BCLC classification system and whether the treatment recommendations are followed. Where MDLTB treatment recommendations were not followed, we explore the underlying reasons.

Finally, we found the greatest degree of discordance between MDLTB recommendations and treatment received in early (BCLC Stage A) disease. We therefore further evaluated whether survival outcomes in patients with early-stage HCC differed by treatment approach.

Materials and Methods

Setting

This study was conducted at a tertiary care, university-affiliated, 1500-bed hospital with comprehensive cancer and organ transplantation centers. The MDLTB was held weekly and composed of hepatologists, transplant surgeons, surgical oncologists, oncologists, diagnostic and interventional radiologists, pathologists, clinical nurse coordinators, and trainees. The MDLTB reviewed 6–15 cases with benign and malignant liver abnormalities per week, including new referrals and follow-up cases.

Study Design and Data Collection

This retrospective cohort study evaluated the consistency of MDLTB recommendations with published guidelines, the adherence of physicians to MDLTB recommendations, and measured survival outcomes associated with each treatment type. The study was approved by Yale University's Institutional Review Board. Due to the retrospective nature of the study, per Yale University's IRB protocol, patient consent was not required. All patient data was anonymized, kept confidential, and was compliant with the Declaration of Helsinki. All organs were donated voluntarily with written informed consent, as mandated by the United Network for Organ Sharing in the United States.

We examined all consecutive HCC cases reviewed by the American College of Surgeons-accredited MDLTB between February 1st, 2013, and February 1st, 2016. Eligible subjects included all patients over 18 years of age with HCC confirmed by radiology and/or histology reports. These cases were either newly diagnosed at the tertiary care center or referred to the MDLTB by community providers. Only treatment-naïve patients with radiographically suspicious findings were included in the study. Patients that met the following exclusion criteria were not included: (1) patients who presented with recurrent HCC, defined as a new or recurrent lesion after complete treatment of a previous lesion; (2) patients who developed HCC after liver transplantation; (3) patients who had been treated prior to the first MDLTB meeting; (4) patients who were lost to follow up and therefore had no treatment recorded (Figure 1).

Data collected included patient age, albumin, and bilirubin at time of diagnosis, BCLC stage, number of nodules in the liver at the time of diagnosis, date of the first MDLTB review, recommendation from the first MDLTB meeting, treatment administered, date of first treatment, and date of death (if applicable). The Albumin-Bilirubin (ALBI) grade, a ratio of serum albumin to serum bilirubin that has been validated to predict survival in HCC,⁹ was calculated for all

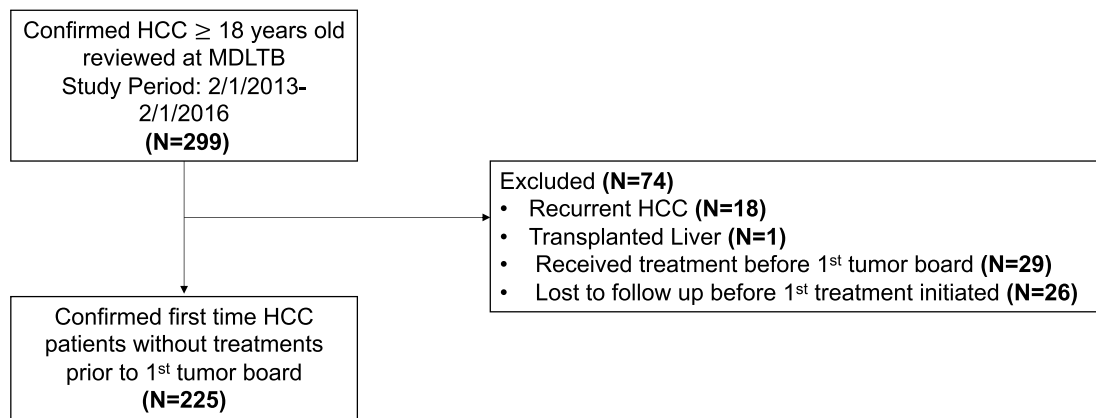


Figure 1 Inclusion criteria. Shown are the inclusion criteria for the retrospective cohort study. A total of 299 patients were assessed for study eligibility, of which 225 were eligible and included for review. Note that patients who received treatment prior to the first tumor board were excluded from the study.

patients using measurements closest to the date of HCC diagnosis. Survival data were accrued through February 1st, 2022. The first MDLTB review is defined as the first meeting in which a definitive treatment recommendation was proposed. The distinction is made because there are cases where the first chronological meeting did not result in a treatment recommendation but instead the board requested additional diagnostic testing (eg, biopsy or radiologic studies). Lastly, we recorded whether the patient received a liver transplant as part of their treatment.

Curative and Palliative Locoregional Treatments

Surgical resection and ablation were considered curative treatments for HCC. All other tumor-directed therapies, including embolization and systemic therapy, were considered palliative. We use the term “palliative locoregional therapy” to describe this collection of treatment options. Best supportive care indicates no tumor-directed therapy.

Classification of Treatment Compliance with Guidelines and Adherence

Each MDLTB recommendation and each administered treatment was evaluated for compliance with the 2012 BCLC staging and treatment guidelines.¹⁰ Given that the 2022 BCLC guideline has shifted towards a more personalized approach, we also examined whether our study sample’s treatments would have been compliant with the 2022 guideline.

If the tumor board recommended watchful waiting (eg, surveillance imaging in three to six months) when a liver transplant was indicated on the basis of decompensated cirrhosis (eg, BCLC Stage D), the recommendation was classified as compliant with guidelines.

If the MDLTB recommended a locoregional therapy (ablation or transarterial embolization) as a bridge to transplantation, the tumor board recommendation was classified as compliant with guidelines, regardless of whether liver transplantation ultimately occurred.

Treatment adherence to the MDLTB recommendation was defined as administering the same modality (eg, transarterial chemoembolization [TACE] or ablation) as the board’s recommendation. When the MDLTB recommended combined therapies such as ablation with concomitant TACE, we considered the recommendation curative; however, if at the time of treatment only TACE was performed, we considered the treatment palliative and not adherent to the tumor board recommendation. If the treatment was not adherent to the MDLTB recommendation, the reason for the discrepancy was evaluated by reviewing the clinical documentation near the date of first treatment.

If the first tumor board did not recommend a treatment but instead recommended additional diagnostics (eg, biopsy or diagnostic imaging), the following tumor board discussion that included a treatment recommendation is compared to the treatment administered by the medical team. If the treating physician followed the MDLTB recommendation for additional diagnostics, but initiated treatment without a subsequent MDLTB discussion, we considered the treatment adherent to the MDLTB recommendation. Because these cases technically did not have an MDLTB-recommended treatment, we conducted a sensitivity analysis excluding these cases.

Data Analysis

We calculated the percentage of MDLTB recommendations compliant with BCLC guidance and the percentage of treatments adherent to the MDLTB recommendations. We defined the survival time as the time between the first treatment and the date of death. For each HCC BCLC stage, we stratified by therapy received and computed the mean survival time.

For BCLC Stage A patients, we compared the mean survival time between patients undergoing curative therapy (ablation and surgery) and patients undergoing palliative locoregional therapy (embolization) stratified by unifocal and multifocal (more than one nodule) disease using Kaplan–Meier survival analyses. Fewer than 50% of these patients had passed away at the time of analysis. Therefore, in order to perform a quantitative analysis of survival, we computed the Cox proportional hazard ratio. The Kaplan–Meier log-rank test and Cox proportional hazards were calculated with R version 4.1.1 using the Survival package.¹¹

Results

MDLTB Recommendation Compliance with BCLC Classification and Adherence of Physician Treatment to MDLTB Recommendation

A total of 225 patients were included in this study (Figure 2A). A total of 94.7% of cases (n=213) received an MDLTB recommendation compliant with the 2012 BCLC staging and treatment guidelines (Figure 2A). A total of 5.3% of cases (n=12) received an MDLTB recommendation that was not compliant with the guidelines (Figure 2A).

Among the cases that received a BCLC-compliant MDLTB recommendation (n=213), 85.9% of them (n=183) adhered to the recommendation and received a BCLC-compliant treatment (Figure 2A). A total of 14.1% of them (n=30) did not adhere to the MDLTB recommendation (Figure 2A). In these 30 cases, 70.0% (n=21) still received BCLC-compliant treatment (ie, there were multiple BCLC-compliant treatment modalities for a patient's disease stage, and the patient received a BCLC-compliant treatment which was not the MDLTB-recommended treatment) (Figure 2A). Of these 21 cases, 95.2% (20 cases) were disagreements on whether to use curative (ablation/surgery) or palliative locoregional

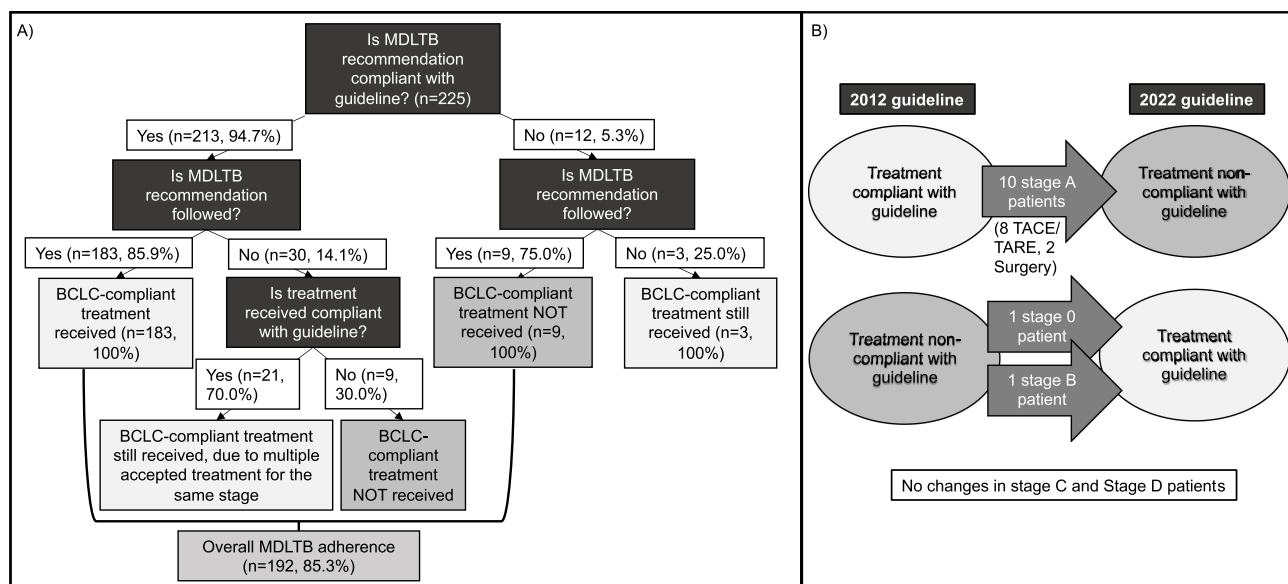


Figure 2 Flowcharts demonstrating MDLTB recommendation compliance to guidelines and adherence of physician treatment to MDLTB recommendation. **(A)** Flow chart demonstrating compliance and adherence according to the contemporaneous (2012) guideline. 94.7% of MDLTB recommendations followed the concurrent 2012 BCLC classification guideline. Treatment compliance stratified by MDLTB adherence is shown above. Overall, 85.3% of MDLTB treatment recommendations were adhered to during treatment. **(B)** Changes in guideline compliance between 2012 and 2022 guidelines. Note that all patients in the study were treated prior to the publication of the 2022 guideline. One Stage 0 and one Stage B patient who received treatment non-compliant with the 2012 guideline are compliant with the 2022 guideline. Ten Stage A patients' treatments which were compliant with the 2012 guideline are not compliant with the 2022 guideline. There are no changes in treatment compliance in the Stage C and Stage D patients.

(TACE/selective internal radiation therapy [SIRT]) treatment. All but one of these disagreements (n=19) occurred in the treatment of patients with Stage A disease; the one exception occurred in the treatment of a Stage D patient.

Among the 30 cases that received a BCLC-compliant MDLTB recommendation and did not adhere to it, 30.0% of patients (n=9) ended up not receiving a BCLC-compliant treatment (Figure 2A). Three of them were due to patient preference, three due to the patient being too ill to start any treatment, two due to feasibility of the procedure given tumor location, and one due to the patient's enrollment in a clinical trial.

Among the 12 cases that did not receive an MDLTB recommendation compliant with BCLC classification, 75% (n=9) were adherent to the MDLTB recommendation and thus received treatment that was not compliant with the BCLC classification (Figure 2A). One Stage C patient received a recommendation and treatment of best supportive care, one Stage C patient received surgery, and two Stage C patients received TACE. Three Stage B patients received surgery, one Stage B patient received a recommendation and treatment of sorafenib, and one Stage B patient received best supportive care. The remaining 25% (n=3) of cases received BCLC-compliant but MDLTB-non-adherent therapy (ie, the MDLTB recommended therapy for a stage less advanced than the patient's actual stage) (Figure 2A). Two of these three patients were Stage D but the MDLTB recommended Stage C treatment, and for the one Stage C patient, the MDLTB recommended either resection or TACE, but SIRT was administered.

Overall, treatment adherent to MDLTB recommendations occurred in 85.3% of patients (n=192) (Figure 2A).

Forty-three cases in our cohort had the first MDLTB meeting recommending additional diagnostics rather than treatment. Among these 43 cases, 29 cases had a treatment recommendation from the MDLTB in the subsequent meeting after diagnostic results came back. However, 14 cases received treatment prior to any treatment recommendation from the MDLTB (Supplemental Figure 1A). Because these 14 cases technically did not have an MDLTB-recommended treatment, we conducted a sensitivity analysis excluding them. After excluding these 14 cases, the adherence rate lowered from 85.3% to 84.4% (n=178) (Supplemental Figure 1B).

MDLTB Recommendation Compliance with 2022 BCLC Classification and Changes Compared to the 2012 BCLC Classification

Lastly, we evaluated whether treatment recommendations would have been compliant with the 2022 BCLC classification. Under the new classification, the HCC staging did not change for any of our patients. Applying the 2022 BCLC guidelines to the MDLTB recommendations during the study period, compliance with guidelines would be impacted as follows. Overall, after applying the updated 2022 BCLC classification to our cohort, 88.4% percent of patients (n=199) received therapies recommended in the update compared to 92.0% (n=207) who received therapies recommended in the 2012 classification (Figure 2B).

Survival

Table 1 describes survival in years for all 225 patients by BCLC stage and the modality of therapy received. For patients with Stage A unifocal HCC, patients who received curative therapy lived significantly longer than patients who received palliative locoregional therapy (5.55 years vs 4.26 years, $p=0.037$), with a hazard ratio for mortality of 0.47 (Figure 3A). However, in Stage A multifocal disease, there was no survival difference between curative and palliative locoregional therapies (4.74 years vs 5.22 years, $p=0.26$) (Figure 3B). Survival regression models controlling for age, model for end-stage liver disease score (MELD), and ALBI all yielded similar results (Table 2). A sensitivity analysis excluding large tumors (maximal tumor diameter > 3 cm) yielded similar results (results not shown).

Because liver transplant dramatically improves survival and thereby skews survival results, we repeated this analysis after excluding liver transplant recipients (Table 1). There were 17 patients who underwent liver transplant throughout their course of treatment (13 Stage A, 1 Stage B, and 3 Stage D). Censoring transplant cases resulted in lower survival across all stages.

Among the Stage A unifocal patients who did not receive a transplant, those receiving curative treatment also lived significantly longer than those who received palliative locoregional treatment (5.24 vs 4.01 years, $p=0.032$), with a hazard ratio for mortality of 0.46 (Figure 3C). In patients with Stage A multifocal disease, there was no difference

Table 1 Survival Time for Each Treatment Type Stratified by Disease Stage

	Total Sample (N = 225)	Survival Time (Years)	Total Sample Excluding Transplants (N=208)	Survival Time (Years)
BCLC Stage 0	N=11, 4.9%		N=11, 5.3%	
Curative therapy (Ablation/Surgery)	N=10, 90.9%	5.26	N=10, 90.9%	5.26
Palliative locoregional therapy (TACE)	N=1, 9.1%	2.57	N=1, 9.1%	2.57
BCLC Stage A Unifocal	N=73, 32.4%		N=65, 31.3%	
Curative therapy (Ablation/Surgery)	N=47, 64.4%	5.55	N=41, 63.1%	5.24
Palliative locoregional therapy (TACE/TARE)	N=24, 32.9%	4.26	N=22, 33.8%	4.01
Other (Hospice)	N=2, 2.7%	0.21	N=2, 3.1%	0.21
BCLC Stage A Multifocal	N=32, 14.2%		N=27, 13.0%	
Curative therapy (Ablation/Surgery)	N=19, 59.4%	4.74	N=15, 55.6%	3.92
Palliative locoregional therapy (TACE)	N=13, 40.6%	5.22	N=12, 44.4%	4.95
BCLC Stage B	N=44, 19.6%		N=43, 20.7%	
Palliative locoregional therapy (TACE/TARE)	N=38, 86.4%	2.58	N=37, 86.0%	2.48
Curative therapy (Ablation/Surgery)	N=4, 9.1%	7.24	N=4, 9.3%	7.24
Other (Hospice/Chemotherapy)	N=2, 4.5%	0.14	N=2, 4.7%	0.14
BCLC Stage C	N=37, 16.4%		N=37, 17.8%	
Stage specific (Chemotherapy/SIRT)	N=27, 73.0%	1.20	N=27, 73.0%	1.20
Other (TACE, Hospice, Surgery)	N=10, 27.0%	1.57	N=10, 27.0%	1.57
BCLC Stage D	N=28, 12.4%		N=25, 12.0%	
Hospice	N=18, 64.3%	0.51	N=18, 72.0%	0.51
Transplant	N=2, 7.1%	7.79	NA	NA
Other (Ablation/Embolization as a bridge to transplant)	N=8, 28.6%	3.10	N=7, 28.0%	2.54

Note: Survival times and percentages are computed for both the entire cohort and for a subset of the cohort excluding transplant recipients.

observed in overall survival across treatment type (3.92 vs 4.95 years, $p=0.16$) (Figure 3D). Again, adjusted models controlling for age, MELD, and ALBI yielded similar results (Table 2).

Discussion

Worldwide, HCC is the third most common cause of cancer-related deaths. Due to the high complexity of managing patients with HCC, MDLTBs are crucial for timely diagnosis, staging, and formulating individualized treatment plans.^{3,12,13} Evaluation by an MDLTB has been shown to be associated with reduced mortality,¹⁴ suggesting that adherence to MDLTB recommendations may provide a clinical benefit.

However, in most health systems, following MDLTB recommendations is not required. In fact, a prior single-site study, Gashin et al, demonstrated that only ~55–60% of MDLTB recommendations were followed.¹⁴ A subsequent study, Charriere et al, which assessed treatment adherence, found that 64% of patients received adherent treatment;¹⁵ however, this study did not assess the reasons for non-adherence, making the non-adherence rate difficult to interpret. The reasons for not adhering to tumor board recommendations are complex and often patient-specific, and in many cases, can be desirable if nuances of the case would suggest an alternative treatment may lead to an improved quality of life or prolonged survival.¹⁶ Hence, when interpreting adherence rates, we stress that one should not consider 100% to be the optimal adherence rate. We also caution the reader that, because causes of unavoidable non-adherence will be a function of referral patterns and patient biology, the optimal adherence rate will vary across patient populations.

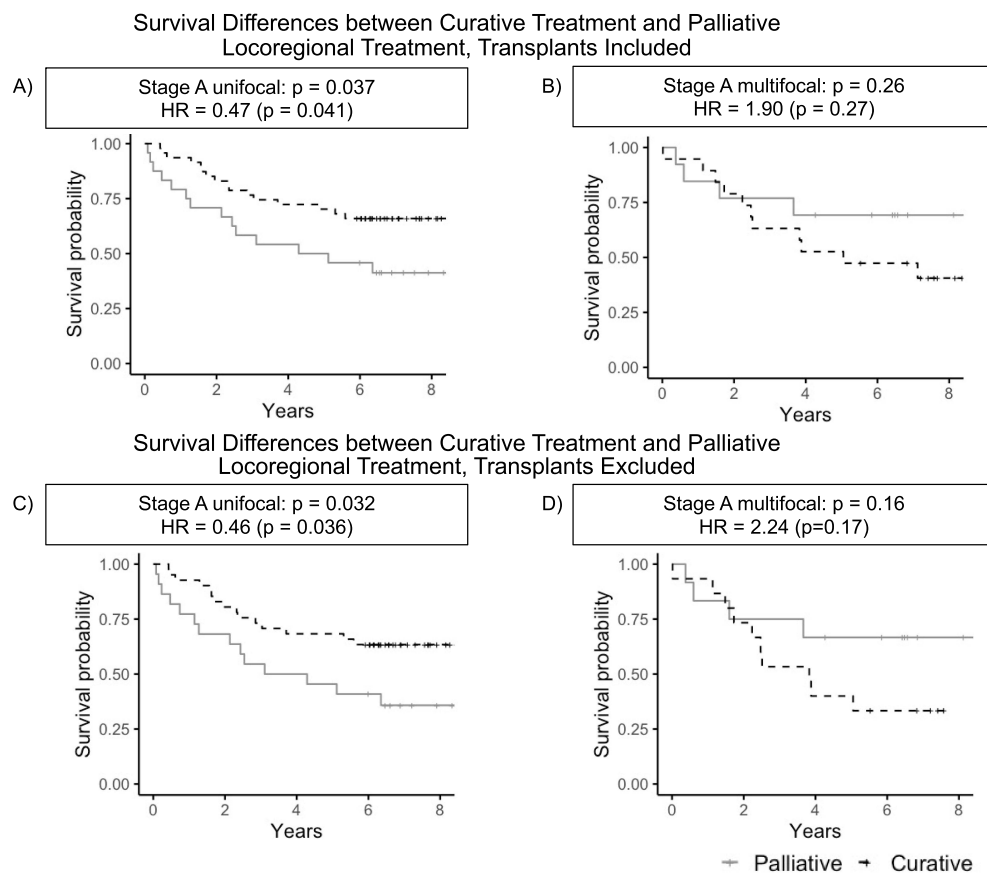


Figure 3 Survival differences between curative treatment and palliative locoregional treatment, with and without transplants. Shown are survival curves for patients with Stage A disease who received curative treatment and for patients who received palliative locoregional treatment, stratified by unifocal (A) vs multifocal (B). To control for liver transplant as a confounder, the analysis was repeated in a subset of the cohort excluding transplants (C and D). Stage A unifocal patients who received curative treatment had statistically significant improved survival compared to Stage A unifocal patients who received palliative locoregional therapy ($p=0.041$, log-rank test; see (A)); this survival benefit is also present in the subset excluding transplants ($p=0.036$, see (C)). Such a survival benefit is not present in patients with Stage A multifocal HCC ($p=0.27$, see (B)), and is also absent in the subset excluding liver transplants ($p=0.17$, see (D)).

In this study, we develop on the work of Gashin et al and Charriere et al. Rather than measure adherence to every MDLTB recommendation (as in Gashin et al), we measured whether a given patient’s overall treatment was adherent to the MDLTB’s treatment recommendation (ie, our unit of analysis is patients rather than MDLTB recommendations). We analyzed a series of 225 patients evaluated by an MDLTB and determined whether the treatment they received was

Table 2 Survival Models Comparing Curative and Palliative Treatment in Patients with Unifocal Stage A Disease Controlling for Potential Confounding Factors

	Transplant Included			Transplant Excluded		
	Curative vs Palliative HR	95% CI	p value	Curative vs Palliative HR	95% CI	p value
Unadjusted	0.47	0.23–0.97	0.04	0.46	0.22–0.95	0.04
Adjusted for age	0.47	0.23–0.97	0.04	0.45	0.22–0.94	0.03
Adjusted for MELD	0.50	0.24–1.05	0.07	0.49	0.23–1.02	0.06
Adjusted for ALBI	0.47	0.23–0.97	0.04	0.48	0.23–0.99	0.05

Notes: Four models are shown: a univariate, unadjusted model and three bivariate models which control for age, MELD, and ALBI, respectively. In all four models, curative therapy is associated with prolonged survival (HR between 0.47–0.50).

adherent to the recommendation. Our study explored the reasons for deviating from the MDLTB recommendations. We also explored whether the MDLTB recommendation was stage-specific according to the BCLC classification.

We have shown a high adherence rate to MDLTB recommendations at a single center (85.3%, n=192). We note that this adherence rate, although measured differently than prior studies, is considerably higher than previously reported (see, for example, Gashin et al and Charriere et al). Because prior work did not characterize the reasons for non-adherence, it is difficult to infer the root cause of these differences. We speculate that our low non-adherence rate could be due to the tumor board's low personnel turnover rate at our center. When treatment did not adhere to the MDLTB recommendation, feasibility given tumor location, patient preference, and patient illness were the prevailing reasons.

In the cases where adherence was possible, but the recommendation was not followed, the majority of discrepancies centered on the decision to treat with curative (surgery or ablation) or palliative intent (20/24), with the overwhelming majority of discrepancies occurring in patients (19/20) with Stage A HCC disease. Most importantly, the tumor board overwhelmingly suggested curative treatment in these patients (17/20). In 11/17 of these cases, curative treatment was not possible either due to tumor location or due to patient preference. However, in 6/17 of these cases, treatment deviated from the MDLTB recommendations due to physician preference. This small proportion of cases (6/24, 25%) may be an opportunity for quality improvement. However, the majority of non-adherence to recommendations (75%) was unavoidable.

Another source of disagreement (3/24) between the physician and the MDLTB occurred when the board anticipated the patient's improvement and consequently recommended a therapy for a lower stage (eg, anticipating a patient with BCLC D disease would improve to BCLC C, and thus recommending a treatment appropriate for Stage C disease), but the treating physician disagreed. This is expected in clinical practice, as the physician who is directly interacting with the patient might have a more comprehensive picture of the patient. Furthermore, liver disease may worsen abruptly or cancer may progress rapidly in the interval between the MDLTB discussion and treatment.

Lastly, we studied whether patients with unifocal Stage A disease had a difference in survival by treatment selection. We found that BCLC Stage A patients with unifocal disease had significantly longer survival when treated with surgery or ablation (curative treatment) than those treated with palliative locoregional therapies. During the study period, patients in the curative group were twice as likely to survive compared to the palliative locoregional group, a finding that was not altered after controlling for age and degree of underlying hepatic function (MELD, ALBI) or after excluding liver transplant recipients. This retrospective observational analysis may be vulnerable to confounding by patient and/or provider characteristics. However, after controlling for several known predictors of mortality in liver disease and HCC, we were able to detect a statistically significant difference in survival between treatment groups despite a small sample size. Given that this survival difference is of a clinically relevant magnitude, it is imperative that curative therapy is considered for all patients with Stage A unifocal HCC unless a compelling contraindication is present.

Because the 2022 BCLC classification encourages a more personalized approach, and non-adherence is sometimes due to idiosyncratic patient factors, we repeated our evaluation of treatments recommended by the MDLTB and those received by the patient according to the 2022 update. We found that the vast majority of patients still received BCLC-compliant therapies (88.4% using the 2022 update compared to 92.0% using the 2012 classification). This difference was mostly due to changes in the management of Stage A patients and broadening the treatment options for Stage 0 and Stage B disease.

Major limitations of this study include its retrospective, observational design and that it is limited to a single site. Consequently, it is unknown whether these results will generalize to other medical systems. A future, ideally prospective, multi-site study of patient outcomes related to MDLTB recommendations should consider the shift to a more personalized approach to care. Reasons for deviating from MDLTB recommendations should be assessed through the nuances of the growing options for therapy and center-specific approaches to delivering personalized HCC care. Minimally invasive surgical approaches may expand the pool of patients eligible for curative resection, which may improve the adherence to MDLTB recommendations when those recommendations are for curative therapy. Our results indicate that 2–3% of patients with HCC who were assessed by our MDLTB ultimately received an inferior, non-adherent treatment (ie, palliative locoregional therapy when curative treatment was indicated) due to the preference of the treating physician. This could be due to center-specific physician expertise, which will inevitably have an effect on treatment. This observation may be an opportunity for further quality improvement.

Conclusion

In this single-site retrospective cohort study, we found that there was excellent adherence to tumor board recommendations, which primarily followed the 2012 BCLC classification.

In the cases where there was discordance between the tumor board recommendation and the actual treatment delivered, most non-adherence was unavoidable. We also found that for patients with Stage A unifocal disease, receiving curative therapy was associated with improved survival compared to palliative locoregional therapy. Every effort should be made to consider curative treatments in patients with unifocal Stage A HCC. Given the growing number of treatment options for HCC, the complexity of downstaging and stage shifting, and the encouragement of personalized approaches, future studies should consider how best to measure the efficacy of multidisciplinary liver tumor boards. Consensus on key indicators of success, such as stage-appropriate therapy or referral to clinical trial would allow for more rigorous prospective studies.

Abbreviations

ALBI, albumin-bilirubin; BCLC, Barcelona-Clinic Liver Cancer; ECOG, Eastern Cooperative Oncology Group; HCC, hepatocellular carcinoma; MELD, model of end-stage liver disease; MDLTB, multidisciplinary liver tumor board; PS, performance status; TACE, transarterial chemoembolization.

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Disclosure

Dr Mario Strazzabosco reports that he is an advisor (received no compensation) for ENGITIX, outside the submitted work. The authors report no conflicts of interest in this work.

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