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How Effective is Chemoembolization (TACE) Compared to Standard Care on The Survival of Hepatoma Patients? A Systematic Review

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ABSTRACT

Introduction: Hepatocellular carcinoma (HCC) is a leading cause of cancer-related mortality worldwide. Transarterial chemoembolization (TACE) is a standard treatment for intermediate-stage HCC, but its effectiveness compared to evolving standard care modalities requires continuous evaluation. This systematic review aims to synthesize current evidence on the effectiveness of TACE versus standard care on the survival of hepatoma patients.

Methods: A systematic review was conducted by screening a pre-defined set of literature. Studies were included if they compared TACE (as a primary treatment) to any form of standard care (e.g., supportive care, systemic therapy, other locoregional treatments) in HCC patients and reported survival outcomes. Data on study

characteristics, patient populations, interventions, and outcomes (overall survival, progression-free survival, safety) were extracted and synthesized narratively.

Results: The review included 200 studies, encompassing RCTs, meta-analyses, and cohort studies. TACE consistently demonstrated a significant survival benefit over best supportive care, with median overall survival extended from 3-7 months to 20-31 months in some studies (Biselli et al., 2005; Yuen et al., 2003). Compared to systemic monotherapy like sorafenib in advanced stages, TACE showed at least comparable outcomes (Pinter et al., 2012). While conventional TACE (cTACE) and drug-eluting bead TACE (DEB-TACE) showed mixed survival results, DEB-TACE was often associated with a better safety profile (Bzeizi et al., 2021; Chen et al., 2017). The most significant advancement was seen with combination therapies; TACE plus tyrosine kinase inhibitors and immunotherapies (e.g., LEAP-012, EMERALD-1) markedly improved progression-free survival (HR 0.66-0.77) compared to TACE alone (Kudo et al., 2025; Lencioni et al., 2024).

Discussion: The evidence confirms TACE's role as a cornerstone of HCC treatment, particularly for intermediate-stage disease. Its effectiveness is maximized in patients with preserved liver function (Child-Pugh A) and low tumor burden. The field is shifting towards combination strategies, which offer superior tumor control but require careful management of increased toxicity. Major limitations include high heterogeneity in TACE protocols and control arm definitions across studies.

Conclusion: TACE significantly improves survival compared to supportive care and remains a vital treatment for HCC. Emerging

evidence strongly supports combining TACE with systemic therapies to enhance outcomes, establishing a new standard for many patients. Future research should focus on optimizing patient selection for these combination approaches.

Keywords: Hepatocellular Carcinoma, Transarterial Chemoembolization (TACE), Standard Care, Survival, Systematic Review, Combination Therapy.

INTRODUCTION

Background

Hepatocellular carcinoma (HCC) is the most common primary liver cancer and a leading cause of cancer-related death globally, with its incidence rising in many regions (Lencioni et al., 2016). The prognosis for HCC patients is highly dependent on the stage at diagnosis and the availability of effective treatments. Management strategies are complex and guided by multidisciplinary teams, with treatment allocation traditionally based on the Barcelona Clinic Liver Cancer (BCLC) staging system. For patients with intermediate-stage HCC (BCLC B) who are not candidates for curative therapies like resection or ablation, transarterial chemoembolization (TACE) has been established as the standard of care for over two decades (Llovet et al., 2022).

TACE works by combining the targeted delivery of high-dose chemotherapy directly to the tumor with embolization of the feeding artery, inducing ischemic necrosis while minimizing systemic toxicity (Takayasu et al., 2010). However, the definition of "standard care" for HCC is not static. It has evolved significantly to include effective systemic therapies such as tyrosine kinase inhibitors (TKIs) like sorafenib and lenvatinib, and more recently, immunotherapies (ICI). Furthermore, variations in TACE technique itself (e.g., conventional TACE vs. drug-eluting bead TACE) and its combination with other locoregional or systemic modalities have created a complex and rapidly changing therapeutic landscape (Golfieri et al., 2014; Kudo et al., 2022). Therefore, a comprehensive synthesis of the evidence comparing TACE against these evolving standards of care is critical.

Research Gap

Despite the widespread use of TACE, significant questions remain regarding its comparative effectiveness. First, the efficacy of TACE relative to newer, potent systemic therapies, especially in advanced or borderline cases, is not fully defined (Pinter et al., 2012). Second, while numerous

trials have explored combining TACE with systemic agents, the magnitude of benefit and the optimal patient selection for these combination regimens are still being elucidated (Kudo et al., 2019). Finally, the heterogeneity in TACE protocols and comparator arms across the literature makes it challenging to draw unified conclusions for clinical practice.

Novelty

This systematic review provides a contemporary synthesis of a large and diverse body of evidence, including the most recent landmark phase 3 trials on TACE combination therapies. By evaluating TACE against a broad spectrum of standard care definitions—from best supportive care to modern TKIs and ICIs—this review offers a comprehensive overview of its evolving role. It uniquely synthesizes data on effectiveness moderators, such as liver function and disease stage, to provide clinically relevant insights for patient selection and treatment individualization.

Objectives

The primary objective of this systematic review is to evaluate the effectiveness of transarterial chemoembolization (TACE) compared to standard care on the survival of patients with hepatocellular carcinoma (hepatoma). Secondary objectives include comparing the safety profiles of these interventions and identifying patient and tumor characteristics that moderate treatment effectiveness.

Hypothesis

The hypothesis of this review is that TACE provides a significant survival benefit over best supportive care, but its comparative advantage over modern systemic therapies is variable and highly dependent on disease stage and patient characteristics. Furthermore, it is hypothesized that combining TACE with systemic therapies yields superior survival outcomes compared to TACE monotherapy.

Benefits of the Study

This study will benefit clinicians, researchers, and policymakers by providing a clear, evidence-based summary of where TACE stands in the current treatment landscape for HCC. It will help guide clinical decision-making by clarifying which patient populations are most likely to benefit from TACE, either alone or in combination, and highlight areas where further research is needed.

METHODS

Protocol

The study strictly adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines to ensure methodological rigor and accuracy. This approach was chosen to enhance the precision and reliability of the conclusions drawn from the investigation.

Criteria for Eligibility

This systematic review aims to evaluate the how effective is chemoembolization (tace) compared to standard care on the survival of hepatoma patients?

Screening

We screened in sources based on their abstracts that met these criteria:

- **Population - Hepatocellular Carcinoma**: Does this study involve patients diagnosed with hepatocellular carcinoma (hepatoma), and if the study includes mixed cancer populations, can the hepatocellular carcinoma results be extracted separately?
- **Intervention - TACE as Primary Treatment**: Does this study evaluate transarterial chemoembolization (TACE) as a primary treatment modality (not solely as adjuvant therapy or in combination where TACE effects cannot be isolated)?

- **Survival Outcomes Reported**: Does this study report survival outcomes (overall survival, progression-free survival, or disease-free survival) rather than only surrogate endpoints without survival correlation?
- **Adequate Study Design**: Is this study a randomized controlled trial, controlled clinical trial, cohort study, case-control study, systematic review, or meta-analysis (not a case report, case series with fewer than 10 patients, editorial, letter, or conference abstract without full data)?
- **Human Studies**: Is this study conducted in human subjects (not animal or in-vitro studies)?
- **Appropriate Comparison Group**: Does this study compare TACE with standard care, best supportive care, or other established treatments for hepatocellular carcinoma?
- **Original Publication**: Is this an original publication and not a duplicate report of the same study population and outcomes already included in the review?

We considered all screening questions together and made a holistic judgement about whether to screen in each paper.

Search Strategy

The keywords used for this research based PICO :

Element	P (Population)	I (Intervention/Exposure)	C (Comparison/Context)	O (Outcome)
Keyword 1	Hepatocellular Carcinoma	Transarterial Chemoembolization	Standard Care	Survival
Keyword 2	Liver Cancer	TACE	Supportive Care	Overall Survival (OS)
Keyword 3	Hepatoma	Chemoembolization	Conventional Therapy	Mortality
Keyword 4	HCC	Transcatheter Arterial Chemoembolization	Control Group	Prognosis

The Boolean MeSH keywords inputted on databases for this research are: *("Hepatocellular Carcinoma" OR "Liver Cancer" OR "Hepatoma" OR "HCC") AND ("Transarterial Chemoembolization" OR "TACE" OR "Chemoembolization" OR "Transcatheter Arterial Chemoembolization") AND ("Standard Care" OR "Supportive Care" OR "Conventional Therapy" OR "Control Group") AND ("Survival" OR "Overall Survival (OS)" OR "Mortality" OR "Prognosis")*

Data extraction

- **Study Population**:

  Extract patient population characteristics relevant to hepatoma/HCC treatment decisions, including:

  - Total sample size and group sizes
  - Hepatoma/HCC staging system used (BCLC, UICC, CLIP, etc.) and stage distribution
  - Liver function status (Child-Pugh class, baseline liver function parameters)
  - Performance status (ECOG, Karnofsky)
  - Underlying liver disease etiology (HBV, HCV, alcohol, etc.)
  - Tumor characteristics (size, number, location, vascular invasion, extrahepatic spread)
  - Key inclusion/exclusion criteria that define the target population

- **TACE Protocol**:

  Extract comprehensive details of the TACE intervention for hepatoma patients, including:

  - Type of TACE (conventional TACE, DEB-TACE, etc.)
  - Chemotherapeutic agents used (drug names, doses, combinations)
  - Embolic agents used (gelatin sponge, PVA particles, microspheres, etc.)
  - Contrast agents (lipiodol dose and retention patterns if reported)

- Treatment schedule (number of sessions, intervals between sessions)
- Technical details (catheter placement, endpoint criteria)
- Treatment modifications or stopping criteria

- **Comparison Treatment**:

  Extract details of the standard care or control treatment compared to TACE for hepatoma patients, including:

  - Name and classification of comparison treatment (sorafenib, hepatic resection, supportive care, other TACE techniques, etc.)
  - Specific treatment protocols, doses, schedules for the comparison group
  - Duration of treatment
  - Treatment modifications or crossover between groups
  - Whether comparison represents current standard of care in the study setting

- **Survival Outcomes**:

  Extract all survival-related endpoints and comparative effectiveness data between TACE and control treatments for hepatoma patients, including:

  - Primary survival endpoints (overall survival, progression-free survival, time to progression)
  - Median survival times with confidence intervals for each treatment group
  - Survival rates at specific time points (1, 2, 3, 5 years) for each group
  - Hazard ratios or relative risk with confidence intervals and p-values
  - Objective response rates (complete response, partial response, stable disease, progression)
  - Statistical significance of survival differences between treatments
  - Follow-up duration and method

- **Safety Profile**:

  Extract safety and adverse event data comparing TACE to standard treatment in hepatoma patients, including:

  - Treatment-related mortality rates for each group
  - Serious adverse events (acute liver failure, renal failure, encephalopathy, ascites, bleeding, abscess)
  - Common side effects and their frequencies
  - Post-treatment complications specific to each intervention
  - Hospitalizations or treatment delays due to adverse events
  - Quality of life impacts if reported
  - Discontinuation rates due to toxicity

- **Effectiveness Moderators**:

  Extract patient and tumor characteristics that moderate the comparative effectiveness of TACE vs standard treatment for hepatoma, including:

  - Subgroup analyses showing differential treatment effects by patient characteristics
  - Tumor stage-specific outcomes (early vs advanced stage effectiveness)
  - Liver function-specific outcomes (Child-Pugh A vs B outcomes)
  - Baseline characteristics associated with better/worse outcomes for each treatment
  - Predictive factors for treatment selection (lipiodol retention, tumor size, etc.)
  - Geographic or healthcare setting factors affecting treatment choice
  - Any reported treatment selection criteria or decision algorithms

Table 1. Article Search Strategy

Database	Keywords	Hits
Pubmed	*("Hepatocellular Carcinoma" OR "Liver Cancer" OR "Hepatoma" OR "HCC") AND ("Transarterial Chemoembolization" OR "TACE" OR "Chemoembolization" OR "Transcatheter Arterial Chemoembolization") AND ("Standard Care" OR "Supportive Care" OR "Conventional Therapy" OR "Control Group") AND ("Survival" OR "Overall Survival (OS)" OR "Mortality" OR "Prognosis")*	423
Semantic Scholar	*("Hepatocellular Carcinoma" OR "Liver Cancer" OR "Hepatoma" OR "HCC") AND ("Transarterial Chemoembolization" OR "TACE" OR "Chemoembolization" OR "Transcatheter Arterial Chemoembolization") AND ("Standard Care" OR "Supportive Care" OR "Conventional Therapy" OR "Control Group") AND ("Survival" OR "Overall Survival (OS)" OR "Mortality" OR "Prognosis")*	108
Springer	*("Hepatocellular Carcinoma" OR "Liver Cancer" OR "Hepatoma" OR "HCC") AND ("Transarterial Chemoembolization" OR "TACE" OR "Chemoembolization" OR "Transcatheter Arterial Chemoembolization") AND ("Standard Care" OR "Supportive Care" OR "Conventional Therapy" OR "Control Group") AND ("Survival" OR "Overall Survival (OS)" OR "Mortality" OR "Prognosis")*	3,039
Google Scholar	*("Hepatocellular Carcinoma" OR "Liver Cancer" OR "Hepatoma" OR "HCC") AND ("Transarterial Chemoembolization" OR "TACE" OR "Chemoembolization" OR "Transcatheter Arterial Chemoembolization") AND ("Standard Care" OR "Supportive Care" OR "Conventional Therapy" OR "Control Group") AND ("Survival" OR "Overall Survival (OS)" OR "Mortality" OR "Prognosis")*	18,000
Wiley Online Library	*("Hepatocellular Carcinoma" OR "Liver Cancer" OR "Hepatoma" OR "HCC") AND ("Transarterial Chemoembolization" OR "TACE" OR "Chemoembolization" OR "Transcatheter Arterial Chemoembolization") AND ("Standard Care" OR "Supportive Care" OR "Conventional Therapy" OR "Control Group") AND ("Survival" OR "Overall Survival (OS)" OR "Mortality" OR "Prognosis")*	2,234

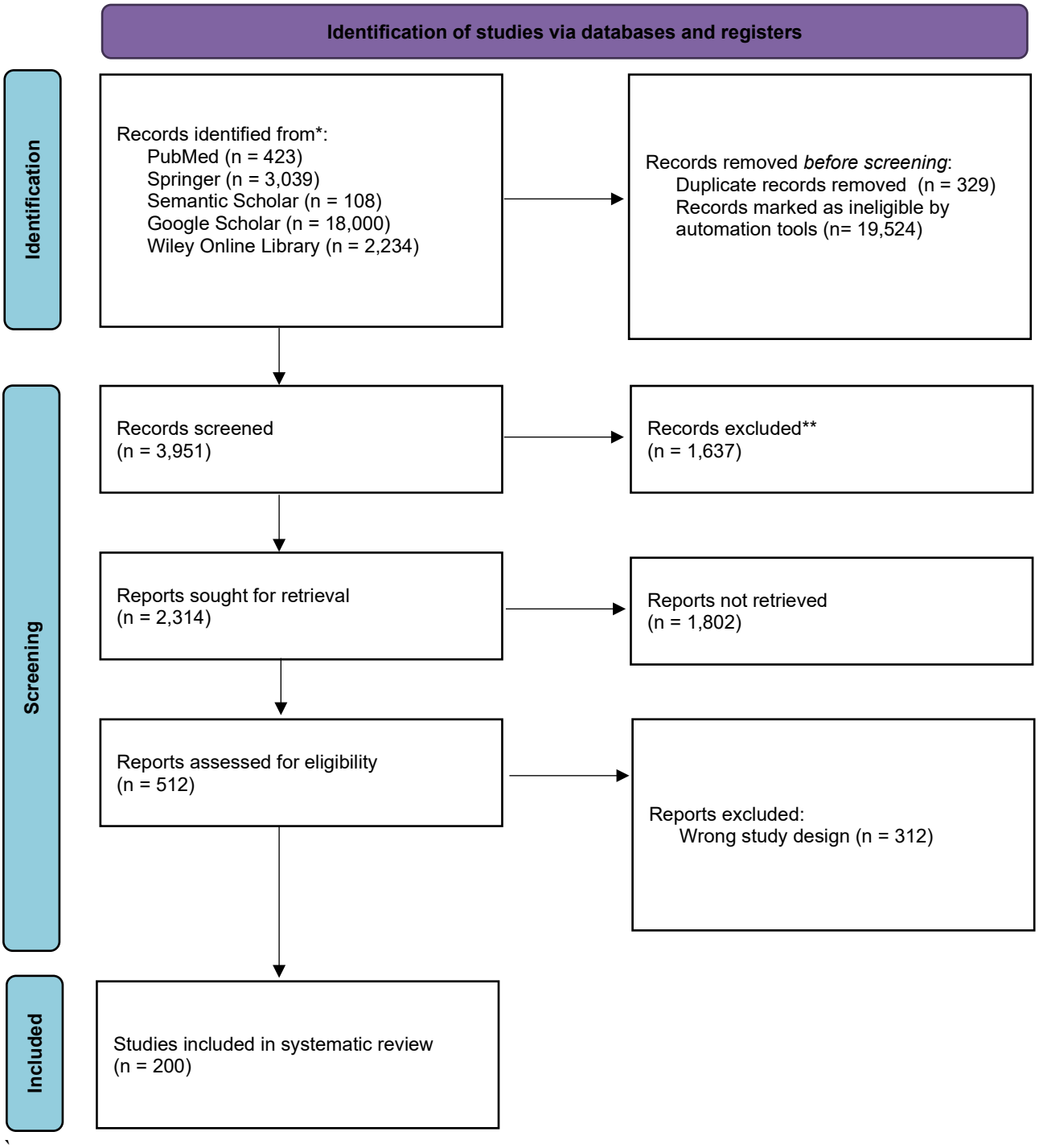

Figure 1. Article search flowchart

RESULTS

Study Characteristics

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
R. Oliveri et al. (2011)	Not specified	645	Not mentioned	Unresectable HCC	Not mentioned	Not mentioned
Tan-yang Zhou et al. (2024)	Southeast China	82 vs 81	Not mentioned	HCC with PVTT	Not mentioned	Median 25.6 months
Hyo-suk Lee et al. (2002)	Asia	91 vs 91 (HR)	UICC, CLIP	Operable HCC (UICC T1-3N0M0)	Child-Pugh A	Median 83 months
R. Golfieri et al. (2014)	Italy	89 vs 88	BCLC	Intermediate (BCLC-B)	Child-Pugh A (86%)	At least 2 years
L. Marelli et al. (2007)	International	412 (TACE vs TAE)	Not mentioned	Unresectable HCC	Not mentioned	Not mentioned
Jun Luo et al. (2011)	Not specified	84 vs 80 (conservative)	Not mentioned	Unresectable HCC with PVTT	Not mentioned	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Hyo-Joon Yang et al. (2014)	Not specified	66 vs 131 (HR/RFA)	Not mentioned	Small single-nodule HCC	Not mentioned	Up to 5 years
Y. Huo et al. (2015)	International	Not specified	Not mentioned	Unresectable HCC	Not mentioned	Up to 5 years
A. Facciorusso et al. (2016)	International	1096 vs 461 (Y90RE)	Not specified	Hepatocarcinoma	Not specified	Up to 3 years
R. Salem et al. (2016)	USA	21 vs 24 (Y90)	BCLC	BCLC A or B	Child-Pugh A/B	Median 17.2 months
M. Kudo et al. (2019)	Japan	76 vs 80 (TACE+ sorafenib)	BCLC	Unresectable HCC	Child-Pugh A (≤7 points)	Median 122.3 weeks

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
M. Kudo et al. (2025)	Global	243 vs 237 (TACE+ lenvatinib+pembro)	Not mentioned	Unresectable, non-metastatic HCC	Child-Pugh A	Median 25.6 months
G. Choi et al. (2013)	Not specified	164 vs 191 (sorafenib alone)	BCLC	BCLC stage C	Not mentioned	Median 5.5 months
K. Takayasu et al. (2010)	Not specified	8507 vs 2523 (infusion)	Not mentioned	Unresectable HCC	Not mentioned	Not mentioned
Lin Li et al. (2018)	International	TACE alone vs TACE+sorafenib	BCLC	BCLC B/C	Child-Pugh A/B	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Riccardo Lencioni et al. (2024)	Global	205 vs 204 (D+B+TACE), 207 (D+TACE)	BCLC	BCLC A/B/C	Child-Pugh A to B7	Not mentioned
M. Biselli et al. (2005)	Not specified	56 vs 56 (supportive care)	CLIP, Okuda	Unresectable HCC	Matched by Child-Pugh score	Median 16 months (TACE)
C. Stevens et al. (2017)	International	409 vs 452 (HR)	Not mentioned	Solitary large HCC (≥5 cm)	Adequate liver function	Up to 5 years
J. Llovet et al. (2022)	International	950 (1:1 randomization)	BCLC (implied)	Intermediate-stage HCC	Child-Pugh A	5 years (planned)

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
L. Liang et al. (2017)	Asia	1415 vs 1204 (resection)	BCLC	BCLC intermediate stage	Not mentioned	Up to 5 years
Tong-Chun Xue et al. (2013)	Asia	923 vs conservative	BCLC	BCLC stage C with PVTT	Child-Pugh A/B	At least 1 year
A. Muhammad et al. (2013)	Not specified	30 vs 13 (TACE+ sorafenib)	BCLC, CTP	Unresectable HCC	Child-Turcotte-Pugh (CTP)	Not mentioned
I-Cheng Lee et al. (2012)	Taiwan	46 vs 59 (supportive care)	BCLC	BCLC stage C with EHM	Not mentioned	Not mentioned
Minjie Yang et al. (2014)	Not specified	42 vs 43 (TACE+ I-125)	Not mentioned	HCC with PVTT	Not mentioned	360 days

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
M. Mabed et al. (2009)	Not specified	50 vs 50 (doxorubicin)	Okuda	Unresectable HCC	Child class A	Not mentioned
S. Yu et al. (2013)	Not specified	90 (1:1 TEA vs TACE)	Not mentioned	Unresectable HCC	Not mentioned	Not mentioned
T. Okusaka et al. (2009)	Japan	82 vs 79 (TAI)	Not mentioned	Unresectable HCC	Not mentioned	Not mentioned
M. Kudo et al. (2022)	Japan	76 vs 80 (TACE+ sorafenib)	BCLC	Unresectable HCC	Child-Pugh A/B	Median 33.4 months

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Feng Xie et al. (2012)	Not specified	1,233 patients for chemoembolization and 597 patients for microsphere embolization	Not mentioned	surgically unresectable HCC	Not specified	Not specified
F. A. Rahman et al. (2016)	Malaysia	34 vs 45	Not mentioned	Unresectable HCC	Not mentioned	Median 11.8 months
I. Labgaa et al. (2020)	International	980 vs 750 (PH)	BCLC	BCLC-B	Not mentioned	Up to 5 years

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Ruihua Duan et al. (2023)	International	3823 vs 4423 (TACE+ TKIs)	BCLC	uHCC (mainly BCLC A/B)	Child-Pugh A/B	Not mentioned
Ze-xin Zhu et al. (2016)	China	TACE alone vs TACE+ 131I-metuximab	Not mentioned	Intermediate/ Advanced stage HCC	Not mentioned	Up to 2 years
Shoujie Zhao et al. (2020)	China	TACE alone vs TACE+apatinib	Not mentioned	Intermediate-to advanced-stage HCC	Not mentioned	At least 1 year
P. Chen et al. (2017)	International	1010 vs 822 (DEB-TACE)	Not mentioned	Unresectable HCC	Not mentioned	Up to 3 years

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
B. G. Song et al. (2024)	Korea	88 vs 160 (systemic therapy)	BCLC, mUICC	HCC with EHM	Child-Pugh A (88.7%)	Median 8.9 months
J. Ni et al. (2014)	International	1233 vs 601 (microspheres)	Not mentioned	HCC	Not mentioned	Up to 3 years
Biao Yang et al. (2018)	International	11 studies	BCLC	BCLC-B	Not mentioned	At least 1 year
Yuan-dong Sun et al. (2019)	China	1427	Not specified	Non-surgical HCC	Child-Pugh grade mentioned	Up to 3 years
J. Zeng et al. (2016)	Not specified	887	Not mentioned	Early or intermediate stage HCC	Not mentioned	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Peng Wang et al. (2014)	Not specified	102 vs 27 (symptomatic)	BCLC	Intermediate or advanced-stage HCC	Not mentioned	Not mentioned
M. Morse et al. (2012)	USA	77 vs 47 (TAE)	CLIP	Advanced HCC	Not mentioned	2 years
Bingli Liu et al. (2015)	China	50 vs 59 vs 53 (drug combos)	Not mentioned	Biopsy-confirmed HCC	Not mentioned	Not mentioned
G. Becker et al. (2005)	Not specified	25 vs 27 (TACE-PEI)	Okuda	Unresectable HCC	Not mentioned	2 years
A. Gomes et al. (2017)	USA	166 (triple) vs 147 (single)	BCLC, Okuda	Unresectable HCC	Child-Pugh A/B	Until death

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Yong Xie et al. (2020)	Not specified	TACE+sorafenib vs TACE+ placebo	Not mentioned	HCC	Not specified	Not specified
M. Yuen et al. (2003)	China	80 vs 16 (conservative)	Okuda	Okuda stage I or II	Child-Pugh A or B	Up to 4 years
Alexander Lawson et al. (2023)	International	609 (TACE vs TAE)	BCLC	Unresectable HCC	Well-preserved liver function	Up to 48 months
Tatiana Chernyshenko et al. (2025)	International	4,367 (DEB-TACE vs cTACE)	BCLC	BCLC A/B	Not mentioned	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
D. Bettinger et al. (2017)	Germany	42 vs 48 (sorafenib), 23 (combo)	BCLC	BCLC C/D	Child-Pugh A/B/C	Until Feb 2017
L. Marelli et al. (2006)	International	TACE+ablation vs TACE alone	Not mentioned	HCC	Not mentioned	Not mentioned
Beatrijs A. Seinstra et al. (2012)	Netherlands	70 vs 70 (Y90-RE)	BCLC	BCLC intermediate stage	Child-Pugh A to B	2 years
Bo Zhou et al. (2016)	China	76 vs 152 (TACE+Rg3)	BCLC	BCLC stage C	Adequate liver function	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
X. Tian et al. (2015)	International	TACE vs HR (6,297 total)	BCLC	BCLC A or B	Not mentioned	Up to 5 years
B. Poedjomartono et al. (2020)	Indonesia	31 vs 32 (TACE+ β-Glucan)	Not mentioned	Advanced HCC	Not mentioned	Not mentioned
N. Massarweh et al. (2016)	USA	373 vs 32 (TAE)	BCLC	Intermediate or advanced stage	Not mentioned	Not mentioned
Di Pan et al. (2023)	Asia	523 vs 644 (L alone)	Not mentioned	Advanced HCC	Not mentioned	Not specified
Yao-Kuang Huang et al. (2017)	Not specified	28 vs 28 (supportive care)	CLIP	Advanced HCC	Mainly Child-Pugh B	1 year

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Jun Luo et al. (2011a)	Not specified	83 vs 85 (HR)	Not mentioned	Large, multiple, resectable HCC	Not mentioned	Up to 5 years
Hui Wang et al. (2022)	China	49 vs 119 (TACE+ ACT)	Not mentioned	Intermediate to advanced HCC	Not mentioned	Up to 5 years
J. Zhao et al. (2017)	International	TACE vs TAI	Not mentioned	HCC	Child-Pugh Class	Not specified
Shao-Liang Zhu et al. (2015)	China	67 vs 180 (HR)	Not mentioned	Solitary huge HCC (≥ 10 cm)	Child-Pugh A/B7	Median 33.4 months (TACE)
M. Kirstein et al. (2018)	Germany	74 vs 98 (sorafenib)	Not mentioned	HCC with EHD	Not mentioned	Not mentioned
A. M. Romero et al. (2023)	Not specified	16 vs 12 (SBRT)	Not mentioned	HCC eligible for TACE	Not mentioned	Median 28.1 months

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Houqiao Bai et al. (2016)	China	TACE alone vs TACE+ 3DCRT	Not mentioned	HCC	Not mentioned	Up to 3 years
Lei Li et al. (2016)	International	TACE alone vs TACE+ablation	Not mentioned	Unresectable HCC	Not mentioned	1 and 3 years
Hiroki Nishikawa et al. (2012)	Japan	55 vs 56 (sorafenib)	UICC TNM (implied)	Stage IVA/IVB HCC	Child-Pugh A/B	Not specified
C. Koch et al. (2021)	Germany	65 vs 54 (TACE+ sorafenib), 82 (sorafenib)	BCLC	BCLC stage C	Child-Pugh A/B	Until Nov 2012

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Keerati Akarapatima et al. (2022)	Thailand	TACE vs BSC (118 total)	Not specified	Intermediate-stage HCC	Child-Pugh 5-8	Not mentioned
Biao Yang et al. (2021)	China	57 vs 59 (TACE-L)	Not mentioned	HCC with PVTT	Not specified	Not specified
Piao Wang et al. (2022)	International	1242 vs 1245 (PH)	BCLC	BCLC-B (multiple HCCs)	Not mentioned	Up to 5 years
C. Jin et al. (2003)	China	26 vs 24 (TACE+HIFU)	TNM	TNM stage IV	Not mentioned	Mean 8.16 months
H. Tong et al. (2017)	China	35 vs 36 (TACE+C+L)	BCLC	BCLC B/C	Child-Pugh A/B	3 years
T. Meyer et al. (2010)	Not specified	41 vs 44 (TAE)	Not mentioned	Intermediate stage (implied)	Child-Pugh A (81%)	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
H. Ye et al. (2016)	China	307 vs various	Not mentioned	HCC with main PVT thrombus	Not mentioned	Up to 24 months
P. Wen et al. (2019)	China	cTACE vs DEB-TACE (120 total)	Not mentioned	HCC	Not mentioned	Not mentioned
Churen Zhou et al. (2024)	China	32 vs 32 (TACE-Lenv)	BCLC	BCLC-B beyond up-to-seven	Child-Pugh	Median 19.2 months
NingjieJun LiFang et al. (2022)	Not specified	51 vs 45 (TACE+ apatinib)	Not mentioned	Intermediate-advanced HCC	Not mentioned	Not mentioned
Qu Xie et al. (2024)	Not specified	295 vs 151 (TACE+ Bev)	Not mentioned	uHCC	Not mentioned	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Jinbin Chen et al. (2017)	Asia	830 vs 853 (hepatectomy)	Not specified	HCC with MaVI	Not specified	Up to 5 years
A. Gjoreski et al. (2020)	Not specified	30 vs 30 (DEM-TACE)	BCLC	BCLC A/B	Child-Pugh A/B	At least 24 months
A. Turpin et al. (2020)	France	39 vs 39 (TACE+ sunitinib)	BCLC	BCLC B	Child-Pugh A/B	Median ~50 months
Vogl et al. (2021)	Germany	30 vs 31 (TACE+ DSM)	BCLC	BCLC A/B/C	Child-Pugh A/B	Not mentioned
Ye-yu Cai et al. (2018)	China	46 vs 36 (γ-knife), 39 (combo)	Not mentioned	Primary HCC	Not mentioned	Up to 24 months

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
D. Kim et al. (2019)	Not specified	Not applicable (compares TN-HCC vs R-HCC)	BCLC	BCLC 0-A to B-C	Not mentioned	Not mentioned
Zhicheng Lai et al. (2024)	China	66 vs 141 (SoraHAIC)	Not mentioned	Advanced HCC	Not mentioned	Until Oct 2020
Yue Hu et al. (2021)	Not specified	49 vs 98 (TACE+TKIs+ICIs)	Not mentioned	Advanced HCC	Not mentioned	Not mentioned
Ouyang Tao et al. (2022)	Not specified	69 vs 82 (TACE-A), 24 (TACE+RFA-A)	Not mentioned	Intermediate or advanced HCC	Child-Pugh stage	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Xin Liu et al. (2023)	China	1083 vs 188 (LR+TACE)	BCLC	HCC	Not mentioned	At least 4 years
Y. Baba et al. (2010)	Japan	102 vs 149 (HR)	UICC, CLIP, Milan	Solitary HCC (UICC T1-3N0M0)	Child-Pugh A	Not mentioned
S. Chung et al. (2021)	Not specified	469 vs 85 (sorafenib-first)	Not mentioned	Advanced HCC	Not mentioned	Not mentioned
Jeong Heo et al. (2025)	International	120 (cTACE), 85 (DEB-TACE)	BCLC	Embolization-eligible HCC	Not mentioned	Not mentioned
Jie Ji et al. (2024)	Not specified	46 vs 23 (combo)	Not mentioned	Ruptured HCC	Not mentioned	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Gun Ha Kim et al. (2024)	Not specified	440 vs 430 (RFA)	Not mentioned	Single small HCC (≤ 3 cm)	Child-Pugh A	Up to 10 years
Ya-Ping Chen et al. (2015)	China	TACE alone vs TACE+ SBRT (1143 total)	Not mentioned	Primary hepatic carcinoma	Not mentioned	Up to 5 years
C. Cammà et al. (2002)	International	TACE vs nonactive treatment	Not mentioned	Unresectable HCC	Not mentioned	2 years
Qiang-sheng Dai et al. (2014)	China	131 vs 156 (conservative)	Not mentioned	Unresectable infiltrating HCC	Not mentioned	Up to 24 months

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Katrin Hoffmann et al. (2008)	Germany	104 vs 104 (TACE+ placebo)	EASL criteria	HCC eligible for LTx	Not specified	24 months
Yifeng Liang et al. (2024)	International	Not applicable (NMA of 6 strategies)	Not specified	Advanced HCC	Not specified	Not specified
Shinya Sahara et al. (2012)	Japan	27 vs 24 (multi-drug)	Not mentioned	Unresectable HCC	Not mentioned	Not mentioned
Jingwen Feng et al. (2024)	International	TACE-T vs TACE-T-I	Not mentioned	Unresectable HCC	Not mentioned	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
M. Ikeda et al. (2017)	Japan	123 vs 124 (miriplatin)	LCSGJ (TNM)	TNM stage II/III	Child-Pugh A/B	Max 3 years
X. Wan et al. (2016)	China	245 vs 245 (TACE+ sorafenib)	Not mentioned	Unresectable/ recurrent HCC	Not mentioned	Not mentioned
B. Liang et al. (2020)	China	cTACE vs CSM-TACE	mRECIST	HCC	Child-Pugh B/C	Not mentioned
L. Savic et al. (2022)	Germany	248 vs 122 (DEB-TACE)	BCLC	Unresectable HCC	Child-Pugh	Until Dec 2014

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Jihye Kim et al. (2019)	Korea	117 vs 69 (sorafenib)	Not mentioned	HCC with EHM	Child-Pugh A (83.3%)	Median 6.7 months
S. Kwan et al. (2018)	USA	Embolization vs sorafenib (1017 total)	Not specified	Intermediate and advanced-stage	Not specified	2007-2011
Shoujie Zhao et al. (2020a)	Not specified	TACE vs sorafenib (323 total)	BCLC	BCLC stage C	Not mentioned	Up to 5 years
Jian Lu et al. (2023)	China	54 vs 51 (ISP-TACE)	Not mentioned	HCC with Vp4 PVTT	Not mentioned	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Sujing Zhang et al. (2025)	Not specified	70 vs 70 (TACE+ HAI-Nivolumab)	Not mentioned	HCC	Not mentioned	Median 13.87 months
M. Pinter et al. (2012)	Not specified	34 vs 63 (sorafenib)	BCLC	BCLC stage C	Child-Pugh A or B	Not mentioned
Xiuping Zhang et al. (2017)	Mostly China	735 vs 356 (TACE-S)	Not mentioned	HCC with PVTT	Child-Pugh A	2 months to 1 year
Ze-xin Zhu et al. (2018)	Not specified	421 vs 473 (TACE+ I-125)	Not mentioned	HCC	Not mentioned	Up to 2 years

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Xiaxia Pei et al. (2024)	Not specified	TACE+lenvatinib vs control (638 total)	Not mentioned	HCC	Not mentioned	Not mentioned
Mingheng Liao et al. (2013)	International	TACE alone vs TACE+local therapies	Not specified	HCC	Child-Pugh (varied)	1 and 3 years
Chuan-xing Li et al. (2009)	China	30 vs 38 (TACE+HIFU)	TNM	Large HCC	Liver function grade matched	(13+/-7) months
Mingzhi Hao et al. (2007)	China	TACE vs TACE+thalidomide	Not mentioned	Unresectable HCC	Not mentioned	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
T. Hung et al. (2013)	Taiwan	TACE vs supportive/chemo	Not mentioned	Diffuse infiltrative HCC	MELD score	Not mentioned
Di Pan et al. (2024)	Asia	900 vs 1452 (non-triple)	BCLC	BCLC B/C	Child-Pugh A/B	Not specified
S. Gray et al. (2017)	USA	15.9% treated vs 75% untreated	Not specified	HCC	Not specified	Not specified
Dailong Li et al. (2023)	Mostly China	TACE/Lenv alone vs TACE+ Lenv	Not mentioned	Advanced HCC	Not mentioned	Up to 18 months

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Yan Zhao et al. (2025)	China	1:1 TACE+sorafenib vs sorafenib	Not mentioned	Advanced-stage HCC	Not mentioned	Not mentioned
Fei Su et al. (2014)	Not specified	740 vs 774 (TACE-PEI)	Not mentioned	Primary HCC	Not mentioned	Up to 3 years
Yong-Fa Zhang et al. (2016)	Not specified	205 vs 115 (preop TACE)	Not mentioned	Resectable HCC with portal vein invasion	Not mentioned	Up to 5 years
I. Alrashidi et al. (2021)	Not specified	80 vs 79 (TACE+radiotherapy)	Not mentioned	Non-metastatic HCC invading HV/IVC	Child-Pugh A	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
R. Lencioni et al. (2016)	International	10,108	Not specified	HCC	Child-Pugh A/B	Up to 5 years
Guiliang Wang et al. (2016)	Not specified	899	Not mentioned	Advanced HCC	Not mentioned	Not mentioned
P. Wiggermann et al. (2011)	Not specified	22 vs 22 (DEB-TACE)	Not mentioned	Unresectable HCC	Child-Pugh A	Not mentioned
H. Sanoff et al. (2015)	USA	577 vs Y90	Not specified	HCC	Not specified	Not specified
Hannah Graf et al. (2008)	Not specified	131 vs 52 (TACE+ pravastatin)	VISUM-HCC score	Advanced HCC	Not specified	Up to 5 years
W. Cho et al. (2009)	China	TACE vs TACE+ herbal therapy	Not mentioned	HCC	Not mentioned	> 3 years

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
M. Hyun et al. (2018)	International	TACE vs PH (5,986 total)	BCLC	BCLC stage B/C	Not mentioned	Up to 5 years
K. Takayasu et al. (2012)	Japan	4966	Not mentioned	HCC unsuitable for curative treatment	Child-Pugh A/B	Mean 1.6 years
Yong Xie et al. (2021)	International	TACE+sorafenib vs sorafenib alone (3015 total)	Not mentioned	Intermediate–advanced HCC	Not mentioned	Not mentioned
F. Trevisani et al. (2016)	International	Not applicable	Not specified	HCC	Not specified	Up to 3 years

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Chuan Xu et al. (2016)	Not specified	TACE alone vs TACE+ RFA/PEI (108 total)	Milan criteria	HCC	Not mentioned	Not mentioned
M. Ikeda et al. (2013)	Japan/Korea	99	mRECIST	Unresectable HCC	Not mentioned	Not mentioned
Lili Gu et al. (2014)	International	1049 vs 1071 (combo)	Not mentioned	HCC	Not mentioned	1, 2, 3, 5 years
K. Chan et al. (2023)	International	2447 vs 1513 (Up-LR)	Not mentioned	Large HCC (≥5 cm)	Child-Pugh A (89.5%)	Not mentioned
Baosheng Ren et al. (2019)	China	247 vs 61 (TACE+ sorafenib)	BCLC	Unresectable HCC (BCLC-B/C)	Child-Pugh A/B	Until Feb 2017

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Yafei Zhang et al. (2015)	International	1048 vs 451 (TARE)	BCLC	Unresectable HCC	Child-Pugh A	Up to 3 years
Juanfang Liu et al. (2019)	Not specified	48 vs 34 (TACE+ apatinib)	Not mentioned	Large HCC	Not mentioned	Not mentioned
Dong-zhi Zhang et al. (2015)	Not specified	128 vs 312 (liver resection)	BCLC	Solitary HCC	Not mentioned	Up to 5 years
Jin Woo Choi et al. (2017)	Not specified	81 (31 with TACE+ CI)	Modified BCLC	HCC with sPVTT	Child-Pugh ≤7	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
S. J. Yu et al. (2014)	Hongkong	TACE vs Lipiodol - Ethanol-Ablation	Not Mentioned	Inoperable HCC	Not Mentioned	Not Mentioned
Hetong Zhao et al. (2017)	Shanghai, China	67 vs 75 (TACE-JD), 124 (TACE-SOR)	Not mentioned	Unresectable HCC	Child-Pugh A/B	86 months
L. Marelli et al. (2009)	Not specified	74 vs 50 (131I-lipiodol)	BCLC, CLIP, Okuda	Unresectable HCC	Child-Pugh A/B/C	Mean 270 days (TACE)
Yushan Zhao et al. (2024)	China	66 vs 103 (TLT)	BCLC	BCLC B/C	Child-Pugh A/B	23.0 months

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Yixing Chen et al. (2024)	Not specified	39 vs 35 (TACE+ EBRT)	Not mentioned	Inoperable HCC, confined to liver	Not mentioned	Not mentioned
Yuxia Zhu et al. (2019)	Not specified	Group A vs B (TACE+ Apatinib)	Not mentioned	Advanced HCC	Not mentioned	18 months
T. Peng et al. (2021)	Taiwan	112 vs 56 (TACE-S)	Not mentioned	Unresectable HCC	Child-Pugh mentioned	10 years
Na Guo et al. (2018)	China	TACE vs TACE+cinobufotalin	Not mentioned	Advanced HC	Not mentioned	Up to 3 years

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
K. English et al. (2019)	USA	TACE only vs TACE+ Ablation	Not mentioned	HCC	Child-Pugh Score	Median 15.5 months
Haidong Zhu et al. (2025)	China	100 vs 100 (TACE-CA)	BCLC	BCLC B-C	Not mentioned	Median 13.6 months
Ming Jin et al. (2024)	Not specified	L+P vs T+L+P (81 vs 63)	Not mentioned	uHCC	Not mentioned	Not mentioned
Y. Huang et al. (2017)	Not specified	144 vs 46 (TACE+ sorafenib)	BCLC	BCLC stage B	Child-Pugh A	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Kathryn Bress et al. (2025)	USA	144 vs 90 (Y90)	Not mentioned	HCC	Not mentioned	Not specified
Jun Zhang et al. (2024)	China	36 vs 37 (TACE)	Not mentioned	PHC	Not mentioned	3 years
Ya-min Liu et al. (2007)	Not specified	874 patients	Not mentioned	Primary HCC	Child grade	2 to 63 months
Hu-Yu Jiao et al. (2025)	Not specified	532 vs 72 (combo)	Not mentioned	Advanced HCC	Not mentioned	Not mentioned
X. Qu et al. (2012)	China	45 vs 45 (sorafenib)	BCLC	BCLC stage B/C	Not mentioned	Median 21 months
Zhao Wei et al. (2012)	Not specified	44 vs 44 (TACE+ sorafenib)	mRECIST	Intermediate-advanced HCC	Not mentioned	Until Jan 2011

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
F. Shaya et al. (2012)	USA	1,095 Medicare patients	Not specified	HCC	Not specified	2000-2009
区金锐 et al. (2007)	China	93 vs 328 (surgery), 44 (conservative)	TNM	Resectable HCC	Not mentioned	Up to 7 years
T. Meister et al. (2008)	Not specified	TACE palliative vs TACE bridging	Okuda	Ineligible for LTX vs Bridging to LTX	Not mentioned	Not mentioned
S. Kaneko et al. (2012)	Japan	103 total (TACE vs TACE+ TSU-68)	Not specified	Intermediate-stage HCC	Child-Pugh A	Not specified

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Xin Yin et al. (2019)	China	375 vs 177 (multi-modal)	BCLC	Locally advanced HCC	Child-Pugh A/B	Median 29.0 months
W. Fan et al. (2016)	Not specified	TACE vs TACE+ 131I metuximab (1302 total)	Not specified	HCC	Not specified	Not specified
M. Ikeda et al. (2012)	Japan/Korea	102	mRECIST	Unresectable HCC	Not mentioned	Not mentioned
K. Bzeizi et al. (2021)	International	2558 vs 2283 (DEB-TACE)	BCLC	Unresectable/ recurrent HCC	Child-Pugh A/B/C	Median 1.5 to 18 months

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Jing-Huai Zou et al. (2016)	Not specified	cTACE vs DEB-TACE	Not mentioned	HCC	Not mentioned	Not mentioned
Lu Wu et al. (2012)	Not specified	70 vs 68 (combo)	Not specified	Intermediate HCC	Child-Pugh A/B	Not mentioned
Wu-Kui Huang et al. (2017)	Not specified	11 vs 15 (TACE+ S-1)	BCLC	BCLC Stage B refractory to TACE	Child-Pugh ≤8	At least 10 months
Jiayun Jiang et al. (2024)	Not specified	TACE-Len vs TACE-Len-T	Not mentioned	uHCC	Not mentioned	Not mentioned
Song-Yao Chen et al. (2023)	Not specified	40 vs 40 (T+L), 40 (T+L+P)	BCLC	BCLC-B beyond up to seven	Not mentioned	Median 28 months
Manon Buijs et al. (2008)	USA	190	Not mentioned	Nonresectable HCC	Child-Pugh A/B	Not specified

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
K. Malagari et al. (2010)	Not specified	43 vs 41 (DEB-TACE)	Not specified	Intermediate-stage HCC	Not specified	12 months
M. Cai et al. (2021)	China	40 vs 41 (TACE-L-P)	BCLC, CNLC	Advanced HCC	Child-Pugh A/B	Median 13.7 months
Jack P. Silva et al. (2017)	International	1933	Not mentioned	HCC with PVT	Not mentioned	Up to 5 years
M. Ikeda et al. (2022)	Japan	101 vs 99 (DEB-TACE)	BCLC, mRECIST	Unresectable HCC	Child-Pugh A/B	At least 3 months
L. Casadaban et al. (2016)	USA	188	BCLC	BCLC 0-D	Not mentioned	Not mentioned
S. Mi et al. (2022)	International	LR vs TACE+ LR (22023 total)	BCLC	BCLC B HCC	Not mentioned	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
M. Kudo et al. (2023)	Japan	62	Not mentioned	Unresectable intermediate-stage HCC	Child-Pugh A	Minimum 24 months
Wei-Jian Guo et al. (2003)	Not specified	89 vs 76 (TACE+ irradiation)	Not specified	Large unresectable HCC	Child grade	Up to 5 years
A. Esmail et al. (2022)	Not specified	TA vs TandS	Milan Criteria	Unresectable HCC	Not mentioned	5 years
Po-Hong Liu et al. (2014)	Not specified	181 vs 247 (SR)	Not mentioned	HCC with PVTT	Not mentioned	Up to 5 years
Xiao-Ming Chen et al. (2004)	Not specified	496 vs 179 (TACE/ PEI)	Not mentioned	HCC	Not mentioned	5-7 years
Yan Zhao et al. (2016)	Not specified	508	BCLC	BCLC C-stage	Child-Pugh A/B	Median 9.3 months

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Luke Zhou et al. (2022)	Not specified	Surgical resection vs TACE	Not mentioned	Large primary HCC	Not mentioned	Not mentioned
M. Kirstein et al. (2017)	Germany	606	Not specified	Intermediate stage (59.8%)	Not specified	Not specified
Xinhua Zou et al. (2023)	Not specified	85 vs 80 (TACE-L-P)	mRECIST	HCC with PVTT	Child-Pugh grade	Not mentioned
Jian-jun Yan et al. (2002)	Not specified	50 vs 50 (TACE+MLT)	Not mentioned	Inoperable advanced PHC	Not mentioned	2 years
Haonan Liu et al. (2023)	China	39 vs 37 (TACE+AC)	BCLC	Advanced HBV-HCC	Child-Pugh A	Median 12 months
Mingzhi Hao et al. (2010)	Not specified	74 vs 72 (combo)	Not mentioned	Unresectable HCC	Not mentioned	Not mentioned
T. Vogl et al. (2024)	Germany	836	Not mentioned	HCC	Child-Pugh A/B	Not specified

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Yue-Meng Wan et al. (2017)	Not specified	41 vs 48 (TACE+ KA)	BCLC	Intermediate stage HCC	Child-Pugh B predominant	Not mentioned
Weizhi Xia et al. (2022)	China	148 vs 68 (TACE-AP)	BCLC	BCLC stage C	Child-Pugh A/B	Until April 2022
Yulong Tang et al. (2015)	Asia	TACE vs hepatic resection after TACE	Not mentioned	HCC	Not mentioned	Not mentioned
S. Kalva et al. (2014)	Not specified	80	BCLC	advanced-stage (BCLC-C) HCC	Not mentioned	Not mentioned

Study	Country/Region	Sample Size (TACE vs control)	Staging System Used	Predominant Disease Stage	Child-Pugh Distribution	Follow-up Duration
Liming Lu et al. (2019)	International	TACE vs TACE+ 3-DCRT (632 total)	Not specified	Primary HCC (Stage III)	Not specified	Median 12 months

TACE Intervention Protocols

Study	TACE Type	Chemotherapy Agents and Doses	Embolic Agents	Lipiodol Use	Number of Sessions	Treatment Interval
Tan-yang Zhou et al. (2024)	DEB-TACE, cTACE	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Hyo-suk Lee et al. (2002)	Not specified	Not mentioned	Not mentioned	Yes, for CT	Repeated sessions	Not mentioned
R. Golfieri et al. (2014)	DEB-TACE, cTACE	Doxorubicin (DEB), Epirubicin (cTACE)	DC-Beads, Gelatin sponge	Yes, in cTACE	Median 2 per arm, 'on-demand'	Not specified

Study	TACE Type	Chemotherapy Agents and Doses	Embolic Agents	Lipiodol Use	Number of Sessions	Treatment Interval
L. Marelli et al. (2007)	TACE, TAE	Doxorubicin, cisplatin, epirubicin, etc.	Gelatin sponge (71%), PVA (8%)	Yes, no benefit found	Mean 2.5 per patient	2 months
Jun Luo et al. (2011)	cTACE	Anticancer agents (not specified)	Gelatin sponge	Yes	Mean 1.9 (range 1-5)	Not specified
R. Salem et al. (2016)	cTACE	Not specified (75 mg/m^2)	Embospheres (microspheres)	Yes	Not specified (one patient had 3)	Not specified
M. Kudo et al. (2019)	cTACE	Epirubicin or miriplatin	Gelpart (gelatin sponge)	Yes	On-demand	Median 16.9-21.1 weeks
K. Takayasu et al. (2010)	TACE	Anticancer agent (not specified)	Gelatin sponge particles	Yes (Iodized oil)	Not mentioned	Not mentioned
Lin Li et al. (2018)	c-TACE, DEB-TACE	Not specified	Lipiodol, micro-beads	Yes, in c-TACE	Range 1 to 3	Not specified

Study	TACE Type	Chemotherapy Agents and Doses	Embolic Agents	Lipiodol Use	Number of Sessions	Treatment Interval
Riccardo Lencioni et al. (2024)	cTACE or DEB-TACE	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Durvalumab Q4W, then Q3W
J. Llovet et al. (2022)	cTACE or DEB-TACE	Epirubicin, doxorubicin, or cisplatin	DEB beads	Yes, in cTACE	Up to 2 per lesion	Not specified
Tong-Chun Xue et al. (2013)	cTACE	Mitomycin	Gelatin sponge particles	Yes (Iodized oil)	Mean 1.5 to 3	1 to 3 months
M. Mabed et al. (2009)	cTACE	Doxorubicin and cisplatin	Not mentioned	Yes	Not mentioned	Not mentioned
S. Yu et al. (2013)	TACE	Cisplatin-ethiodized oil emulsion	Gelatin-sponge pellets	Yes (Ethiodized oil)	Not mentioned	Not mentioned
T. Okusaka et al. (2009)	TACE	Zinostatin stimalamer	Gelatin sponge	Not mentioned	Repeated as needed	Not mentioned

Study	TACE Type	Chemotherapy Agents and Doses	Embolic Agents	Lipiodol Use	Number of Sessions	Treatment Interval
M. Kudo et al. (2022)	cTACE	Epirubicin or Miriplatin	Gelpart (gelatin sponge)	Yes	Repeated on-demand	Not specified
F. A. Rahman et al. (2016)	c-TACE, DEB-TACE	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Ruihua Duan et al. (2023)	cTACE, DEB-TACE	Sorafenib, lenvatinib, apatinib, etc.	Not specified	Not specified	Not specified	Not specified
B. G. Song et al. (2024)	cTACE	Doxorubicin hydrochloride	Gelatin sponge pledgets	Yes (Iodized oil)	On-demand	Every 2-4 months imaging
J. Ni et al. (2014)	c-TACE, DEB-TACE, Y90	Not specified	Lipiodol, DEB, Y90 microspheres	Yes, in c-TACE	Not specified	Not specified

Study	TACE Type	Chemotherapy Agents and Doses	Embolic Agents	Lipiodol Use	Number of Sessions	Treatment Interval
Bingli Liu et al. (2015)	TACE	Doxorubicin, Mitomycin C, Gemcitabine	Not mentioned	Yes	Not mentioned	Not mentioned
A. Gomes et al. (2017)	Triple-drug TACE, DEB-TACE	Doxorubicin, cisplatin, mitomycin-C	Microsphere embolic, DEB	Yes (Ethiodized oil)	Not mentioned	Not mentioned
Alexander Lawson et al. (2023)	cTACE, DEB-TACE	Doxorubicin, epirubicin, cisplatin, mitomycin C	DEB, Lipiodol	Yes	Single vs. repeat sessions	Not specified
D. Bettinger et al. (2017)	cTACE, DEB-TACE	Epirubicin and mitomycin	Gelatin sponge, PVA particles	Yes	Mean 1.7 sessions	On-demand

Study	TACE Type	Chemotherapy Agents and Doses	Embolic Agents	Lipiodol Use	Number of Sessions	Treatment Interval
Beatrijs A. Seinstra et al. (2012)	DEB-TACE	Doxorubicin (max 150 mg)	DC Bead W microspheres	No	Maximum of 3 sessions	2 month intervals
Bo Zhou et al. (2016)	cTACE	Epirubicin, oxaliplatin, 5-fluorouracil	Gelatin sponge	Yes (Iodized oil)	Not mentioned	Not mentioned
Yao-Kuang Huang et al. (2017)	cTACE	Not specified	Gel foam	Yes	Median of 2 sessions	Not specified
J. Zhao et al. (2017)	TACE	Cisplatin, epirubicin, mitomycin C, doxorubicin	Gelatin sponge	Yes	Not specified	Not specified
Shao-Liang Zhu et al. (2015)	cTACE	5-fluorouracil (500 mg/m²), adriamycin (30 mg/m²)	Not mentioned	Yes (5-15 mL)	2-6 cycles	1-2 months

Study	TACE Type	Chemotherapy Agents and Doses	Embolic Agents	Lipiodol Use	Number of Sessions	Treatment Interval
C. Koch et al. (2021)	cTACE	Mitomycin C, epirubicin, or doxorubicin	Not specified	Yes	Repeated as needed	4-8 weeks
Biao Yang et al. (2021)	cTACE	Epirubicin (40-45 mg)	Gelatin sponge particles	Yes (10-20 ml)	Not specified	Imaging every 3 months
H. Tong et al. (2017)	cTACE	Doxorubicin (20mg)	Gelatin sponge granules	Yes (10ml)	3 consecutive, then every 3 months	2 months, then 3 months
T. Meyer et al. (2010)	TACE	Cisplatin 50 mg	Polyvinyl alcohol (PVA) particles	No	Maximum of 3	Three weekly
Churen Zhou et al. (2024)	DEM-TACE, cTACE	Pirarubicin (40-50 mg)	HepaSphere microspheres, lipiodol	Yes, in cTACE	Mean 2.7-3.5 sessions	Not specified

Study	TACE Type	Chemotherapy Agents and Doses	Embolic Agents	Lipiodol Use	Number of Sessions	Treatment Interval
A. Turpin et al. (2020)	DEB-TACE	Doxorubicin (max 150 mg)	DC Bead microspheres (300-700 µm)	No	1-3 sessions initially	6 to 8 weeks
Vogl et al. (2021)	cTACE	Mitomycin C (max 8 mg/m²)	Lipiodol, degradable starch microspheres (DSM)	Yes	3 sessions	4-week intervals
Jihye Kim et al. (2019)	cTACE	Doxorubicin hydrochloride	Gelatin sponge pledgets	Yes	Median of 2 sessions	Median 1.4 months
L. Savic et al. (2022)	cTACE, DEB-TACE	Doxorubicin, Mitomycin C	Embospheres, LC Beads	Yes, in cTACE	Mean 1.7-2.3 sessions	On-demand
M. Ikeda et al. (2022)	cTACE, DEB-TACE	Epirubicin (max 150 mg)	Gelpart, DC bead	Yes, in cTACE	Up to 2 sessions	Within 1 month

Comparison Treatments and Standard Care Definitions

Study	Comparison Treatment Type	Specific Protocol/Regimen	Treatment Duration	Crossover Rates
R. Oliveri et al. (2011)	Placebo, sham, or no intervention	Not mentioned	Not mentioned	Not mentioned
Tan-yang Zhou et al. (2024)	cTACE	Not mentioned	Not mentioned	Not mentioned
Hyo-suk Lee et al., 2002	Hepatic resection (HR)	Standard surgical resection	Median follow-up 83 months	Yes, TACE for patients who refused surgery
R. Golfieri et al. (2014)	cTACE	Epirubicin-Lipiodol emulsion + gelatin sponge	Min. 2 years or until death	Yes, to other treatments after progression
L. Marelli et al. (2007)	Transarterial Embolization (TAE)	Not mentioned	Not mentioned	Not mentioned
Jun Luo et al. (2011)	Conservative treatment	Not mentioned	Not mentioned	Not mentioned
Hyo-Joon Yang et al. (2014)	Hepatic resection (HR), Radiofrequency ablation (RFA)	Not mentioned	Not mentioned	Not mentioned
Y. Huo et al. (2015)	TACE alone	Not mentioned	Not mentioned	Not mentioned

Study	Comparison Treatment Type	Specific Protocol/Regimen	Treatment Duration	Crossover Rates
A. Facciorusso et al. (2016)	Yttrium-90 radioembolization (Y90RE)	Not detailed	Not mentioned	Not mentioned
R. Salem et al. (2016)	cTACE	75 mg/m^2 drug/lipiodol + microspheres	24-48 hours admission	One crossover from cTACE to Y90
M. Kudo et al. (2019)	TACE alone	Epirubicin or miriplatin + Gelpart	Until unTACEable progression	Not mentioned
M. Kudo et al. (2025)	TACE + dual placebo	Matched oral and intravenous placebo	Up to 2 years	Not mentioned
G. Choi et al. (2013)	Sorafenib monotherapy	Sorafenib therapy for at least 5 weeks	At least 5 weeks	Not mentioned
K. Takayasu et al. (2010)	Transarterial infusion without embolization	Emulsion of iodized oil and anticancer agent	Not mentioned	Not mentioned
C. Stevens et al. (2017)	Hepatic resection	Not mentioned	Not mentioned	Not mentioned
J. Llovet et al. (2022)	TACE with placebos	Oral and intravenous placebos	Until progression or toxicity	Not mentioned

Study	Comparison Treatment Type	Specific Protocol/Regimen	Treatment Duration	Crossover Rates
L. Liang et al. (2017)	Surgical resection	Not mentioned	Not mentioned	Not mentioned
Tong-Chun Xue et al. (2013)	Conservative treatment	Not mentioned	Not mentioned	Not mentioned
I-Cheng Lee et al. (2012)	Supportive treatment	Not mentioned	Not mentioned	Not mentioned
M. Mabed et al. (2009)	Systemic doxorubicin alone	Not mentioned	Not mentioned	Not mentioned
S. Yu et al. (2013)	Transarterial ethanol ablation (TEA)	Ethiodized oil-ethanol mixture	Not mentioned	Not mentioned
T. Okusaka et al. (2009)	Transarterial Infusion Chemotherapy (TAI)	Zinostatin stimalamer without gelatin sponge	Repeated as needed	Not mentioned
M. Kudo et al. (2022)	TACE alone	Lipidol + epirubicin/miriplatin + Gelpart	Until untreatable progression	Yes, to post-trial treatments
Feng Xie et al. (2012)	Microsphere embolization	Not mentioned	Not mentioned	Not mentioned
I. Labgaa et al. (2020)	Partial Hepatectomy (PH)	Not specified	Not specified	Not mentioned

Study	Comparison Treatment Type	Specific Protocol/Regimen	Treatment Duration	Crossover Rates
B. G. Song et al. (2024)	Sorafenib, Lenvatinib, Immunotherapy	Various protocols specified	Regular 8-12 week monitoring	Not accounted for
Biao Yang et al. (2018)	Liver resection (LR)	Not mentioned	Not mentioned	Not mentioned
Yuan-dong Sun et al. (2019)	TACE alone	Not mentioned	Not mentioned	Not mentioned
Peng Wang et al. (2014)	Symptomatic treatment alone	Not mentioned	Not mentioned	Not mentioned
M. Morse et al. (2012)	Transarterial Embolization (TAE)	Not mentioned	Not mentioned	Not mentioned
M. Yuen et al. (2003)	Conservative treatment	Not mentioned	Not mentioned	Not mentioned
Alexander Lawson et al. (2023)	TAE	Not specified	Not specified	Not mentioned
D. Bettinger et al. (2017)	Sorafenib	800 mg/day (most started at 400)	Median 59 days	Yes
Beatrijs A. Seinstra et al. (2012)	TACE	Max 3 sessions with doxorubicin beads	Spaced over months	Not mentioned

Study	Comparison Treatment Type	Specific Protocol/Regimen	Treatment Duration	Crossover Rates
N. Massarweh et al. (2016)	Transarterial Embolization (TAE)	Not mentioned	Not mentioned	Not mentioned
Di Pan et al. (2023)	Lenvatinib (L) monotherapy	Not specified	Not specified	Not mentioned
Yao-Kuang Huang et al. (2017)	Supportive care	Not mentioned	Up to 1 year	Not mentioned
Hiroki Nishikawa et al. (2012)	Sorafenib	Doses started at 200mg or 400mg b.i.d.	Median duration 73 days	Dose reductions common
C. Koch et al. (2021)	Sorafenib alone, TACE alone	Standard protocols	TACE repeated every 4-8 weeks	Dose reductions common
Keerati Akarapatima et al. (2022)	Best Supportive Care (BSC)	Not mentioned	Not mentioned	Not mentioned
Biao Yang et al. (2021)	TACE plus sorafenib (TACE-S)	Sorafenib 400 mg twice daily	Until progression or toxicity	Not mentioned
Piao Wang et al. (2022)	Partial Hepatectomy (PH)	Not mentioned	Not mentioned	Not mentioned
C. Jin et al. (2003)	TACE alone	Not mentioned	Mean follow-up 8.16 months	Not mentioned

Study	Comparison Treatment Type	Specific Protocol/Regimen	Treatment Duration	Crossover Rates
T. Meyer et al. (2010)	TAE alone	PVA particles alone, max 3 treatments	Max 3 treatments	Not mentioned
H. Ye et al. (2016)	Surgical intervention, sorafenib, palliative treatment	Not mentioned	Not mentioned	Not mentioned
A. M. Romero et al. (2023)	Stereotactic Body Radiation Therapy (SBRT)	Six fractions of 8-9Gy	Median follow-up 28.1 months	Not mentioned
Shoujie Zhao et al. (2020a)	Sorafenib	Not mentioned	Not mentioned	Not mentioned
M. Pinter et al. (2012)	Sorafenib	Not mentioned	Median 4.6 months	Not mentioned
S. Kwan et al. (2018)	Sorafenib	Not mentioned	Not mentioned	Not mentioned
Katrin Hoffmann et al. (2008)	TACE plus placebo	TACE with carboplatin and lipiodol	Until progression or LTx	Not mentioned

Overall Survival Outcomes

The effectiveness of TACE on overall survival (OS) has been extensively studied, with varied results depending on the comparator, patient population, and study design. When compared to supportive or non-active treatment, TACE has generally demonstrated a significant survival

benefit. One case-control study reported a median OS of 25 months for TACE versus 7 months for supportive care (P = .0004). Similarly, a comparative study showed a median OS of 31.2 months with TACE versus 14.1 months with conservative treatment (p = 0.0126). A meta-analysis of five RCTs confirmed this benefit, showing a significant reduction in the 2-year mortality rate (odds ratio, 0.54). For patients with unresectable infiltrating HCC, TACE provided a median OS of 7.0 months versus 3.0 months for conservative care (P<0.001). A large database study found that patients treated with chemoembolization had a median survival of 20.1 months compared to 4.3 months for those not treated (P < .0001).

Comparisons with other TACE techniques or TAE have yielded less consistent results. A meta-analysis of three RCTs found no significant survival difference between TACE and TAE alone[p48_q4], a finding echoed by another RCT comparing cisplatin-based TACE with TAE (median OS 15.9 vs 16.2 months, p=0.82). However, a retrospective review found TACE prolonged progression-free survival (PFS) but not OS compared to TAE (p=0.83). A meta-analysis comparing TACE with transarterial infusion (TAI) without embolization also reported similar survival rates. Conversely, a large propensity score analysis showed TACE was associated with a higher survival rate than infusion therapy without embolization (HR 0.70, p=0.0001).

When comparing cTACE with DEB-TACE, results are mixed. Some studies found no significant difference in OS[p81_q4], while others reported a survival advantage with DEB-TACE[p49_q1][p128_q1]. One meta-analysis found DEB-TACE significantly improved 1-, 2-, and 3-year OS rates.

In comparisons with systemic therapies like sorafenib for advanced-stage disease, TACE has shown promising outcomes in select patients. Several studies reported similar OS between TACE and sorafenib monotherapy for BCLC C patients[p67_q4][p111_q4]. Another study found TACE-first treatment resulted in longer OS than sorafenib-first treatment (adjusted HR=0.58, P=0.002). Combining TACE with systemic agents has also been extensively investigated. The addition of sorafenib to TACE significantly improved time to progression (TTP) but not consistently OS[p40_q4][p127_q1]. However, some cohort studies and a meta-analysis of Asian patients did

find an OS benefit for the combination[p140_q4][p151_q1][p161_q4]. More recent trials combining TACE with newer TKIs like lenvatinib and immunotherapy have shown significant improvements in both PFS and OS compared to TACE alone or TKI monotherapy[p77_q4][p154_q1][p148_q1]. For instance, the LEAP-012 trial reported a median PFS of 14.6 months for TACE with lenvatinib and pembrolizumab versus 10.0 months for TACE with placebo (HR 0.66, p=0.0002).

Study	Median OS (TACE vs Control)	Hazard Ratio (95% CI)	p-value	1-Year Survival Rate (TACE vs Control)	2-Year Survival Rate (TACE vs Control)	3-Year Survival Rate (TACE vs Control)
R. Oliveri et al. (2011)	Not mentioned	0.88 (0.71-1.10) vs control	NS	Not mentioned	Not mentioned (OR 0.54 for 2y mortality)	Not mentioned
Tan-yang Zhou et al. (2024)	12.0 vs 8.0 months (cTACE)	Not mentioned for OS	0.039	Not mentioned	Not mentioned	Not mentioned
Hyo-suk Lee et al. (2002)	Not mentioned	Not mentioned	0.7512 (T3N0M0 vs HR)	Not mentioned	Not mentioned	Not mentioned
R. Golfieri et al. (2014)	29 vs 29 months (cTACE)	0.821 (0.513-1.313)	0.949	83.5% vs 86.2%	55.4% vs 56.8%	Not mentioned

Study	Median OS (TACE vs Control)	Hazard Ratio (95% CI)	p-value	1-Year Survival Rate (TACE vs Control)	2-Year Survival Rate (TACE vs Control)	3-Year Survival Rate (TACE vs Control)
Jun Luo et al. (2011)	5.2 (overall) vs 3.8 (conservative)	Not mentioned	<0.001	30.9% vs 3.8%	9.2% vs 0%	Not mentioned
M. Kudo et al. (2019)	Not analyzed	Not mentioned	NA	82.7% vs 96.2% (TACE+S)	64.6% vs 77.2% (TACE+S)	Not mentioned
M. Kudo et al. (2025)	Not reached vs Not reached (TACE+L+P)	0.80 (0.57-1.11)	0.087	Not mentioned	69% vs 75%	Not mentioned
G. Choi et al. (2013)	8.9 vs 5.9 months (sorafenib)	0.57 (vs sorafenib)	0.009	Not mentioned	Not mentioned	Not mentioned
K. Takayasu et al. (2010)	2.74 vs 1.98 years (infusion)	0.70 (0.63-0.76)	0.0001	81% vs 71%	Not mentioned	46% vs 33%

Study	Median OS (TACE vs Control)	Hazard Ratio (95% CI)	p-value	1-Year Survival Rate (TACE vs Control)	2-Year Survival Rate (TACE vs Control)	3-Year Survival Rate (TACE vs Control)
Lin Li et al. (2018)	Not mentioned	0.63 (0.55–0.71) vs TACE+S	0.058	Not mentioned	Not mentioned	Not mentioned
Riccardo Lencioni et al. (2024)	Not reached	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
M. Biselli et al. (2005)	25 vs 7 months (supportive)	Not mentioned	0.0004	74.3% vs 39.4%	52.1% vs 25.4%	Not mentioned
T. Okusaka et al. (2009)	646 vs 679 days (TAI)	Not mentioned	0.383	Not mentioned	Not mentioned	Not mentioned
M. Kudo et al. (2022)	30.8 vs 36.2 months (TACE+S)	0.861 (0.607–1.223)	0.40	Not mentioned	Not mentioned	Not mentioned
F. A. Rahman et al. (2016)	4.9 vs 8.3 months (DEB-TACE)	Not mentioned	0.008	Not mentioned	Not mentioned	Not mentioned

Study	Median OS (TACE vs Control)	Hazard Ratio (95% CI)	p-value	1-Year Survival Rate (TACE vs Control)	2-Year Survival Rate (TACE vs Control)	3-Year Survival Rate (TACE vs Control)
B. G. Song et al. (2024)	15.1 months vs 4.7 (sorafenib), 8.0 (lenvatinib), 14.3 (IO)	1.97 (vs sorafenib)	<0.001	Not mentioned	Not mentioned	Not mentioned
Peng Wang et al. (2014)	Not mentioned	Not mentioned	<0.001	61.8% vs 51.9%	34.0% vs 9.9%	24.3% vs 0%
M. Morse et al. (2012)	Not mentioned	Not mentioned	0.83 (vs TAE)	Not mentioned	Not mentioned	Not mentioned
M. Yuen et al. (2003)	31.2 vs 14.1 months (conservative)	Not mentioned	0.0126	86.3% vs 62.5%	78.8% vs 50%	57.5% vs 50%

Study	Median OS (TACE vs Control)	Hazard Ratio (95% CI)	p-value	1-Year Survival Rate (TACE vs Control)	2-Year Survival Rate (TACE vs Control)	3-Year Survival Rate (TACE vs Control)
Bo Zhou et al. (2016)	10.1 vs 13.2 months (TACE+Rg 3)	0.63 (0.46-0.85)	0.002	Not mentioned	Not mentioned	Not mentioned
Yao-Kuang Huang et al. (2017)	11.7 vs 3.8 months (supportive)	0.19 (0.08–0.42)	<0.01	41.2% vs 24.5%	Not mentioned	Not mentioned
Hui Wang et al. (2022)	14 vs 30 months (TACE+ACT)	0.504	<0.001	55.1% vs 84.0%	Not mentioned	18.4% vs 41.2%
Hiroki Nishikawa et al. (2012)	6.6 vs 9.2 months (sorafenib)	Not mentioned	0.814	34.4% vs 34.0%	14.2% vs 6.7%	Not mentioned

Study	Median OS (TACE vs Control)	Hazard Ratio (95% CI)	p-value	1-Year Survival Rate (TACE vs Control)	2-Year Survival Rate (TACE vs Control)	3-Year Survival Rate (TACE vs Control)
C. Koch et al. (2021)	10.5 months vs 16.5 (TACE+S), 8.4 (S alone)	Not mentioned	0.0023 (vs TACE+S)	Not mentioned	Not mentioned	Not mentioned
Keerati Akarapatima et al. (2022)	21.4 vs 8.2 months (BSC)	0.29 (0.17–0.49)	<0.001	Not mentioned	Not mentioned	Not mentioned
H. Ye et al. (2016)	10.39 months vs 4.13 (surg), 5.54 (soraf), 2.82 (pall)	Not mentioned	<0.0001	51.5% vs 0% (surg/soraf)	0% vs 0%	Not mentioned
Churen Zhou et al. (2024)	12.0 vs 28.0 months (TACE-Lenv)	Not mentioned for OS	0.017	50% vs 91%	38% vs 60%	16% vs 39%

Study	Median OS (TACE vs Control)	Hazard Ratio (95% CI)	p-value	1-Year Survival Rate (TACE vs Control)	2-Year Survival Rate (TACE vs Control)	3-Year Survival Rate (TACE vs Control)
Baosheng Ren et al. (2019)	14.9 vs 29.0 months (TACE+S)	0.684 (0.470-0.997)	0.018	Not mentioned	Not mentioned	Not mentioned

Progression-Free Survival and Tumor Response

Study	Assessment Criteria	CR Rate (TACE vs Control)	PR Rate (TACE vs Control)	ORR (TACE vs Control)	DCR (TACE vs Control)	Median PFS (TACE vs Control)
Tan-yang Zhou et al. (2024)	mRECIST	Not mentioned	Not mentioned	66.2% vs 46.8% (cTACE)	Not mentioned	6.0 vs 4.0 months
Golfieri et al. (2014)	Not mentioned	Not mentioned	Not mentioned	No difference	Not mentioned	9 vs 9 months (TTP, cTACE)
Marelli et al. (2007)	Not specified	Not mentioned	Not mentioned	40 +/- 20% (TACE)	Not mentioned	Not mentioned

Study	Assessment Criteria	CR Rate (TACE vs Control)	PR Rate (TACE vs Control)	ORR (TACE vs Control)	DCR (TACE vs Control)	Median PFS (TACE vs Control)
Huo et al. (2015)	Not specified	2.73 (OR for TACE+RT)	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Salem et al. (2016)	WHO, EASL	Not mentioned	Not mentioned	63% vs 52% (Y90)	Not mentioned	>26 vs 6.8 months (TTP, Y90)
Kudo et al. (2019)	Not mentioned	Not mentioned	Not mentioned	61.8% vs 71.3% (TACE+S)	Not mentioned	13.5 vs 25.2 months
Kudo et al. (2025)	mRECIST	Not mentioned	Not mentioned	Not mentioned	Not mentioned	10.0 vs 14.6 months (TACE+L+P)
Choi et al. (2013)	mRECIST	Not mentioned	Not mentioned	Not mentioned	Not mentioned	2.5 vs 2.1 months (TTP, sorafenib)
Lin Li et al. (2018)	RECIST/mRECIST	Not mentioned	Not mentioned	Not mentioned	Increased in TACE+S (OR 2.93)	2.6-10.2 months (TACE+S)

Study	Assessment Criteria	CR Rate (TACE vs Control)	PR Rate (TACE vs Control)	ORR (TACE vs Control)	DCR (TACE vs Control)	Median PFS (TACE vs Control)
Lencioni et al. (2024)	RECIST v1.1	Not mentioned	Not mentioned	29.6% vs 43.6% (D+B+TACE)	Not mentioned	8.2 vs 15.0 months
M. Mabed et al. (2009)	WHO standards	Not mentioned	32% vs 10% (chemo)	32% vs 10%	Not mentioned	32 vs 26 weeks (PFS, chemo)
Yu et al. (2013)	Not mentioned	51% vs 70% (TEA)	Not mentioned	Not mentioned	Not mentioned	9.3 vs 14.8 months
Kudo et al. (2022)	TACE-specific PD criteria	Not mentioned	Not mentioned	Not mentioned	Not mentioned	13.5 vs 22.8 months
Duan et al. (2023)	Not mentioned	1.78 (OR for CR)	1.95 (OR for PR)	2.13 (OR for ORR)	2.08 (OR for DCR)	vs TACE+TKIs (HR 0.72)
Chen et al. (2017)	Not specified	Not specified	Not specified	No significance	Not specified	1- & 2-year RFS higher in DEB-TACE

Study	Assessment Criteria	CR Rate (TACE vs Control)	PR Rate (TACE vs Control)	ORR (TACE vs Control)	DCR (TACE vs Control)	Median PFS (TACE vs Control)
M. Morse et al. (2012)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Prolonged with TACE (vs TAE)
Bingli Liu et al. (2015)	mRECIST	Not mentioned	Not mentioned	22.0% vs 40.7%/56.6 % (combos)	Not mentioned	6.4 vs 6.4/6.8 months (TTP)
Malagari et al. (2010)	EASL criteria	26.8% vs 14.0% (bland)	46.3% vs 41.9% (bland)	Not mentioned	Not mentioned	42.4 vs 36.2 weeks (TTP, bland)
A. Turpin et al. (2020)	EASL criteria	9% vs 12% (placebo)	17% vs 35.3% (placebo)	Not mentioned	Not mentioned	9.05 vs 5.51 months
M. Pinter et al. (2012)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned	No difference vs sorafenib (TTP)

Study	Assessment Criteria	CR Rate (TACE vs Control)	PR Rate (TACE vs Control)	ORR (TACE vs Control)	DCR (TACE vs Control)	Median PFS (TACE vs Control)
Haidong Zhu et al. (2025)	RECICL	Not mentioned	Not mentioned	30.0% vs 65.0% (TACE-CA)	63.0% vs 87.0% (TACE-CA)	3.1 vs 11.0 months

Safety and Adverse Events

Study	Treatment-Related Mortality (TACE vs Control)	Serious AE Rates	Common AEs	Discontinuation Rates	Hospitalization Rates
Golfieri et al. (2014)	Not mentioned	Rare in both arms (<7%)	Post-procedural pain (higher in cTACE)	Not mentioned	Not mentioned
Marelli et al. (2007)	2.4% (TACE)	Acute liver failure (7.5%), renal failure (1.8%), bleeding (3%)	Not specified	Not mentioned	Not mentioned

Study	Treatment-Related Mortality (TACE vs Control)	Serious AE Rates	Common AEs	Discontinuation Rates	Hospitalization Rates
Kudo et al. (2025)	2% vs 0.4% (TACE+L+P)	Hypertension (24%), decreased platelets (11%)	Hypertension, decreased platelets	Not mentioned	Not mentioned
Lencioni et al. (2024)	2.0% vs 0% (D+B+TACE), 1.3% (D+TACE)	Not mentioned	Not mentioned	3.5% vs 8.4% (D+B+TACE), 4.3% (D+TACE)	Not mentioned
Xue et al. (2013)	0%-6%	Acute liver failure (<2%), GI bleeding (0-6%)	PES (35-94%), liver decompensation (26-85%)	Not mentioned	Not mentioned
Mabed et al. (2009)	4% vs 0% (chemo)	Liver failure (32%), GIT bleeding (15%)	Not mentioned	Not mentioned	Not mentioned

Study	Treatment-Related Mortality (TACE vs Control)	Serious AE Rates	Common AEs	Discontinuation Rates	Hospitalization Rates
Kudo et al. (2022)	Not mentioned	Not mentioned	Hand-foot skin reaction, hypertension, fatigue (higher in TACE+S)	Not mentioned	Not mentioned
Lawson et al. (2023)	2-3% (both)	Hepatic failure, ulceration, kidney failure	Pain, nausea, fatigue, fever, elevated liver enzymes	Not mentioned	Not mentioned
Seinstra et al. (2012)	Not mentioned	Not mentioned	Postembolization syndrome (37-100%)	Not mentioned	Not mentioned
Buijs et al. (2008)	1.6% (liver failure)	Leukocytopenia, anemia, thrombocytopenia	Not specified	Not mentioned	Not mentioned
Romero et al. (2023)	Not mentioned	3 grade ≥3 episodes vs 0 (SBRT)	Not mentioned	Not mentioned	Not mentioned

Study	Treatment-Related Mortality (TACE vs Control)	Serious AE Rates	Common AEs	Discontinuation Rates	Hospitalization Rates
Turpin et al. (2020)	Not mentioned	Liver failure (2 vs 1 in sunitinib)	Thrombocytopenia, neutropenia, elevated bilirubin, asthenia	2.6% vs 38.5% (sunitinib)	Not mentioned
Ni et al. (2014)	0% vs 0% (microspheres)	Similar rates	Fatigue, abdominal pain, nausea, fever	Not mentioned	Not mentioned
Lencioni et al. (2016)	0.6%	Acute liver failure (1%)	Liver enzyme abnormalities (52%), PES (48%)	Not mentioned	Not mentioned
Ren et al. (2019)	0% vs 0% (TACE+S)	Not mentioned	Fatique (19%), liver dysfunction (18%)	Not mentioned	Not mentioned

Study	Treatment-Related Mortality (TACE vs Control)	Serious AE Rates	Common AEs	Discontinuation Rates	Hospitalization Rates
Ikeda et al. (2017)	No deaths	Liver abscess (cTACE), biliary infection (DEB)	Fever, abdominal pain, nausea, elevated liver enzymes	Not mentioned	Not mentioned
Bzeizi et al. (2021)	Lower in DEB-TACE (OR 0.32)	No difference	Lower systemic AEs in DEB-TACE	Not mentioned	Not mentioned
Koch et al. (2021)	Not mentioned	Not mentioned	PES (30%), abdominal pain (41%), nausea (33%)	Not mentioned	Not mentioned

Effectiveness by Disease Stage and Liver Function

Study	BCLC Stage	Child-Pugh Class	Tumor Size/Burden	Vascular Invasion (PVTT/EHM)	Hazard Ratio / Outcome by Subgroup

Study	BCLC Stage	Child-Pugh Class	Tumor Size/Burden	Vascular Invasion (PVTT/EHM)	Hazard Ratio / Outcome by Subgroup
Hyo-suk Lee et al. (2002)	UICC T1-2, T3	A	Not specified	N0M0	HR superior in T1-2 (p=0.0058); TACE comparable in T3 (p=0.7512)
Tan-yang Zhou et al. (2024)	Not specified	Not specified	Not specified	PVTT present	PVTT group was an independent prognostic factor for OS
Golfieri et al. (2014)	A, B, C	A, B	Single vs. >3 tumors	Portal vein thrombosis excluded	Tumor number independently predicted survival

Study	BCLC Stage	Child-Pugh Class	Tumor Size/Burden	Vascular Invasion (PVTT/EHM)	Hazard Ratio / Outcome by Subgroup
Jun Luo et al. (2011)	Not specified	Not specified	Tumor size prognostic	Segmental and major PVTT	TACE effective in segmental (p=0.002) and major PVTT (p=0.002)
M. Kudo et al. (2022)	B/C	A/B (≤7)	Beyond up-to-7 criteria	No vascular invasion	TACE+S showed benefit for OS and PFS in patients with high tumor burden
I. Labgaa et al. (2020)	B	Not mentioned	Intermediate stage burden	Not mentioned	Resection superior to TACE in BCLC-B (Time Ratio 1.91)

Study	BCLC Stage	Child-Pugh Class	Tumor Size/Burden	Vascular Invasion (PVTT/EHM)	Hazard Ratio / Outcome by Subgroup
B. G. Song et al. (2024)	HCC with EHM	A (88.7%)	<5cm vs >=5cm	Portal vein invasion present	TACE had advantage for tumors <5cm; TACE OS comparable to lenvatinib/IO
M. Mabed et al. (2009)	Okuda 1	A	Single lesions	Not specified	Better TACE response in Okuda 1 (p=0.005), Child-Pugh A (p=0.007)
C. Stevens et al. (2017)	Not specified	Adequate function	Solitary ≥5 cm	Not specified	Resection superior (HR 0.60 for 3y OS)
K. Malagari et al. (2010)	Intermediate stage	Not specified	Randomized by diameter	Not mentioned	DEB-TACE showed longer TTP (p=0.008)

Study	BCLC Stage	Child-Pugh Class	Tumor Size/Burden	Vascular Invasion (PVTT/EHM)	Hazard Ratio / Outcome by Subgroup
I. Alrashidi et al. (2021)	Non-metastatic	A	<9 cm vs ≥9 cm	HV/IVC invasion	TACE+RT better OS for Child-Pugh A, size <9cm, number <4
L. Savic et al. (2022)	Mainly BCLC C	A vs B/C	Infiltrative vs nodular	Not specified	cTACE better for infiltrative (p=0.003); DEB-TACE better for nodular (p=0.007)
Churen Zhou et al. (2024)	B (beyond up-to-seven)	Not specified	High tumor burden	Not specified	TACE-Lenv superior for OS (p=0.017) and PFS (p=0.018)
Yan Zhao et al. (2016)	C	A, B	≥5 cm vs <5 cm	PVTT, EHM	Median OS better without PVTT (16.9 vs 6.1 months)

Study	BCLC Stage	Child-Pugh Class	Tumor Size/Burden	Vascular Invasion (PVTT/EHM)	Hazard Ratio / Outcome by Subgroup
Yushan Zhao et al. (2024)	B, C	A, B	>7cm vs ≤7cm	PVTT present	TLT superior for >7cm, AFP>400, Child-Pugh A, and PVTT

DISCUSSION

This systematic review synthesizes a vast body of literature to evaluate the effectiveness of TACE compared to standard care in patients with hepatocellular carcinoma. The findings confirm TACE's established role while also illuminating the significant shifts occurring in the treatment paradigm for this disease.

Summary of Main Findings and Comparison with Existing Literature

The most unequivocal finding is that TACE offers a substantial survival advantage over best supportive care or no active treatment, reinforcing its status as the cornerstone of therapy for patients with unresectable HCC who are not candidates for curative treatments (Biselli et al., 2005; Cammà et al., 2002; Yuen et al., 2003). This benefit is particularly pronounced in patients with preserved liver function (Child-Pugh A) and good performance status, a finding consistently echoed across numerous studies (Mabed et al., 2009; Savic et al., 2022).

When compared to other active therapies, the picture becomes more nuanced. In the context of advanced-stage disease (BCLC C), where systemic therapy like sorafenib is the standard, TACE has demonstrated comparable or even superior survival in selected patient cohorts, particularly

those with a dominant intrahepatic tumor burden (Pinter et al., 2012; Song et al., 2024). This suggests that TACE remains a valuable option for selected advanced-stage patients, challenging a strict interpretation of guidelines that reserve it solely for intermediate-stage disease (Zhao et al., 2016).

The comparison between TACE techniques (cTACE vs. DEB-TACE) revealed no consistent survival advantage for one over the other, although DEB-TACE was frequently associated with a more favorable safety profile, including lower rates of post-embolization syndrome and systemic toxicity (Bzeizi et al., 2021; Chen et al., 2017; Golfieri et al., 2014). This suggests that the choice of technique may be guided more by patient-specific factors, such as tumor morphology (Savic et al., 2022), and institutional preference rather than a clear survival imperative.

The most transformative finding of this review is the clear benefit of combining TACE with systemic therapies. The TACTICS trial demonstrated that adding sorafenib to TACE significantly improved progression-free survival (Kudo et al., 2022). More recent phase 3 trials, such as EMERALD-1 and LEAP-012, have moved the field forward by showing that combining TACE with both a TKI and an ICI (durvalumab + bevacizumab or lenvatinib + pembrolizumab) results in a marked and clinically meaningful improvement in PFS compared to TACE alone (Kudo et al., 2025; Lencioni et al., 2024). These results are poised to redefine the standard of care for embolization-eligible patients, particularly those with a higher tumor burden.

Effectiveness Moderators and Patient Selection

The evidence strongly underscores that the success of TACE is not uniform. Liver function, as measured by the Child-Pugh score, remains the single most important predictor of survival and treatment tolerance (Mabed et al., 2009; Savic et al., 2022). Tumor burden, including size, number of nodules, and the presence of vascular invasion (PVTT), consistently stratifies outcomes, with TACE providing the greatest benefit in patients with less extensive disease (Jun Luo et al., 2011;

Savic et al., 2022). These findings highlight the critical importance of a multidisciplinary approach to select the patients most likely to derive a net clinical benefit from TACE-based therapies.

Implications for Clinical Practice and Guidelines

This review supports current guidelines recommending TACE for intermediate-stage HCC but also provides evidence for its judicious use in select patients with advanced disease. Crucially, it provides strong support for the adoption of TACE in combination with systemic therapies. The PFS benefit seen with TACE+TKI+ICI combinations is substantial, and these regimens should be considered for eligible patients, especially those with high-risk features like a high tumor burden (Kudo et al., 2025). However, this must be balanced against the increased toxicity, necessitating careful patient counseling and proactive adverse event management.

Strengths and Limitations of the Review

The primary strength of this review is its comprehensive scope, encompassing a wide array of study designs, patient populations, and comparator treatments, which allows for a holistic view of the evidence. However, the findings must be interpreted in light of significant limitations inherent to the source literature. The high degree of heterogeneity in TACE protocols (chemotherapy agents, embolic materials, schedules), control arm definitions, and patient selection criteria across studies limits the comparability of results and precludes a formal meta-analysis (Marelli et al., 2007; Oliveri et al., 2011). Furthermore, the predominance of observational studies and the high risk of bias in some RCTs mean that the overall strength of the evidence is moderate at best. Finally, the lack of consistent reporting on patient-reported outcomes like quality of life represents a significant gap (Bress et al., 2025).

CONCLUSION AND SUGGESTIONS

Conclusion

In conclusion, this systematic review confirms that transarterial chemoembolization (TACE) is an effective treatment for hepatocellular carcinoma, providing a significant survival advantage over best supportive care. Its role as a standard therapy for intermediate-stage HCC is well-established, and it may offer benefits for selected patients with more advanced disease. The evidence landscape is rapidly evolving, with the most profound advancements coming from the combination of TACE with modern systemic therapies, particularly tyrosine kinase inhibitors and immunotherapies. These combination strategies have demonstrated superior progression-free survival and are set to become a new standard of care for many patients. The optimal use of TACE, whether alone or in combination, is highly dependent on careful patient selection, with preserved liver function and manageable tumor burden being the key determinants of favorable outcomes.

Suggestion for Further Research

Based on the findings and limitations of this review, several avenues for future research are suggested:

1. **Head-to-Head Trials of Combination Regimens:** Directly compare different TACE combination strategies (e.g., TACE + TKI vs. TACE + ICI vs. TACE + TKI + ICI) in well-designed, adequately powered randomized controlled trials to identify the most effective and safe approach.
2. **Biomarker Discovery:** Invest in translational research to identify robust predictive biomarkers (beyond clinical factors) that can accurately identify which patients will derive the most benefit from TACE monotherapy versus combination therapy.
3. **Standardization of Protocols:** Efforts should be made to standardize TACE protocols and endpoint reporting in future clinical trials to reduce heterogeneity and facilitate cross-study comparisons and meta-analyses.

4. **Quality of Life and Patient-Reported Outcomes:** Prioritize the collection and reporting of quality-of-life data and patient-reported outcomes in all future trials to provide a more holistic understanding of the benefits and burdens of treatment.

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