Supplementary

Appendix 1

Search Strategy

PubMed (2846)

((“carcinoma, hepatocellular/surgery"[MeSH Terms] OR "hepatocellular carcinoma"[tw] OR “HCC”[tiab]) AND (resection[tiab] OR "Hepatectomy"[Majr] OR "hepatic lobectomy"[tiab] OR “surgical”[tiab]) AND ("disease-free survival"[Mesh] OR “survival”[tiab] OR recurrence[tiab] OR “neoplasm recurrence, local”[Mesh] OR “disease-free”[tiab]) AND "last 15 years"[dp]) NOT ("Animals"[Mesh] NOT ("Animals"[Mesh] AND "Humans"[Mesh])) AND (“comparative study”[PT] OR “randomized controlled trial”[PT] OR “multicenter study”[PT] OR “retrospective studies”[Mesh] OR “cohort studies”[Mesh] OR “case-control studies”[Mesh] OR “clinical study”[PT] OR “clinical trial”[PT] OR “observational study”[pt])

Cochrane (854)

("hepatocellular carcinoma" OR "hcc") AND (surgery OR surgical OR resection OR lobectomy OR hepatectomy) AND (disease-free OR recurrence OR survival)

Embase: (2871)

(((‘liver cell carcinoma' OR 'hepatocellular carcinoma' OR 'hcc') NEAR/10 (resection OR surgery OR 'hepatic lobectomy' OR 'surgical')) OR ('liver cell carcinoma'/exp/mj AND 'liver resection'/exp/mj)) AND ('disease free survival'/de OR 'disease free interval'/de OR 'cancer survival'/exp OR survival:ti,ab OR recurrence:ti,ab OR 'cancer recurrence'/exp OR 'disease-free':ti,ab) AND human* AND (2005:py OR 2006:py OR 2007:py OR 2008:py OR 2009:py OR 2010:py OR 2011:py OR 2012:py OR 2013:py OR 2014:py OR 2015:py OR 2016:py OR 2017:py OR 2018:py OR 2019:py OR 2020:py) AND ('article'/it OR 'article in press'/it OR 'letter'/it OR 'note'/it OR 'review'/it OR 'short survey'/it) AND 'surgery'/lnk AND ('case control study'/de OR 'clinical article'/de OR 'clinical trial'/de OR 'cohort analysis'/de OR 'comparative effectiveness'/de OR 'comparative study'/de OR 'controlled clinical trial'/de OR 'controlled study'/de OR 'intermethod comparison'/de OR 'major clinical study'/de OR 'medical record review'/de OR 'multicenter study'/de OR 'multicenter study topic'/de OR 'observational study'/de OR 'phase 2 clinical trial topic'/de OR 'phase 3 clinical trial topic'/de OR 'prospective s

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Table S1 PRISMA

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	4
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	5
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	–
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	6
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5–6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplemental file
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5-6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	5-6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	6
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	6
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	7
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	7
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	6–7
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	*Figure 1*
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Supplemental *Table 2*
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Supplemental *Table 4*
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	*Table 1–4*
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	*Table 1–4*
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Supplemental *Table 4*
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	10-11
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	11-13
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	14
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	14
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	2

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Table S2 Study characteristics of included studies

Author	Publication year	Study start year	Study end year	Country/region	Study region	Study design	Sample size	Follow-up duration, median/mean (months)
Chen XP[45]	2006	1990	2003	China	Asia	Retrospective	438	–
Peng BG[46]	2009	1996	2004	China	Asia	Retrospective	53	33.6
Fan J[47]	2005	1997	2004	China	Asia	Retrospective	24	–
Shi J[48]	2010	2001	2003	China	Asia	Retrospective	406	6.4
Shi J[16]	2011	2001	2004	China	Asia	Retrospective	441	6.4
Liang LJ[49]	2008	2001	2005	China	Asia	Retrospective	53	10.2
Zheng N[50]	2016	2000	2008	China	Asia	Retrospective	96	60
Peng ZW[51]	2012	2002	2007	China	Asia	Retrospective	201	–
Chen JS[52]	2012	2006	2008	China	Asia	Retrospective	88	–
Cheng YQ[53]	2019	2002	2012	China	Asia	Retrospective	538	–
Tang QH[54]	2013	2006	2008	China	Asia	Retrospective	186	10.7
Li J[55]	2018	2001	2014	China	Asia	Retrospective	169	–
Ye JZ[56]	2014	2007	2009	China	Asia	Retrospective	90	–
Zhang YF[57]	2016	2005	2012	China	Asia	Retrospective	113	15.3
Wang K[58]	2016	2002	2014	China	Asia	Retrospective	745	–
Zhang F[59]	2020	2005	2012	China	Asia	Retrospective	1517	–
Zhang XP[60]	2019	2004	2014	China	Asia	Prospective	432	–
Zhang YF[61]	2015	2006	2013	China	Asia	Retrospective	28	11
Xu JF[62]	2015	2008	2012	China	Asia	Retrospective	56	–
Li J[63]	2016	2009	2013	China	Asia	Retrospective	24	23
Guo WX[64]	2017	2009	2013	China	Asia	Retrospective	45	3
Li N[65]	2016	2010	2013	China	Asia	Prospective	50	8.4
Chen ZH[66]	2019	2012	2016	China	Asia	Retrospective	105	–
Wei X[67]	2019	2016	2017	China	Asia	Retrospective	82	10.8
Matono R[68]	2012	1985	2005	Japan	Asia	Retrospective	29	–
Kokudo T[69]	2017	2000	2007	Japan	Asia	Retrospective	651	–
Hatano E[70]	2018	2000	2010	Japan	Asia	Retrospective	266	–
Lee JM[71]	2016	2000	2011	Korea	Asia	Retrospective	40	–
Lee D[72]	2018	2005	2008	Korea	Asia	Retrospective	43	22
Yu JI[73]	2018	2010	2014	Korea	Asia	Retrospective	31	24.6
Lei HJ[74]	2006	1991	1999	Taiwan	Asia	Prospective	76	–
Liu PH[75]	2014	2002	2012	Taiwan	Asia	Retrospective	247	24
Chok KS[76]	2014	1989	2010	Hong Kong	Asia	Prospective	88	–
Le Treut YP[77]	2006	1988	2004	France	Europe	Retrospective	26	–
Pesi B[78]	2015	1987	2009	Italy	Europe	Retrospective	62	82.8
Roayaie S[79]	2013	1992	2010	USA	North America	Prospective	165	11.9
Lim C[80]	2015	1995	2012	France	Europe	Retrospective	45	17.5
Cortese S[81]	2020	2007	2015	Spain	Europe	Retrospective	12	81.3
Torzilli G[82]	2013	1990	2009	Multicenter	Multicenter	Retrospective	297	–
Ye J[83]	2016	2009	2011	China	Asia	Retrospective	160	–

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Table S3 Patient and tumor characteristics of included studies

Author	Publication year	Overall number of pts with PVTT	Overall number of pts with HVTT	Mean age - years (SD)	Male (%)	Cirrhosis (%)	Mean platelet (SD) (x 10^9/L)	Size - cm (SD)	Number of nodules (SD)	Single tumour (%)	Multiple nodules (%)	Mean MELD (SD)	Mean AFP (SD)	Poorly differentiated histology (%)	Follow-up duration, median/ mean (months)
Chen XP[45]	2006	438	–	–	87	–	–	–	–	83	17	–	–	–	–
Peng BG[46]	2009	53	–	50.2 (7.5)	94	70	–	8.39 (2.29)	–	–	–	–	–	–	33.6
Fan J[47]	2005	24	-	–	83	–	–	–	–	58	42	–	–	–	–
Shi J[48]	2010	406	–	47.3 (10)	89	79	146.5 (72.8)	–	–	–	–	–	710.2 (417.9)	–	6.4
Shi J[16]	2011	441	–	–	90	–	–	–	–	91	9	–	–	–	6.4
Liang LJ[49]	2008	53	–	46.41 (10.21)	91	77	–	–	–	62	38	–	–	–	10.2
Zheng N[50]	2016	96	–	51.9 (48.2)	78	100	–	7.9 (2.2)	2.4 (1.4)	–	–	7.1 (1.4)	1120.6 (3930.7)	–	60
Peng ZW[51]	2012	201	–	–	93	88	–	–	–	47	53	–	–	–	–
Chen JS[52]	2012	88	–	48.2 (11.4)	93	83	202.4 (78.4)	10.1 (3.5)	–	51	49	–	–	–	–
Cheng YQ[53]	2019	538	–	–	92	70	–	–	–	93	7	–	–	–	–
Tang QH[54]	2013	186	–	48.4 (9.1)	89	80	–	9.53 (3.43)	–	54	46	–	–	–	10.7
Li J[55]	2018	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ye JZ[56]	2014	–	–	49.3 (10.7)	90	–	–	6.9 (1.6)	–	57	43	–	–	–	–
Zhang YF[57]	2016	113	–	49 (11.2)	88	42	209.1 (83.6)	8.5 (4.1)	–	85	15	4.6 (3.1)	–	–	15.3
Wang K[58]	2016	745	–	–	91	69	–	–	–	93	7	–	–	–	–
Zhang F[59]	2020	1517	–	–	–	–	–	–	–	–	–	–	–	–	–
Zhang XP[60]	2019	432	–	–	91	70	–	–	–	87	13	8.82 (3.94)	–	–	–
Zhang YF[61]	2015	–	–	47.4 (10.3)	96	96	208.6 (77.3)	9.6 (3.4)	–	61	39	–	–	–	11
Xu JF[62]	2015	56	–	–	20	61	–	5.6 (4.5)	–	34	66	–	–	–	–
Li J[63]	2016	24	–	52.8 (6.9)	100	100	164.3 (48.6)	–	–	–	–	–	–	17	23
Guo WX[64]	2017	45	–	50.1 (9.2)	89	82	–	9.4 (2.3)	–	–	–	–	–	–	3
Li N[65]	2016	50	–	–	84	60	–	–	–	80	20	–	–	10	8.4
Chen ZH[66]	2019	37	105	–	90	–	–	–	–	80	20	–	–	–	–
Wei X[67]	2019	82	–	50.5 (10.1)	90	17	–	–	–	84	16	–	–	90	10.8
Matono R[68]	2012	29	–	–	86	–	–	–	–	–	–	–	–	–	–
Kokudo T[69]	2017	420	546	64 (11)	83	–	190 (86.9)	8.78 (5.13)	–	–	–	–	–	–	–
Hatano E[70]	2018	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Lee JM[71]	2016	40	–	55 (12.9)	75	68	-	–	–	–	–	8.3 (3.0)	10728 (25073)	–	–
Lee D[72]	2018	43	–	–	84	–	–	–	–	53	47	–	–	–	22
Yu JI[73]	2018	31	–	–	81	45	–	–	–	81	19	–	–	–	24.6
Lei HJ[74]	2006	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Liu PH[75]	2014	247	–	58 (14)	82	100	–	–	–	66	34	7.9 (2.1)	13130 (46071)	–	24
Chok KS[76]	2014	88	–	–	95	–	–	–	–	–	–	–	–	32	–
Le Treut YP[77]	2006	–	–	–	85	–	–	–	–	–	–	–	–	–	–
Pesi B[78]	2015	41	11	–	–	90	–	–	–	–	–	–	–	–	82.8
Roayaie S[79]	2013	–	–	55.8 (11.8)	80	–	214 (102)	0.9 (0.559)	1.4 (0.8)	–	–	–	21840 (76548)	42	11.9
Lim C[80]	2015	45	–	57 (12)	73	16	276.5 (130.9)	1.64 (0.483)	1.5 (1.1)	–	–	–	500 (–)	–	17.5
Cortese S[81]	2020	11	1	59.8 (11.8)	83	92	–	–	1.5 (0.8)	–	–	–	1349.6 (642.9)	–	81.3
Torzilli G[82]	2013	–	–	–	77	57	–	–	–	–	–	–	–	–	–
Ye J[83]	2016	160	–	52.17 (21.09)	76	–	251.11 (73.56)	–	–	–	–	–	–	–	–

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Table S4 Quality assessment of included studies (NOS)

Author	Publication year	Study starty year	Study end year	Representativeness (0,1,2)	HCC as outcome of interest (0,1,2)	Sample size (0,1)	Comparability of study population (0,2)	Outcome assessment (0,1)	Statistical test (0,1)	Total Score (0-9)
Chen XP[45]	2006	1990	2003	2	2	1	2	1	1	9
Peng BG[46]	2009	1996	2004	2	2	1	2	1	1	9
Fan J[47]	2005	1997	2004	2	2	0	2	1	1	8
Shi J[48]	2010	2001	2003	2	2	1	2	1	1	9
Shi J[16]	2011	2001	2004	2	2	1	2	1	1	9
Liang LJ[49]	2008	2001	2005	2	2	1	2	1	1	9
Zheng N[50]	2016	2000	2008	2	2	1	2	1	1	9
Peng ZW[51]	2012	2002	2007	2	2	1	2	1	1	9
Chen JS[52]	2012	2006	2008	2	2	1	2	1	1	9
Cheng YQ[53]	2019	2002	2012	2	2	1	2	1	1	9
Tang QH[54]	2013	2006	2008	2	2	1	2	1	1	9
Li J[55]	2018	2001	2014	2	2	1	2	1	1	9
Ye JZ[56]	2014	2007	2009	2	2	1	2	1	1	9
Zhang YF[57]	2016	2005	2012	2	2	1	2	1	1	9
Wang K[58]	2016	2002	2014	2	2	1	2	1	1	9
Zhang F[59]	2020	2005	2012	2	2	1	2	1	1	9
Zhang XP[60]	2019	2004	2014	2	2	1	2	1	1	9
Zhang YF[61]	2015	2006	2013	2	2	0	2	1	1	8
Xu JF[62]	2015	2008	2012	2	2	1	2	1	1	9
Li J[63]	2016	2009	2013	1	2	0	0	1	1	5
Guo WX[64]	2017	2009	2013	2	2	0	2	1	1	8
Li N[65]	2016	2010	2013	2	2	1	2	1	1	9
Chen ZH[66]	2019	2012	2016	2	2	1	2	1	1	9
Wei X[67]	2019	2016	2017	1	2	1	2	1	1	8
Matono R[68]	2012	1985	2005	1	2	0	0	1	1	5
Kokudo T[69]	2017	2000	2007	1	2	1	2	1	1	8
Hatano E[70]	2018	2000	2010	1	2	1	2	1	1	8
Lee JM[71]	2016	2000	2011	2	2	0	2	1	1	8
Lee D[72]	2018	2005	2008	2	2	0	2	1	1	8
Yu JI[73]	2018	2010	2014	2	2	0	2	1	1	8
Lei HJ[74]	2006	1991	1999	2	2	1	2	1	1	9
Liu PH[75]	2014	2002	2012	2	2	1	2	1	1	9
Chok KS[76]	2014	1989	2010	2	2	1	2	1	1	9
Le Treut YP[77]	2006	1988	2004	2	2	0	2	1	1	8
Pesi B[78]	2015	1987	2009	2	2	1	2	1	1	9
Roayaie S[79]	2013	1992	2010	2	2	1	2	1	1	9
Lim C[80]	2015	1995	2012	2	1	0	2	1	1	8
Cortese S[81]	2020	2007	2015	2	2	0	2	1	1	8
Torzilli G[82]	2013	1990	2009	2	2	1	2	1	1	9
Ye J[83]	2016	2009	2011	2	2	1	2	1	1	9

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Table S5 Studies* that provided data for study, patient and tumour characteristics, by the presence of only portal vein tumor thrombosis (PVTT) or with PVTT and/or hepatic vein tumor thrombosis (HVTT).

	Overall		PVTT Only		PVTT and/or HVTT	
	Number of Studies	Study reference number	Number of Studies	Study reference number	Number of Studies	Study reference number
Study Characteristics						
Median study year	40	16, 45-83	27	16 46 47 48 49 50 51 52 53 54 57 58 59 60 62 63 64 65 67 68 71 72 73 75 76 80 83	13	45 55 56 61 66 69 70 74 77 78 79 81 82
Median follow up (months)	9	16 46 54 61 65 67 72 73 75	8	16 46 54 65 67 72 73 75	1	61
Patient Characteristics						
Male (%)	35	16 45 46 47 48 49 50 51 52 53 54 56 57 58 60 61 62 63 64 65 66 67 68 69 71 72 73 75 76 77 79 80 81 82 83	26	16 46 47 48 49 50 51 52 53 54 57 58 60 62 63 64 65 67 68 71 72 73 75 76 80 83	9	45 56 61 66 69 77 79 81 82
Age (Years)	31	16 46 48 49 50 51 52 54 56 57 60 61 63 64 65 66 67 68 69 71 72 73 75 76 77 78 79 80 81 82 83	22	16 46 48 49 50 51 52 54 57 60 63 64 65 67 68 71 72 73 75 76 80 83	9	56 61 66 69 77 78 79 81 82
Platelet (10^9/L)	12	48 51 52 57 61 63 69 72 79 80 82 83	8	48 51 52 57 63 72 80 83	4	61 69 79 82
MELD Score	5	50 57 60 71 75	5	50 57 60 71 75	0	
Cirrhosis (%)	24	46 48 49 50 51 52 53 54 57 58 60 61 62 63 64 65 67 71 73 75 78 80 81 82	20	46 48 49 50 51 52 53 54 57 58 60 62 63 64 65 67 71 73 75 80	4	61 78 81 82
Alcohol (%)	6	50 71 75 79 80 82	4	50 71 75 80	2	79 82
HBV (%)	29	16 45 46 48 49 50 52 53 54 56 57 58 61 62 63 65 66 67 68 69 71 72 73 75 76 78 79 80 82	21	16 46 48 49 50 52 53 54 57 58 62 63 65 67 68 71 72 73 75 76 80	8	45 56 61 66 69 78 79 82
HCV (%)	16	46 48 52 50 55 52 54 57 62 68 69 71 75 76 78 79 80 82	12	46 48 50 52 54 57 62 68 71 75 76 80	4	69 78 79 82
Child-Pugh A (%)	28	16 46 47 48 49 50 51 52 53 54 56 58 60 61 62 63 65 66 67 69 71 72 73 75 76 77 78 79	21	16 46 47 48 49 50 51 52 53 54 58 60 62 63 65 67 71 72 73 75 76	7	56 61 66 69 77 78 79
Child-Pugh B (%)	27	16 46 47 48 49 50 51 52 53 54 56 58 60 61 62 63 65 66 67 69 71 72 73 75 76 77 78	21	16 46 47 48 49 50 51 52 53 54 58 60 62 63 65 67 71 72 73 75 76	6	56 61 66 69 77 78

*References are listed in the supplemental reference list.

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Table S6 Overall tumor and liver function characteristicsa.

Characteristics	N (n) (n)[b]	Mean / Median / % (95% CI)
Tumor number	5 (540)	1.58 (1.14 – 2.01)
Tumor size (cm)	14 (1,747)	7.43 (5.44 – 9.42)
Poorly differentiated histology (%)	5 (409)	36.99 (13.08 – 69.61)
Lymphatic invasion	3 (803)	11.97 (8.48 – 16.65)
Alpha-fetoprotein (ng/mL)	11 (1,336)	892.91 (496.50 – 1289.32)
Child-Pugh A (%)	28 (5,051)	96.21 (93.23 – 97.91)
Child-Pugh B (%)	27 (4,886)	4.25 (2.43 – 7.34)

[a], All I^2>87.3, all P value for available I^2 were <0.05; [b], N, number of studies; n, number of patients

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Table S7A Studies* that provided data for overall survival (A) and recurrence free survival (B) after liver resection in patients with hepatocellular carcinoma with only portal vein tumor thrombosis (PVTT) or with PVTT and/or hepatic vein tumor thrombosis.

Region	Number of Studies	Reference numbers of studies that provided data for 1-year (%)	Number of Studies	Reference numbers of studies that provided data for 3-year (%)	Number of Studies	Reference numbers of studies that provided data for 5-year (%)
Overall Survival						
Overall	30	16 45 46 47 48 49 50 51 52 54 55 56 57 59 61 62 64 65 66 67 68 69 72 73 75 77 78 80 81 82	26	16 45 46 47 48 49 50 51 52 54 55 56 57 59 61 65 66 68 69 72 75 77 78 80 81 82	19	45 46 50 51 54 55 57 59 68 69 70 74 75 77 78 79 80 81 82
By Country/region						
China	20	16 45 46 47 48 49 50 51 52 54 55 56 57 59 61 62 64 65 66 67	17	16 45 46 47 48 49 50 51 52 54 55 56 57 59 61 65 66	8	45 46 50 51 54 55 57 59
Japan	2	68 69	2	68 69	3	68 69 70
Korea	2	72 73	1	72	0	--
Taiwan	1	75	1	75	2	74 75
France	2	77 80	2	77 80	2	77 80
Italy	1	78	1	78	1	78
Spain	1	81	1	81	1	81
United States	0	–	0	–	1	79
Recurrence-Free Survival						
Overall	15	16 48 49 51 54 57 59 66 67 72 73 78 80 81 82	13	16 48 49 51 54 57 59 66 72 78 80 81 82	6	51 59 78 80 81 82
By Country						
China	9	16 48 49 51 54 57 59 66 67	8	16 48 49 51 54 57 59 66	2	51 59
Korea	2	72 73	1	72	0	–
France	1	80	1	80	1	80
Italy	1	78	1	78	1	78
Spain	1	81	1	81	1	81

*References are listed in the supplemental reference list.

Table S7B Studies* that provided data for overall survival (A) and recurrence free survival (B) after liver resection in patients with hepatocellular carcinoma and only portal vein tumor thrombosis (not inclusive of patients with hepatic vein tumor thrombus) .

Region	Number of Studies	Reference numbers of studies that provided data for 1-year (%)	Number of Studies	Reference numbers of studies that provided data for 3-year (%)	Number of Studies	Reference numbers of studies that provided data for 5-year (%)
Overall Survival						
Overall	20	16 46 47 48 49 50 51 52 54 57 59 62 64 65 67 68 72 73 75 80	16	16 46 47 48 49 50 51 52 54 57 59 65 68 72 75 80	9	46 50 51 54 57 59 68 75 80
By Country/region						
China	15	16 46 47 48 49 50 51 52 54 57 59 62 64 65 67	12	16 46 47 48 49 50 51 52 54 57 59 65	6	46 50 51 54 57 59
Japan	1	68	1	68	1	68
Korea	2	72 73	1	72	0	--
Taiwan	1	75	1	75	1	75
France	1	80	1	80	1	80
Recurrence-Free Survival						
Overall	11	16 48 49 51 54 57 59 67 72 73 80	9	16 48 49 51 54 57 59 72 80	3	51 59 80
By Country						
China	8	16 48 49 51 54 57 59 67	7	16 48 49 51 54 57 59	2	51 59
Korea	2	72 73	1	72	0	--
France	1	80	1	80	1	80

*References are listed in the supplemental reference list.

Table S7C Studies* that provided data for overall survival (A) and recurrence free survival (B) after liver resection in patients with hepatocellular carcinoma with hepatocellular carcinoma with portal vein tumor thrombosis and/or hepatic vein tumor thrombosis.

Region	Number of Studies	Reference numbers of studies that provided data for 1-year (%)	Number of Studies	Reference numbers of studies that provided data for 3-year (%)	Number of Studies	Reference numbers of studies that provided data for 5-year (%)
Overall Survival						
Overall	10	45 55 56 61 66 69 77 78 81 82	10	45 55 56 61 66 69 77 78 81 82	10	45 55 69 70 74 77 78 79 81 82
By Country						
China	5	45 55 56 61 66	5	45 55 56 61 66	2	
Japan	1	69	1	69	1	69
Taiwan	0	--	0	--	1	74
France	1	77	1	77	1	77
Italy	1	78	1	78	1	78
Spain	1	81	1	81	1	81
United States	0	--	0	--	1	79
Recurrence-Free Survival						
Overall	4	66 78 81 82	4	66 78 81 82	3	78 81 82
By Country						
China	1	66	1	66	0	--
Italy	1	78	1	78	1	78
Spain	1	81	1	81	1	81

*References are listed in the supplemental reference list.

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Table S8 Studies that provided data for overall survival (A) and recurrence free survival (B) after liver resection in patients with hepatocellular carcinoma by presence of and sub-classification of portal vein tumor thrombosis.

Sub-classification	Number of Studies	Reference numbers of studies that provided data for 1-year (%)	Number of Studies	Reference numbers of studies that provided data for 3-year (%)	Number of Studies	Reference numbers of studies that provided data for 5-year (%)	Number of Studies	Reference numbers of studies that provided data for Median Survival
Overall Survival								
Segmental & Second-Order Branch	3	48 78 83	3	48 78 83	1	78	3	48 58 83
First-Order Branch	4	48 67 78 83	3	48 78 83	1	78	3	48 58 83
Main Trunk & Superior Mesenteric Vein	3	48 65 67	2	48 65	1	65	2	48 58
Recurrence-Free Survival								
Segmental & Second-Order Branch	1	48	1	48	0	–	0	–
First-Order Branch	2	48	1	48	0	–	0	–
Main Trunk & Superior Mesenteric Vein [c]	2	48 67	1	48	0	–	0	–

*References are listed in the supplemental reference list.

Table S9 Meta-regression of variables associated with 5-year overall survival after surgical resection

Characteristics	N (n)[a]	Coefficient	95% CI	P
Age, per year	15 (2,242)	0.0213	-0.0591 – 0.1016	0.6037
Tumor size, cm	8 (1,335)	0.1056	-0.0373 – 0.2486	0.1475
Cirrhosis	10 (1,237)	0.0027	-0.0038 – 0.0092	0.4168
Platelet (per 10^9 increase)	7 (1,531)	0.0045	-0.0121 – 0.0211	0.5944
Hepatitis B	13 (2,441)	-0.0011	-0.0080 – 0.0059	0.7638
Hepatitis C	11 (1,869)	0.0027	-0.0032 – 0.0085	0.3711

[a], N, number of studies; n, number of patients

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Table S10 Systematic review of overall survival (OS) after liver resection in patients with hepatocellular carcinoma and macrovascular invasion, by tumor characteristics and characteristics of liver disease

Variable	Study author	Number of patients[a]	Median survival (months) (95% CI)	1-year OS (%)	3-year OS (%)	5-year OS (%)
Tumor characteristics						
AFP < 400	Chen JS[52]	32	10			
AFP ≥ 400	Chen JS[52]	56	8			
Characteristics of liver disease						
Non-Cirrhosis	Chen JS[52]	15	9			
	Pesi B[78]	6		50	16.6	0
Cirrhosis	Chen JS[52]	73	9			
	Li J[63]	24	30 (24.1 – 36.0)			
Hepatitis B virus	Shi J[48]	354	14.1			
	Chen JS[52]	79	9			
	Li J[63]	24	30 (24.1 – 36.0)			

[a], Number of patients within the specified subgroup

Table S11 Systematic review of overall survival (OS) and recurrence-free survival (RFS) after liver resection in patients with hepatocellular carcinoma and macrovascular invasion, by viral versus non-viral etiology.

Study author	Median OS (months) (95% CI)	1-year OS (%)	3-year OS (%)	5-year OS (%)	1-year RFS (%)	3-year RFS (%)	5-year RFS (%)
Viral							
Cheng YQ[53]	9.2	–	–	–	–	–	–
Pesi B[78]	–	57.10	34.80	21.70	–	–	–
Torzilli G[82]	–	85	58	53	51	36	30
Non-Viral							
Cheng YQ[53]	16.0	–	–	–	–	–	–
Pesi B[78]	–	47.50	25.30	25.30	–	–	–
Torzilli G[82]	–	77	53	0	52	0	0

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Table S12 Systematic review of overall survival (OS) and recurrence-free survival (RFS) after liver resection in patients with hepatocellular carcinoma and macrovascular invasion for isolated hepatic vein tumor thrombosis (HVTT).

Study author	Number of patients[†]	Median OS (months) (95% CI)	1-year OS (%)	3-year OS (%)	5-year OS (%)	Median RFS (months) (95% CI)
Peripheral hepatic vein tumor thrombosis						
Chen ZH[66]	21	–	–	–	–	–
Kokudo T[69]	305	58.20	–	–	–	28.32
Major hepatic vein tumor thrombosis						
Chen ZH[66]	10	–	–	–	–	–
Kokudo T[69]	170	56.04	–	–	–	10.56
Pesi B[78]	8	–	75	45	31	–
Cortese S[81]	1	–	–	–	–	–
Tumor thrombosis of the inferior vena cava						
Chen ZH[66]	74	–	52.70	14.86	–	–
Kokudo T[69]	71	16.44	–	–	–	9.84
Pesi B[78]	3	–	50	0	0	–

[†], Number of patients within the specified subgroup

Table S13 Median overall survival (OS), overall survival, and recurrence-free survival (RFS) after liver resection in patients with hepatocellular carcinoma and macrovascular invasion by surgery type.

Study author	Median OS (months) (95% CI)	1-year OS (%)	3-year OS (%)	5-year OS (%)	1-year RFS (%)	3-year RFS (%)	5-year RFS (%)
Open surgery (%)							
Zhang F[59]	21	67	30	10	57	21	4
Chen ZH[66]	19.4	64.2	19.7	–	51.9	22.6	–
Lim C[80]	4.8	30.8	20.5	15.4	32.5	11.6	11.6
Minimally invasive surgery (%)							
Pesi B[78]	12.9	53.30	30.10	20.00	31.70	20.80	15.60

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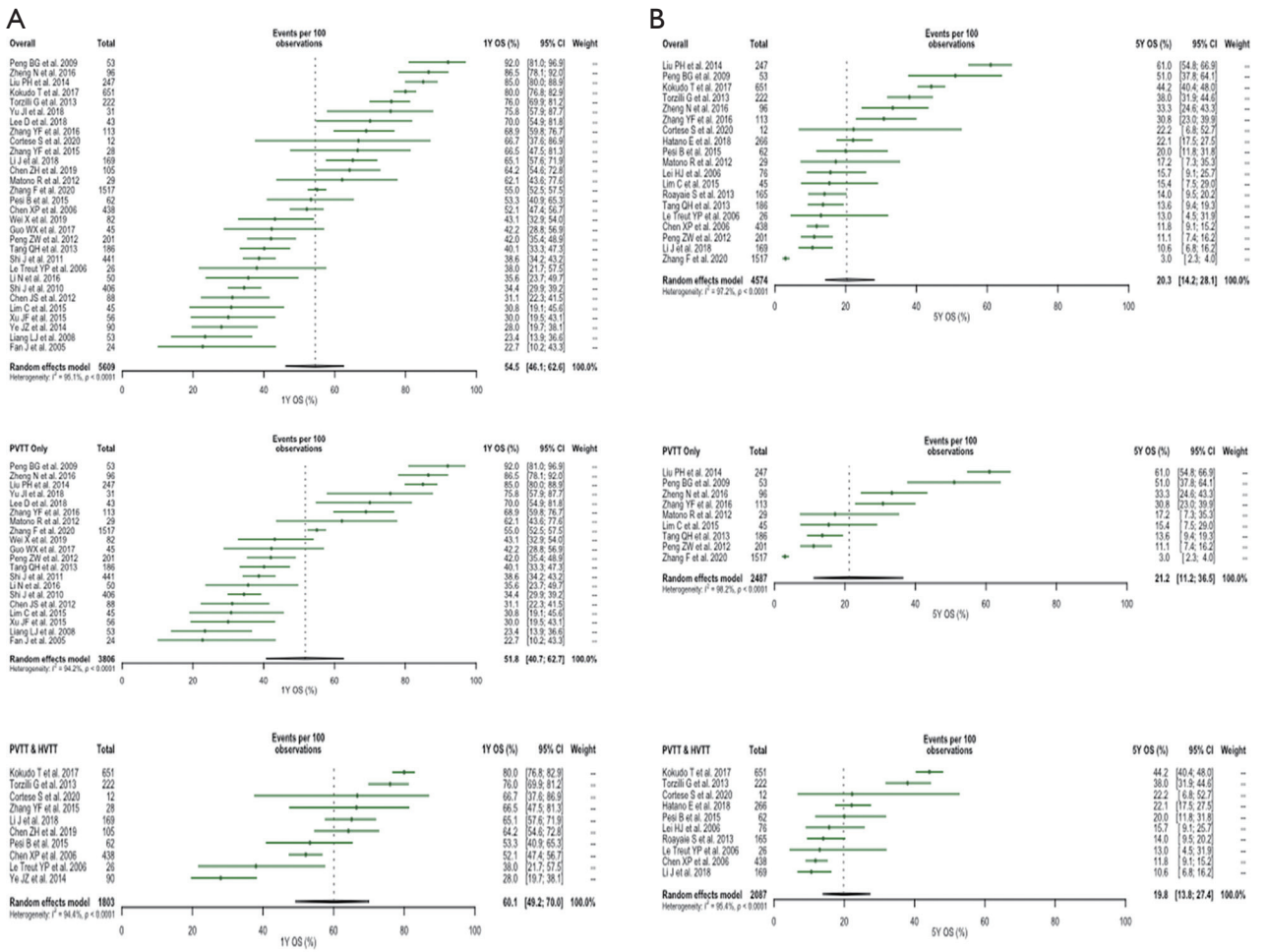

Figure S1 Overall survival. (A) Forest plot for 1-year overall survival, overall and by the presence of only PVTT or with PVTT and/or HVTT. (B) Forest plot for 5-year overall survival overall and by the presence of only PVTT or with PVTT and/or HVTT. PVTT, portal vein tumor thrombosis; HVTT, hepatic vein tumor thrombosis.

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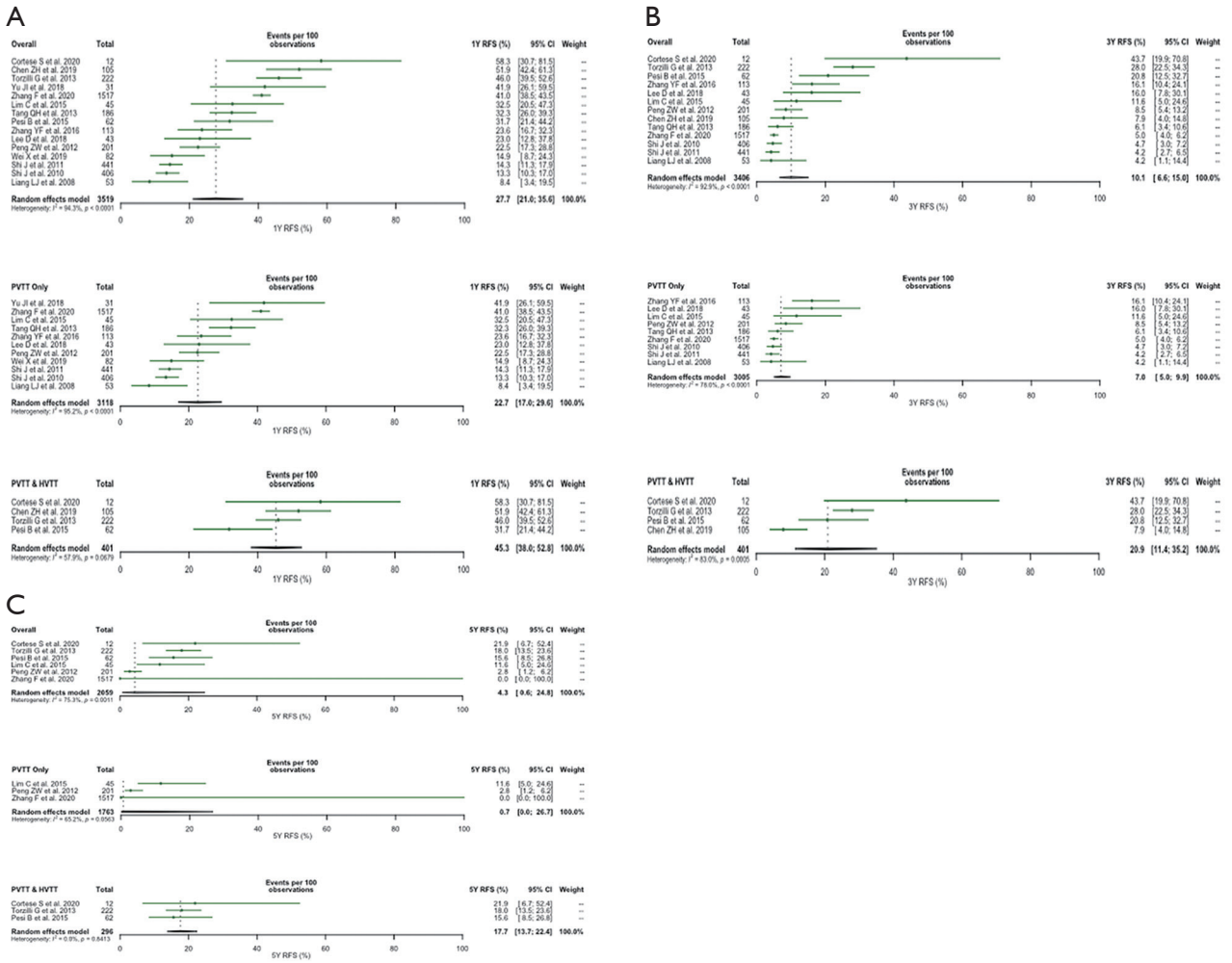

Figure S2 Recurrence free survival. (A) Forest plot for 1-year recurrence free survival overall and by the presence of only PVTT or with PVTT and/or HVTT. (B) Forest plot for 3-year recurrence free survival overall and by the presence of only PVTT or with PVTT and/or HVTT. (C) Forest plot for 5-year recurrence-free survival overall and by the presence of only PVTT or with PVTT and/or HVTT. PVTT, portal vein tumor thrombosis; HVTT, hepatic vein tumor thrombosis.

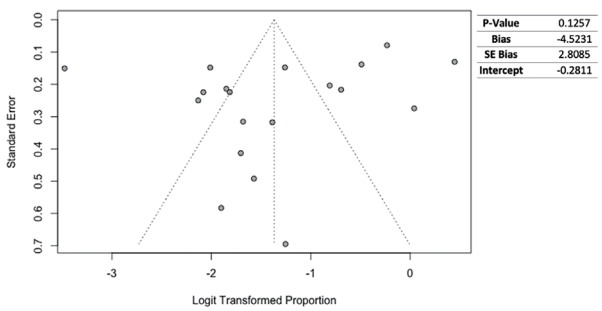

Figure S3 Egger's test and funnel plot for 5-year overall survival.

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