SUPPLEMENTAL MATERIAL

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Supplementary Table 1. Checklist of the PRISMA extension for network meta-analysis.

Section/topic	Item #	Checklist item*	Reported on Page #
TITLE			
Title	1	Identify the report as a systematic review *incorporating a network meta-analysis (or related form of meta-analysis).*	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: • Background: main objectives; • Methods: data sources; study eligibility criteria, participants, and interventions; study appraisal and *synthesis methods, such as network meta-analysis.* • Results: number of studies and participants identified; summary estimates with corresponding confidence/credible intervals; *treatment rankings may also be discussed. Authors may choose to summarize pairwise comparisons against a chosen treatment included in their analyses for brevity.* • Discussion/Conclusions: limitations; conclusions and implications of findings. • Other: primary source of funding; systematic review registration number with registry name.	2-3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known, *including mention of why a network meta-analysis has been conducted.*	4-7
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5-7
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. *Clearly describe eligible treatments included in the treatment network, and note whether any have been clustered or merged into the same node (with justification).*	7-8
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.	7
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplemental Material page 6
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable,	9

Section/topic	Item #	Checklist item*	Reported on Page #
		included in the meta-analysis).	
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.	8-9
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	8-9
Geometry of the network	S1	Describe methods used to explore the geometry of the treatment network under study and potential biases related to it. This should include how the evidence base has been graphically summarized for presentation, and what characteristics were compiled and used to describe the evidence base to readers.	9
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.	10-11
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means). *Also describe the use of additional summary measures assessed, such as treatment rankings and surface under the cumulative ranking curve (SUCRA) values, as well as modified approaches used to present summary findings from meta-analyses.*	9-10
Synthesis of results	14	Describe the methods of handling data and combining results of studies for each network meta-analysis. This should include, but not be limited to: • *Handling of multi-arm trials;* • *Selection of variance structure;* • *Selection of prior distributions in Bayesian analyses; and* • *Assessment of model fit.*	10
Assessment of Inconsistency	S2	Describe the statistical methods used to evaluate the agreement of direct and indirect evidence in the treatment network(s) studied. Describe efforts taken to address its presence when found.	10
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).	11
Additional analyses	16	Describe methods of additional analyses, if done, indicating which were pre-specified. This may include, but not be limited to the following: • Sensitivity or subgroup analyses; • Meta-regression analyses; • *Alternative formulations of the treatment network; and* • *Use of alternative prior distributions for Bayesian analyses (if applicable).*	11
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each	11& Figure 1

Section/topic	Item #	Checklist item*	Reported on Page #
		stage, ideally with a flow diagram.	
Presentation of network structure	S3	Provide a network graph of the included studies to enable visualization of the geometry of the treatment network	18 & Figure 2
Summary of network geometry	S4	Provide a brief overview of characteristics of the treatment network. This may include commentary on the abundance of trials and randomized patients for the different interventions and pairwise comparisons in the network, gaps of evidence in the treatment network, and potential biases reflected by the network structure.	18
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.	13-15 & Table 1
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).	16 & Supplemental Material page 7-8 and page18
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study:1) simple summary data for each intervention group, and 2) effect estimates and confidence/credible intervals. *Modified approaches may be needed to deal with information from larger networks.*	16-17
Synthesis of results	21	Present results of each meta-analysis done, including confidence/credible intervals. *In larger networks, authors may focus on comparisons versus a particular comparator (e.g. placebo or standard care), with full findings presented in an appendix. League tables and forest plots may be considered to summarize pairwise comparisons.* If additional summary measures were explored (such as treatment rankings), these should also be presented.	17-18
Exploration for inconsistency	S5	Describe results from investigations of inconsistency. This may include such information as measures of model fit to compare consistency and inconsistency models, P values from statistical tests, or summary of inconsistency estimates from different parts of the treatment network.	17
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	21
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression, *alternative network geometries studied, alternative choice of prior distributions for Bayesian analyses,* and so forth [see Item 16]).	19-21
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).	21-22
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). *Comment on the validity of the assumptions, such as transitivity and consistency. Comment on any concerns regarding network geometry (e.g., avoidance of certain comparisons).*	24-25

Section/topic	Item #	Checklist item*	Reported on Page #
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	22-24
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.	27

PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analysis; PICOS = population, intervention, comparators, outcomes, study design.

*Text in italics indicates wording specific to reporting of network meta-analyses that has been added to guidance from the PRISMA statement.

Supplementary Table 2. Search strategies

Database	Query	Results
Pubmed	(((((((((""Biliary Tract Neoplasms""[Mesh]) OR ""Bile Duct Neoplasms""[Mesh]) OR ""Gallbladder Neoplasms""[Mesh]) OR ""Cholangiocarcinoma""[Mesh]) OR Biliary Tract Cancer) OR ""Biliary Tract Neoplasms"") OR ""Bile duct cancer"")) AND ((((((""Chemoradiotherapy, Adjuvant""[Mesh]) OR Radiotherapy, Adjuvant[Mesh]) OR ""Chemotherapy, Adjuvant""[Mesh]) OR ""Adjuvants, Immunologic""[Mesh]) OR ""adjuvant therapy"") OR ""adjuvant treatment"")) AND ((((((""Clinical Study"" [Publication Type]) OR ""Observational Study"" [Publication Type]) OR ""Clinical Trial"" [Publication Type]) OR case control study) OR ""Case-Control Studies""[Mesh]) OR (((random) OR control) OR randomized control trial))	509
Embase	(('biliary tract cancer'/exp OR 'biliary tract tumor'/exp OR 'bile duct tumor'/exp OR 'gallbladder tumor'/exp OR 'bile duct carcinoma'/exp OR 'biliary tract cancer' OR 'biliary tract neoplasms' OR 'bile duct neoplasms' OR 'bile duct cancer' OR 'gallbladder cancer' OR cholangiocarcinoma) AND ('adjuvant therapy'/exp OR 'adjuvant chemotherapy'/exp OR 'adjuvant radiotherapy'/exp OR 'adjuvant chemoradiotherapy'/exp OR 'adjuvant treatment') AND ('clinical article'/de OR 'clinical study'/de OR 'clinical trial'/de OR 'clinical trial (topic)'/de OR 'cohort analysis'/de OR 'comparative effectiveness'/de OR 'comparative study'/de OR 'controlled clinical trial'/de OR 'controlled study'/de OR 'major clinical study'/de OR 'methodology'/de OR 'multicenter study'/de OR 'observational study'/de OR 'phase 2 clinical trial'/de OR 'phase 2 clinical trial (topic)'/de OR 'phase 3 clinical trial'/de OR 'phase 3 clinical trial (topic)'/de OR 'prospective study'/de OR 'randomized controlled trial'/de OR 'randomized controlled trial (topic)'/de OR 'retrospective study'/de) AND ([adult]/lim OR [aged]/lim OR [middle aged]/lim OR [very elderly]/lim OR [young adult]/lim))	892
CINAHL	((Biliary Tract Cancer OR "bile duct cancer" OR "Gallbladder" OR "biliary tract neoplasm" OR "Cholangiocarcinoma") AND ("adjuvant therapy" OR "adjuvant treatment" OR "adjuvant chemotherapy" OR "adjuvant radiotherapy" OR "adjuvant Chemoradiotherapy" OR "adjuvant radiochemotherapy"))	274
Cochrane	("MeSH: [Biliary Tract Neoplasms]"/exp OR "MeSH: [cholangiocarcinoma]"/exp OR ("Biliary Tract Cancer"):ti,ab,kw) AND ("MeSH: [Radiotherapy, Adjuvant]"/exp OR "MeSH: [Chemotherapy, Adjuvant]"/exp) OR "MeSH: [Chemoradiotherapy, Adjuvant]"/exp OR "Adjuvant therapy" OR "Adjuvant treatment")	52
clinicaltrials.gov	(("Biliary Tract Cancer" OR "bile duct cancer" OR "Gallbladder" OR "Cholangiocarcinoma") AND "Adjuvant")	46

Supplementary Table 3. Checklist for quality assessment and scoring using Newcastle-Ottawa Scale.

Checklist items
Selection
1. How representative was the treatment group in comparison for BTC? • If yes, one star; • No star if the patients were selected or selection of group was not described.
2. How representative was the observation group in comparison for BTC? • If drawn from the same community as the treatment group, one star; • No star if drawn from a different source or selection of group was not described.
3. Ascertainment of treatment: secure record or structured interview? • If the treatment were confirmed from surgical records or databases (eg NCDB or SEER), one star; • No star if it was not described.
4. Demonstration that outcome of interest was not present at start of study. • Yes, one star; • No, no star.
Comparability
5. Group comparable for age, sex, primary tumour site, resection margin status, tumour stage, lymph node status, distant metastasis. • If yes, two stars; • One star was assigned if one of these eight characteristics was differed in groups or not reported. • No star was assigned if there are at least 3 characteristics in the groups differed.
Outcome
6. Assessment of outcome? • One star if for information ascertained by record lincage or independent blind assessment; • No star if this information was not reported.
7. Was follow-up long enough for outcomes to occur? • Yes, one star if the follow-up period was 5 years or more; • No, no star if the follow-up period was less than 5 years or this information was not reported.
8. Adequacy of follow-up. • One star if follow-up 90%; • No star if this information was not reported.

Supplementary Table 4. Quality assessment of included retrospective studies.

Study	Selection				Comparability	Outcome assessment			Score
	1	2	3	4	5	6	7	8	
Todorokia 2000	*	*	*	*	**	*	*	*	9
Jiang 2010	*	*	*	*	*	*	*	*	8
Kim 2011	*	*	*	*	**	*	*	-	8
Kobayashi 2012	*	*	*	*	**	*	*	*	9
Dover 2016	*	*	*	*	*	*	*	-	7
Kim 2016	*	*	*	*	*	*	*	-	7
Morine 2017	*	*	*	*	**	*	*	-	8
Gu 2017	*	*	*	*	**	*	*	-	8
Akahoshi 2018	*	*	*	*	**	*	*	-	8
Bergeat 2018	*	*	*	*	**	*	*	-	8
Hester 2018	*	*	*	*	**	*	*	-	8
Zheng 2018	*	*	*	*	**	*	*	*	9
Choudhary 2019	*	*	*	*	*	*	*	-	7
Im 2021	*	*	*	*	**	*	*	*	9
Miyata 2021	*	*	*	*	**	*	*	-	8
Wan 2021	*	*	*	*	**	*	*	*	9

Supplementary Table 5. Assessment of transitivity.

Items	Comparisons	Mean Diff.	Std.Error	Sig.	95% CI
Age*	ART vs. Observation	-3.594	2.710	0.557	-11.150 to 3.961
	ACRT vs. Observation	-1.327	2.430	0.947	-8.100 to 5.445
	ACT vs. Observation	1.416	2.012	0.895	-4.192 to 7.024
	ACRT vs. ART	2.267	3.178	0.891	-6.592 to 11.130
	ACT vs. ART	5.010	2.872	0.327	-2.994 to 13.010
	ACT vs. ACRT	2.743	2.608	0.722	-4.527 to 10.010
Percentage female	ART vs. Observation	0.81	9.782	0.9998	-25.46 to 27.09
	ACRT vs. Observation	11.09	7.547	0.47	-9.19 to 31.36
	ACT vs. Observation	6.10	6.485	0.78	-11.33 to 23.52
	ACRT vs. ART	10.28	10.78	0.78	-18.68 to 39.23
	ACT vs. ART	5.28	10.06	0.95	-21.75 to 32.32
	ACT vs. ACRT	-4.99	7.91	0.92	-26.24 to 16.26
Sample size	ART vs. Observation	-145.1	157.3	0.793	-567.7 to 277.5
	ACRT vs. Observation	-25.2	121.4	0.996	-351.3 to 300.8
	ACT vs. Observation	-44.7	104.3	0.973	-324.9 to 235.5
	ACRT vs. ART	119.9	173.4	0.900	-345.8 to 585.6
	ACT vs. ART	100.4	161.9	0.925	-334.5 to 535.2
	ACT vs. ACRT	-19.5	127.2	0.999	-361.2 to 322.2
Publication year	ART vs. Observation	-3.750	2.633	0.492	-10.8 to 3.323
	ACRT vs. Observation	1.375	2.031	0.905	-4.082 to 6.832
	ACT vs. Observation	2.231	1.746	0.582	-2.459 to 6.920
	ACRT vs. ART	5.125	2.901	0.305	-2.669 to 12.92
	ACT vs. ART	5.981	2.709	0.139	-1.297 to 13.2
	ACT vs. ACRT	0.856	2.129	0.978	-4.864 to 6.575
Percentage R0	ART vs. Observation	-12.66	17.17	0.881	-58.75 to 33.42
	ACRT vs. Observation	7.61	13.97	0.947	-29.87 to 45.09
	ACT vs. Observation	3.64	12.52	0.991	-29.95 to 37.23
	ACRT vs. ART	20.27	18.70	0.701	-29.90 to 70.44
	ACT vs. ART	16.30	17.64	0.792	-31.03 to 63.64
	ACT vs. ACRT	-3.97	14.54	0.993	-42.98 to 35.03
Percentage N0	ART vs. Observation	19.33	11.23	0.332	-11.32 to 49.99
	ACRT vs. Observation	-14.00	7.74	0.291	-35.13 to 7.13
	ACT vs. Observation	-10.90	5.99	0.285	-27.24 to 5.44
	ACRT vs. ART	-33.33	12.43	0.056	-67.27 to 0.60
	ACT vs. ART	-30.24	11.42	0.060	-61.41 to 0.94
	ACT vs. ACRT	3.10	8.01	0.980	-18.78 to 24.97

The characteristics included age, percentage female, sample size, publication year, percentage R0 and N0 have been evaluated in the network. All the comparisons had similar mean age and other main characteristics with P-value over 0.05.

* Median age was given instead of mean age in the Bergeat, Dover, Miyata, Gu, and Edeline studies. Information of age in the Jiang, Kobayashi, Akahoshi, Ebata, Choudhary, Im (2021), and Wan studies were presented as younger or older than a specific age that couldn't be integrated into the figure.

Supplementary Table 6. Results of global heterogeneity and local heterogeneity.

Comparisons	Local		Global			Heterogeneity assessment
	Pair-wise (I^2)	Network (I^2)	Between study variance (τ^2)	Pair-wise (I^2)	Consistency effect (I^2)	
Overall survival for BTC patients						
ACT vs Observation	20.3%	20.2%	0.022	0.0%	19.4%	Low to high
ART vs Observation	0.0%	**81.9%**				
ACRT vs Observation	33.4%	47.5%				
ACT vs ART	0.0%	49.4%				
ACRT vs ART	0.0%	28.8%				
ACRT vs ACT	0.0%	0.0%				
Overall survival for BTC patients with R0 resection margin						
ACT vs Observation	0.0%	0.0%	0.069	0.96%	0.0%	Low to moderate
ART vs Observation	NA	0.0%				
ACRT vs Observation	0.0%	0.0%				
ACT vs ART	NA	0.0%				
ACRT vs ART	0.0%	0.0%				
ACRT vs ACT	33.5%	21.6%				
Overall survival for BTC patients with R1 resection margin						
ACT vs Observation	33.8%	36.5%	0.179	24.9%	13.5%	Low to moderate
ART vs Observation	0.0%	34.5%				
ACRT vs Observation	28.1%	28.5%				
ACT vs ART	NA	0.0%				
ACRT vs ART	NA	0.0%				
ACRT vs ACT	NA	0.0%				
Overall survival for GBC patients						
ACT vs Observation	44.1%	45.0%	0.028	12.1%	6.0%	Low to moderate
ACRT vs Observation	0.0%	0.0%				
ACRT vs ACT	0.0%	0.0%				
Overall survival for CCA patients						
ACT vs Observation	0.0%	0.0%	0.064	0.0%	25.8%	Low to high
ART vs Observation	0.0%	0.0%				
ACRT vs Observation	**66.7%**	**93.7%**				
ACT vs ART	0.0%	47.7%				
ACRT vs ART	0.0%	17.6%				
ACRT vs ACT	0.0%	0.0%				
Overall survival for BTC patients in Asia						
ACT vs Observation	**56.5%**	**57.0%**	0.271	27.5%	**64.9%**	Low to high
ART vs Observation	0.0%	0.0%				
ACRT vs Observation	**71.6%**	**91.7%**				
ACT vs ART	0.0%	9.8%				
ACRT vs ART	0.0%	0.0%				
ACRT vs ACT	0.0%	0.0%				
Overall survival for BTC patients in Western						
ACT vs Observation	0.0%	0.0%	0.007	0.0%	0.0%	Low
ART vs Observation	0.0%	0.0%				
ACRT vs ACT	0.0%	0.0%				
Overall survival for BTC patients without distant-metastasis						
ACT vs Observation	0.0%	0.0%	0.011	0.0%	1.7%	Low to high
ART vs Observation	0.0%	**63.2%**				
ACRT vs Observation	33.1%	41.0%				
ACT vs ART	0.0%	42.7%				
ACRT vs ART	0.0%	20.6%				
ACRT vs ACT	0.0%	0.0%				
Disease-free survival for BTC patients						

ACT vs Observation	6.1%	6.6%	0.017	0.0%	0.0%	Low to high
ART vs Observation	0.0%	0.0%				
ACRT vs Observation	20.0%	**82.2%**				
ACT vs ART	0.0%	0.0%				
ACRT vs ART	0.0%	0.0%				
ACRT vs ACT	0.0%	0.0%				
Disease-free survival for GBC patients						
ACT vs Observation	**75.0%**	48.1%	0.169	**51.2%**	34.1%	Low to high
ACRT vs Observation	9.7%	0.0%				
ACRT vs ACT	3.7%	0.0%				
Disease-free survival for CCA patients						
ACT vs Observation	0.0%	0.0%	0.029	0.0%	0.0%	Low to moderate
ART vs Observation	0.0%	0.0%				
ACRT vs Observation	35.0%	47.0%				
ACT vs ART	0.0%	0.0%				
ACRT vs ART	0.0%	0.0%				
ACRT vs ACT	0.0%	0.0%				
Disease-free survival for BTC patients in Asia						
ACT vs Observation	32.8%	32.4%	0.067	0.0%	0.0%	Low to high
ART vs Observation	0.0%	0.0%				
ACRT vs Observation	35.8%	**67.6%**				
ACT vs ART	0.0%	0.0%				
ACRT vs ART	0.0%	0.0%				
ACRT vs ACT	0.0%	0.0%				
Disease-free survival for BTC patients in Western						
ACT vs Observation	0.0%	0.0%	0.023	0.0%	0.0%	Low
ACRT vs Observation	0.0%	0.0%				
ACRT vs ACT	NA	NA				
Disease-free survival for BTC patients for patients without distant-metastasis						
ACT vs Observation	0.0%	0.0%	0.012	0.0%	0.0%	Low to moderate
ART vs Observation	0.0%	0.0%				
ACRT vs Observation	20.0%	38.7%				
ACT vs ART	0.0%	0.0%				
ACRT vs ART	0.0%	0.0%				
ACRT vs ACT	0.0%	0.0%				

The numbers with high heterogeneity are in bold (We inferred the magnitude of heterogeneity by comparing the estimated $\tau 2$ to empirical distributions of heterogeneity typically found in meta-analyses. Low heterogeneity could be considered when the estimated τ^2 is less than the 25% quantile of the empirical distribution, moderate heterogeneity for τ^2 between 25% and 50% quantile, and high heterogeneity for τ^2 larger than the 50% quantile.). NA=Not available, because only one study was included in this type of comparison; ACT=Adjuvant Chemotherapy; ART=Adjuvant Radiotherapy; ACRT=Adjuvant Chemoradiation therapy; R0=negative resection margins; R1=microscopic positive resection margins; GBC=gallbladder cancer; CCA= cholangiocarcinoma.

Supplementary Table 7. Node-splitting analysis of inconsistency.

Comparison	Direct effect	Indirect effect	Overall	*P*
	lnHR (95% Cl)			
Overall survival for BTC patients				
ACRT, ACT	0.24 (0.02, 0.51)	0.10 (-0.30, 0.58)	0.18 (-0.01, 0.40)	0.52
ACRT, ART	1.3 (0.63, 1.90)	-0.56 (-1.10, -0.08)	-0.13 (-0.53, 0.37)	**0.0000**
ACT, ART	0.60 (0.05, 1.10)	-0.66 (-1.10, -0.18)	-0.31 (-0.71, 0.16)	**0.001**
ACRT, Observation	0.35 (0.07, 0.73)	0.83 (0.25, 1.60)	0.35 (0.18, 0.61)	0.15
ACT, Observation	0.24 (-0.03, 0.54)	0.19 (-0.52, 0.94)	0.17 (0.02, 0.38)	0.89
ART, Observation	0.70 (0.29, 1.10)	-0.92 (-2.90, 1.10)	0.48 (0.07, 0.86)	0.13
Overall survival for BTC patients with R0 resection margin				
ACRT, ACT	1.2 (-0.82, 3.3)	0.35 (-0.31, 1.2)	0.41 (-0.16, 1.20)	0.43
ACRT, ART	NA	NA	NA	NA
ACT, ART	0.92 (-1.30, 3.20)	0.05 (-2.20, 2.30)	0.53 (-1.00, 2.10)	0.58
ACRT, Observation	0.49 (-0.03, 1.20)	1.4 (-0.69, 3.40)	0.53 (0.07, 1.20)	0.41
ACT, Observation	0.14 (-0.40, 0.65)	-0.24 (-2.00, 1.60)	0.12 (-0.35, 0.54)	0.69
ART, Observation	0.37 (-1.80, 2.40)	-0.90 (-3.00, 1.20)	-0.41 (-2.00, 1.10)	0.41
Overall survival for BTC patients with R1 resection margin				
ACRT, ACT	0.60 (-0.69, 1.90)	0.57 (-0.80, 1.80)	0.68 (-0.32, 1.60)	0.97
ACRT, ART	1.20 (-0.17, 2.5)	-0.31 (-2.40, 1.60)	0.66 (-0.52, 1.80)	0.18
ACT, ART	0.57 (-0.67, 1.80)	-0.88 (-2.60, 0.86)	-0.017 (-1.10, 1.00)	0.15
Overall survival for GBC patients				
ACRT, ACT	0.17 (-0.37, 0.82)	0.81 (-0.63, 2.50)	0.20 (-0.09, 0.55)	0.35
ACRT, Observation	0.25 (-0.20, 0.76)	0.55 (-0.98, 1.90)	0.25 (-0.02, 0.54)	0.67
ACT, Observation	0.061 (-0.51, 0.45)	-0.35 (-2.00, 1.30)	0.06 (-0.26, 0.30)	0.58
Overall survival for CCA patients				
ACRT, ACT	0.35 (0.03, 0.81)	0.15 (-0.29, 0.72)	0.30 (-0.03, 0.81)	0.45
ACRT, ART	1.3 (0.60, 2.00)	-0.57 (-1.10, 0.01)	0.04 (-0.51, 0.77)	**0.00035**
ACT, ART	0.61 (-0.02, 1.20)	-0.70 (-1.20, -0.13)	-0.27 (-0.77, 0.29)	**0.0056**
ACRT, Observation	0.56 (0.03, 1.30)	0.69 (-0.13, 1.70)	0.49 (0.16, 1.00)	0.77
ART, Observation	0.69 (0.27, 1.10)	-0.98 (-3.0, 1.10)	0.46 (-0.02, 0.91)	0.12
ACT, Observation	0.19 (-0.20, 0.59)	0.51 (-0.41, 1.60)	0.18 (-0.07, 0.50)	0.50
Overall survival for BTC patients in Asia				
ACRT, ACT	0.71 (-0.18, 1.70)	-0.02 (-0.74, 0.95)	0.33 (-0.37, 1.20)	0.23
ACRT, ART	1.3 (0.53, 2.20)	-0.75 (-1.50, 0.05)	0.18 (-0.56, 1.20)	**0.0018**
ACT, ART	0.11 (-0.78, 1.00)	-0.27 (-1.30, 0.85)	-0.15 (-0.78, 0.56)	0.56
ACRT, Observation	0.63 (-0.040, 1.50)	2.00 (-0.17, 4.30)	0.77 (0.17, 1.60)	0.24
ACT, Observation	0.55 (-0.11, 1.20)	-0.057 (-1.4, 1.4)	0.44 (-0.06, 0.99)	0.41
ART, Observation	0.67 (0.07, 1.30)	0.71 (-0.54, 1.80)	0.59 (-0.01, 1.10)	0.96
Overall survival for BTC patients in Western				
ACRT, ACT	0.16 (-0.11, 0.39)	0.49 (-0.28, 1.30)	0.18 (-0.02, 0.37)	0.40
ACRT, Observation	0.25 (-0.01, 0.55)	0.35 (-0.26, 0.89)	0.28 (0.09, 0.46)	0.70
ACT, Observation	0.12 (-0.09, 0.31)	0.32 (-0.48, 1.1)	0.10 (-0.06, 0.26)	0.61
Overall survival for BTC patients without distant-metastasis				
ACRT, ACT	0.24 (0.03, 0.48)	0.20 (-0.17, 0.69)	0.20 (0.039, 0.40)	0.86
ACRT, ART	1.30 (0.66, 1.90)	-0.74 (-1.40, -0.04)	-0.01 (-0.52, 0.53)	**0.0000**
ACT, ART	0.59 (0.06, 1.10)	-0.82 (-1.50, -0.15)	-0.21 (-0.72, 0.31)	**0.001**
ART, Observation	0.66 (0.13, 1.20)	-1.00 (-3.00, 0.98)	0.32 (-0.18, 0.81)	0.12
ACRT, Observation	0.31 (0.08, 0.69)	0.61 (0.11, 1.40)	0.31 (0.15, 0.52)	0.28
ACT, Observation	0.14 (-0.12, 0.42)	0.20 (-0.43, 0.94)	0.10 (-0.04, 0.27)	0.85
Disease-free survival for BTC patients				
ACRT, ACT	0.49 (0.10, 0.93)	0.26 (-0.14, 0.70)	0.32 (0.05, 0.63)	0.41
ACRT, ART	1.30 (0.60, 2.10)	-0.10 (-0.95, 0.72)	0.41 (-0.14, 1.00)	**0.009**
ACT, ART	0.33 (-0.27, 0.94)	-0.20 (-0.92, 0.54)	0.09 (-0.44, 0.63)	0.27
ACRT, Observation	0.43 (0.17, 0.75)	1.10 (0.34, 1.80)	0.52 (0.28, 0.81)	0.11
ACT, Observation	0.22 (0.04, 0.41)	-0.14 (-0.87, 0.60)	0.20 (0.03, 0.38)	0.35

ART, Observation	0.29 (-0.30, 0.86)	-0.30 (-1.90, 1.30)	0.11 (-0.41, 0.63)	0.50
Disease-free survival for GBC patients				
ACRT, ACT	0.30 (-0.52, 1.20)	1.50 (-0.38, 3.30)	0.50 (-0.20, 1.30)	0.22
ACRT, Observation	0.30 (-0.47, 1.10)	-0.25 (-2.10, 1.60)	0.27 (-0.48, 0.97)	0.52
ACT, Observation	-0.28 (-1.30, 0.60)	-0.15 (-2.10, 1.80)	-0.24 (-1.10, 0.44)	0.89
Disease-free survival for CCA patients				
ACRT, ACT	1.00 (0.33, 1.70)	0.27 (-0.18, 0.78)	0.45 (0.05, 0.95)	0.09
ACRT, ART	1.30 (0.62, 2.10)	-0.14 (-1.10, 0.79)	0.53 (-0.08, 1.30)	**0.017**
ACT, ART	0.33 (-0.32, 0.98)	-0.19 (-0.98, 0.63)	0.09 (-0.49, 0.67)	0.32
ACRT, Observation	0.58 (0.20, 1.10)	1.40 (0.02, 2.70)	0.64 (0.29, 1.10)	0.28
ACT, Observation	0.21 (-0.04, 0.49)	-0.15 (-1.40, 1.10)	0.20 (-0.03, 0.44)	0.55
ART, Observation	0.28 (-0.33, 0.89)	-0.33 (-2.00, 1.30)	0.11 (-0.45, 0.66)	0.50
Disease-free survival for BTC patients in Asia				
ACRT, ACT	0.88 (0.29, 1.50)	0.25 (-0.32, 0.92)	0.50 (0.09, 1.00)	0.14
ACRT, ART	1.30 (0.56, 2.20)	0.02 (-0.99, 1.10)	0.64 (-0.01, 1.40)	0.052
ACT, ART	0.33 (-0.43, 1.10)	-0.13 (-1.00, 0.85)	0.13 (-0.49, 0.78)	0.44
ACRT, Observation	0.65 (0.21, 1.30)	1.2 (0.30, 2.10)	0.76 (0.39, 1.30)	0.31
ACT, Observation	0.30 (-0.06, 0.70)	-0.01 (-0.90, 0.99)	0.25 (-0.05, 0.59)	0.52
ART, Observation	0.28 (-0.39, 0.95)	-0.30 (-2.00, 1.40)	0.12 (-0.48, 0.72)	0.54
Disease-free survival for BTC patients in Western				
ACRT, ACT	0.09 (-0.51 to 0.69)	0.23 (-0.51 to 0.99)	0.09 (-0.33 to 0.55)	0.76
Disease-free survival for BTC patients without distant-metastasis				
ACRT, ACT	0.48 (0.12, 0.89)	0.34 (-0.04, 0.77)	0.35 (0.09, 0.65)	0.61
ACRT, ART	1.30 (0.62, 2.00)	-0.12 (-0.94, 0.69)	0.39 (-0.17, 0.96)	**0.01**
ACT, ART	0.33 (-0.26, 0.92)	-0.26 (-0.98, 0.48)	0.05 (-0.46, 0.57)	0.19
ACRT, Observation	0.43 (0.18, 0.72)	0.98 (0.27, 1.70)	0.49 (0.25, 0.75)	0.16
ACT, Observation	0.15 (-0.05, 0.33)	-0.13 (-0.85, 0.62)	0.14 (-0.04, 0.30)	0.46
ART, Observation	0.29 (-0.29, 0.86)	-0.33 (-2.00, 1.30)	0.10 (-0.42, 0.62)	0.46

Nonsignificant values ($P > 0.05$) indicate no inconsistency between direct and indirect effects. NA=Not available; CI=confidence interval. ACT=Adjuvant Chemotherapy; ART=Adjuvant Radiotherapy; ACRT=Adjuvant Chemoradiation therapy.

Supplementary Table 8. Comparisons of the fitness of consistency and inconsistency models using deviance information criteria

Item	Model	Overall	Resection margin status		Tumor Site		The regions		Non-distant metastasis
			R0	R1	GBC	CCA	Asia	Western	
OS	Consistency	46.17	15.37	16.03	16.95	31.39	226.5	11.88	37.79
	Inconsistency	46.05	17.96	15.99	16.70	32.54	228.1	12.93	38.31
DFS	Consistency	29.93	NA	NA	9.50	22.21	22.76	7.88	23.61
	Inconsistency	31.15	NA	NA	10.26	24.96	25.12	7.89	25.28

The fitness of the Bayesian model was evaluated by deviance information criteria (DIC), which is adjusted with the complexity of the model.

NA=Not applicable; OS=overall survival; DFS=disease-free survival; R0=negative resection margins; R1=microscopic positive resection margins; GBC=gallbladder cancer; CCA= cholangiocarcinoma.

Supplementary Table 9. Ranking results of network meta-analysis for overall survival (OS) and disease-free survival (DFS).

Treatment	Rank of probability for OS (%)					Rank of probability for DFS (%)				
	1	2	3	4	SUCRA	1	2	3	4	SUCRA
ACT	0.7	10.5	**87.5**	1.3	36.9	7.9	63.1	35.4	0.7	54.7
ART	**70.9**	20.3	7.5	1.2	**87.0**	7.5	28.4	29.6	34.5	36.3
ACRT	28.4	**69.1**	2.5	0.0	75.3	**91.7**	7.9	0.3	0.0	**97.1**
Observation	0.0	0.0	2.4	97.5	0.8	0.0	0.6	34.6	64.8	11.9

The number in each cell represents the posterior probability of the row-defining treatment being ranked at the column-defining position. The numbers with the biggest probability of ranking first and last are in bold and underscored. ACT=Adjuvant Chemotherapy; ART=Adjuvant Radiotherapy; ACRT=Adjuvant Chemoradiation therapy.

Supplementary Table 10. Rank results for OS and DFS in the sensitivity analysis.

Treatment	Rank of probability (%)									
	1	**2**	**3**	**4**	**SUCRA**	**1**	**2**	**3**	**4**	**SUCRA**
	OS for studies including observational studies					**DFS for studies including observational studies**				
ACT	3.8	53.7	6.4	0.0	43.2	1.6	60.3	34.6	3.4	53.4
ART	**56.4**	23.2	18.3	2.1	**77.9**	6.9	28.9	28.1	36.0	35.6
ACRT	39.8	53.7	6.4	0.0	**77.8**	**91.4**	8.0	0.5	0.0	**97.0**
Observation	0.0	0.0	3.2	96.8	1.1	0.0	2.7	36.7	60.6	14.1
Treatment	**OS for studies with high quality**					**DFS for studies with high quality**				
ACT	4.0	31.0	63.0	2.0	45.7	0.9	63.3	34.9	0.9	54.7
ART	47.3	22.9	18.5	11.2	68.8	3.8	31.6	31.6	32.9	35.4
ACRT	**48.7**	45.6	5.6	0.1	**90.0**	**95.3**	4.4	0.3	0.0	**98.3**
Observation	0.0	0.5	6.3	86.7	1.6	0.0	0.7	33.2	66.1	11.5
Treatment	**OS for original reported HRs (95%CI) in the studies**					**DFS for original reported HRs (95%CI) in the studies**				
ACT	6.6	41.5	49.8	2.1	50.8	2.2	77.8	18.3	1.6	60.2
ART	38.2	20.0	20.1	21.7	58.2	3.7	11.7	14.7	69.9	16.4
ACRT	**55.2**	37.7	7.0	0.1	**82.7**	**94.0**	5.6	0.3	0.0	**97.9**
Observation	0.0	0.9	23.0	76.1	8.3	0.0	4.9	66.6	28.5	25.5

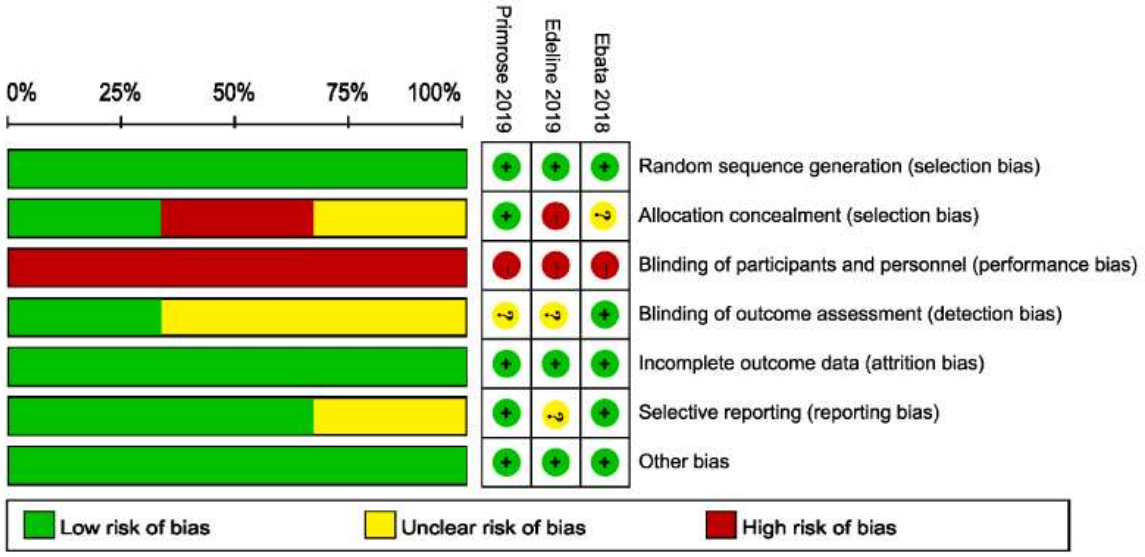
The number in each cell represents the posterior probability of the row-defining treatment being ranked at the column-defining position. The numbers with the biggest probability of ranking first and last are in bold and underscored. ACT=Adjuvant Chemotherapy; ART=Adjuvant Radiotherapy; ACRT=Adjuvant Chemoradiation therapy.

CI=confidence interval; OS=overall survival; DFS=disease-free survival.

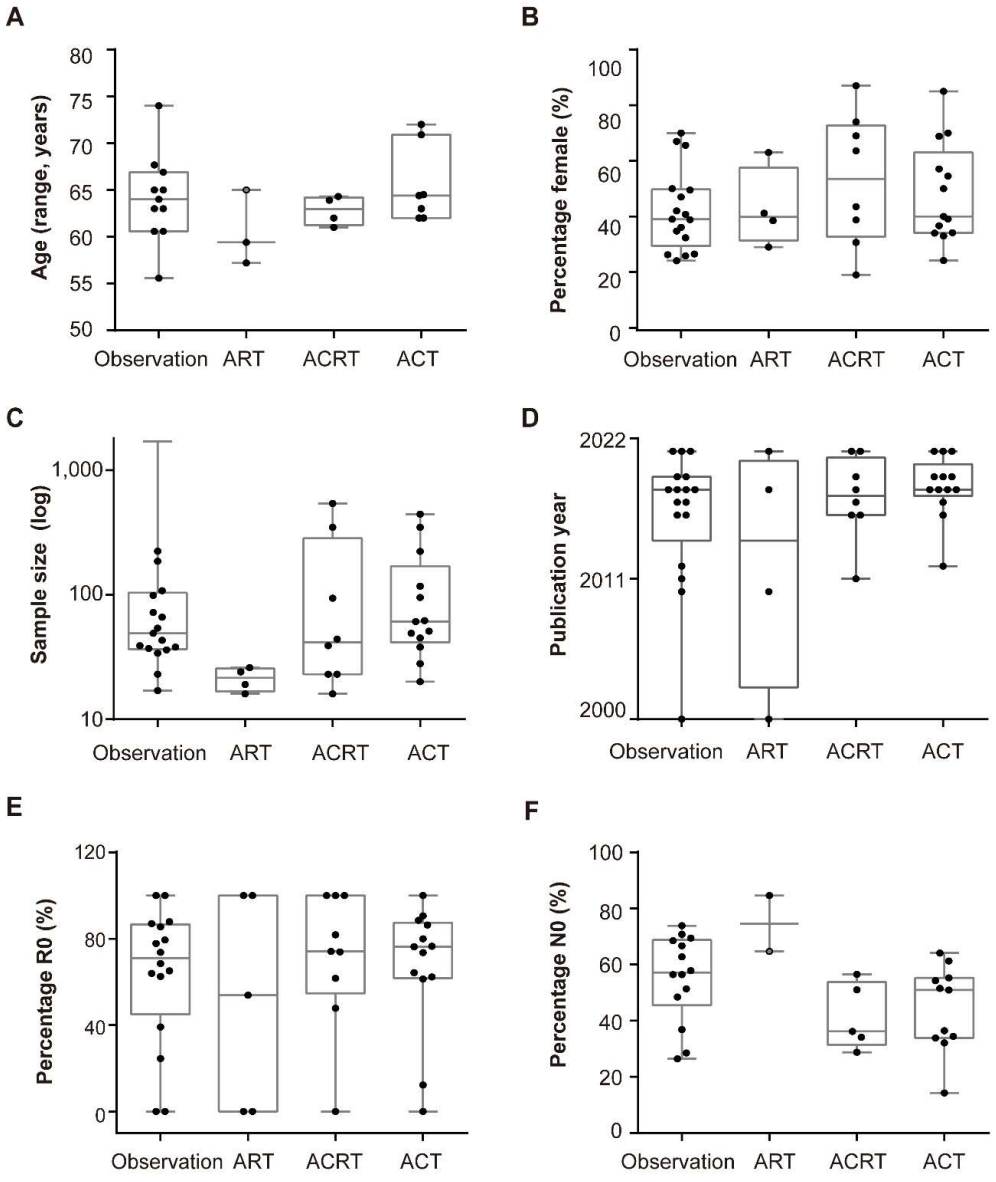
Supplementary Table 11. Ranking results for overall survival (OS) and disease-free survival (DFS) in the subgroup analysis.

Treatment	Rank of probability (%)									
	1	2	3	4	SUCRA	1	2	3	4	SUCRA
	OS for BTC patients with R0 resection margin					OS for BTC patients with R1 resection margin				
ACT	6.0	54.0	32.3	7.6	52.8	5.0	31.9	36.3	26.5	38.5
ART	11.6	12.0	7.6	68.8	22.1	9.9	36.8	17.5	35.8	40.3
ACRT	**81.9**	15.6	2.2	0.3	**93.1**	**83.9**	11.2	3.3	1.6	**92.5**
Observation	0.4	18.4	57.9	23.3	32.0	28.8	1.2	20.1	42.5	36.2
	OS for GBC patients					OS for CCA patients				
ACT	7.4	61.3	31.3	NA	38.1	1.1	15.9	75.7	7.3	37.0
ART	NA	NA	NA	NA	NA	45.4	39.8	12.2	2.7	75.9
ACRT	**90.4**	8.3	1.3	NA	**94.5**	53.5	43.9	2.5	0.1	**83.6**
Observation	2.2	30.4	67.4	NA	17.4	0.0	0.4	9.7	90.0	3.5
	OS for BTC patients in Asia					OS for BTC patients in Western				
ACT	8.5	45.1	43.6	2.8	53.1	3.2	87.2	9.6	NA	46.8
ART	13.5	37.1	42.7	6.7	52.5	NA	NA	NA	NA	NA
ACRT	**78.0**	17.2	4.7	0.1	**91.0**	**96.6**	3.1	0.2	NA	**98.2**
Observation	0.0	0.6	9.0	90.5	3.4	0.2	96.6	90.1	NA	5.0
	OS for BTC patients without distant metastasis					DFS for BTC patients without distant metastasis				
ACT	0.4	19.9	73.1	6.7	38.0	0.3	53.7	42.0	4.0	50.1
ART	**50.2**	29.2	10.6	10.0	73.2	7.1	36.2	21.1	35.5	38.3
ACRT	49.4	50.0	0.6	0.0	**82.9**	**92.6**	7.2	0.2	0.0	**97.5**
Observation	0.0	0.9	15.7	83.3	5.8	0.0	2.9	36.6	60.5	14.1
	DFS for GBC patients					DFS for CCA patients				
ACT	4.1	20.1	75.8	NA	14.1	1.2	57.9	38.2	2.7	52.6
ART	NA	NA	NA	NA	NA	4.4	35.0	28.1	32.5	37.1
ACRT	**78.2**	18.0	3.8	NA	**87.2**	**94.4**	5.2	0.4	0.0	37.1
Observation	17.7	62.0	20.4	NA	48.7	0.0	1.8	33.3	64.8	12.3
	DFS for BTC patients in Asia					DFS for BTC patients in Western				
ACT	0.9	62.8	33.3	3.0	53.9	32.3	60.4	7.3	NA	62.5
ART	3.1	31.1	33.0	32.8	34.8	NA	NA	NA	NA	NA
ACRT	**96.0**	3.8	0.2	0.0	**98.6**	**66.4**	25.2	8.5	NA	**78.9**
Observation	0.0	2.3	33.4	64.2	12.7	1.3	14.5	84.2	NA	8.6

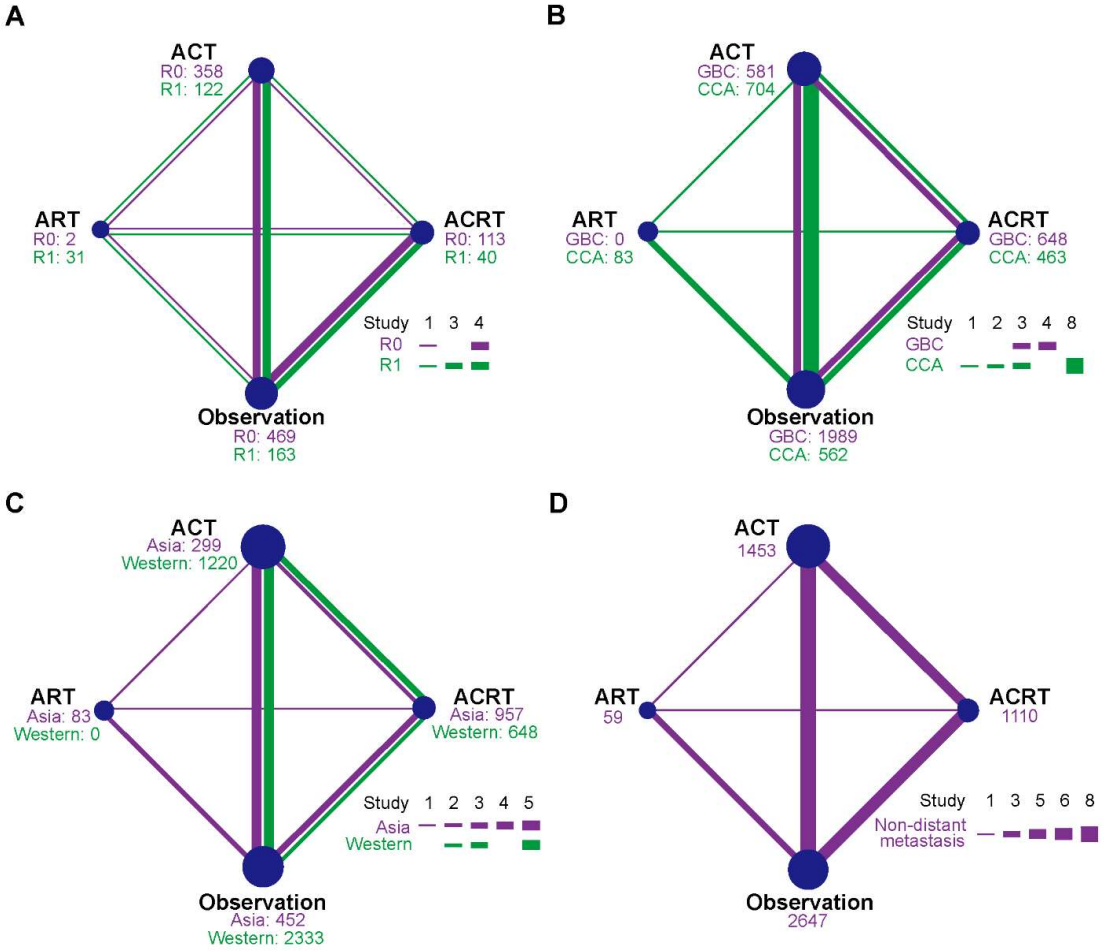
The number in each cell represents the posterior probability of the row-defining treatment being ranked at the column-defining position. The numbers with the biggest probability of ranking first and last are in bold and underscored. NA=Not available; ACT=Adjuvant Chemotherapy; ART=Adjuvant Radiotherapy; ACRT=Adjuvant Chemoradiation therapy.



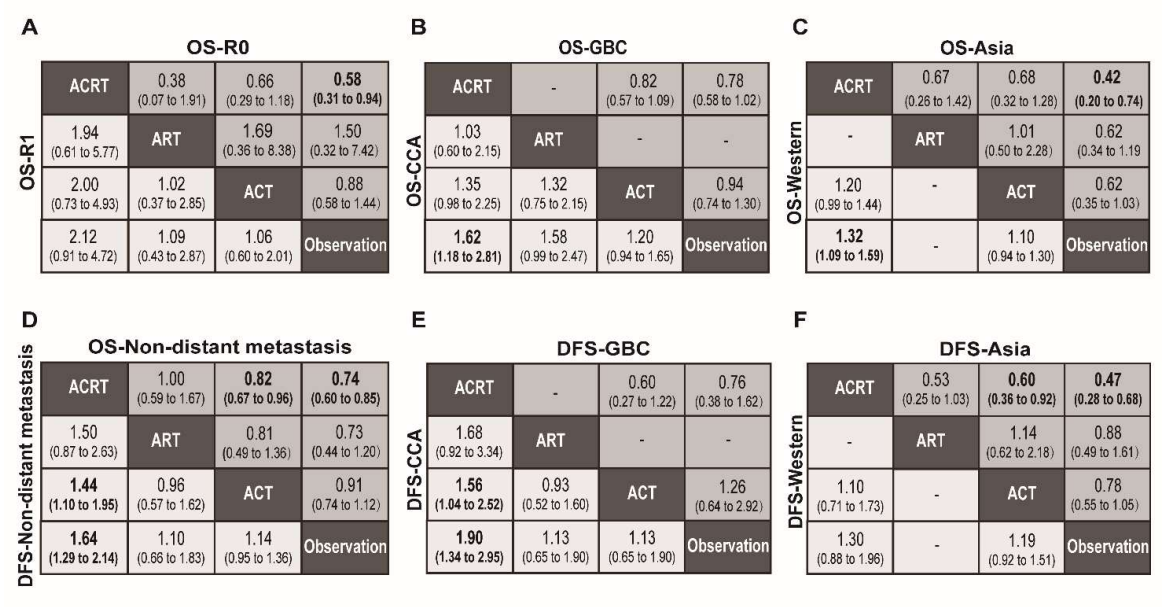
Supplementary Figure 1. Summary of results from quality assessment of three randomized controlled studies using the Cochrane risk of bias tool.



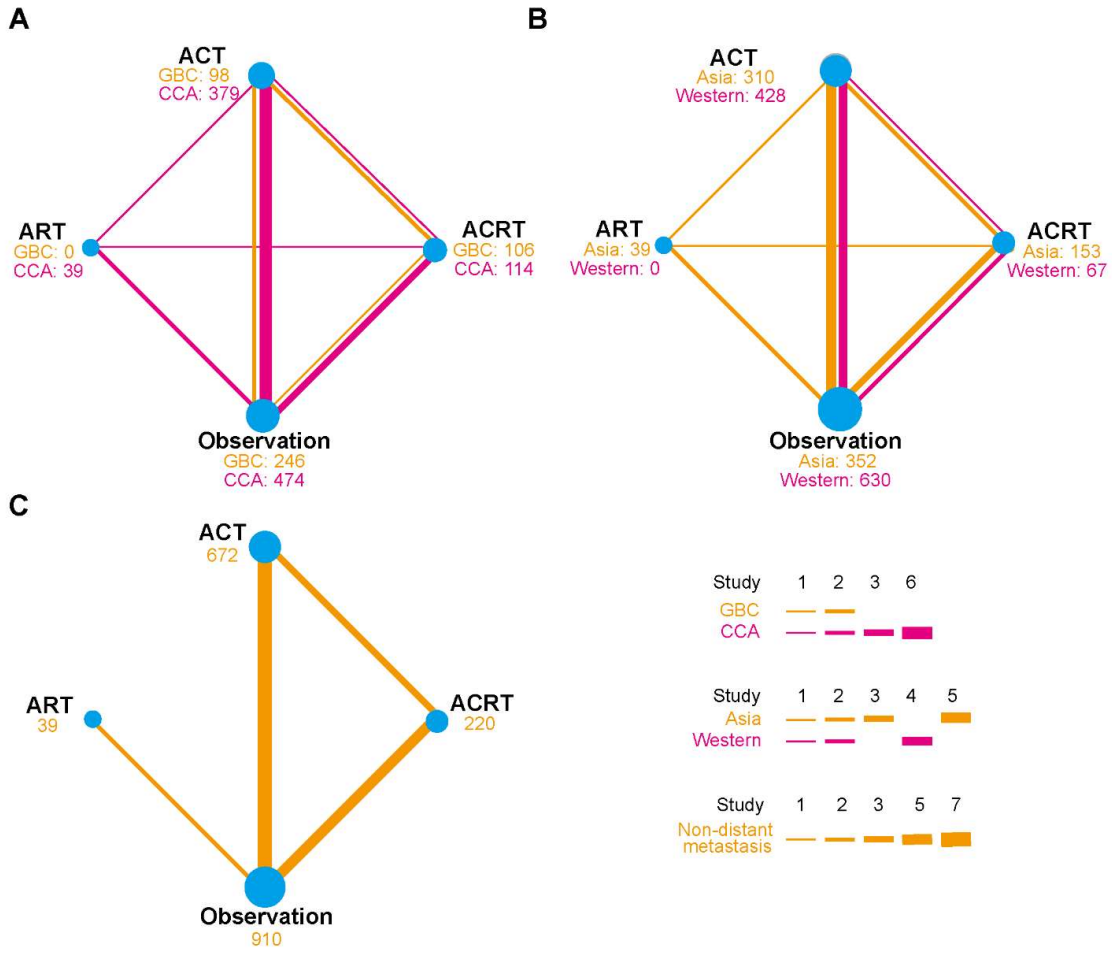
Supplementary Figure 2. Boxplots for distribution of mean age (A), percentage female (B), sample size (C), publication year (D), percentage R0 (E) and N0 (F) across comparisons.



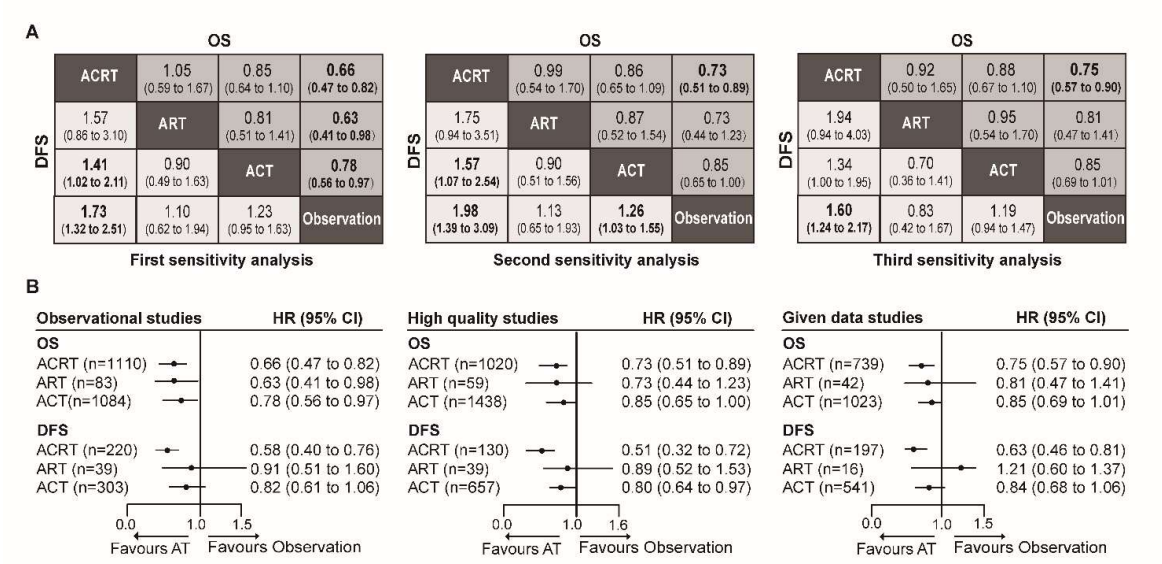
Supplementary Figure 3. Network plots of comparisons on overall survival of treatments in subgroups analyses (patients stratified into R0, R1, GBC, CCA, Asia, Western and non-distal metastasis). (A) Comparisons on overall survival in subgroups of study patients with R0 and R1 resection margin; **(B)** Comparisons on overall survival in patients with GBC and CCA; **(C)** Comparisons on overall survival in subgroups of study patients in Asia and Western; **(D)** Comparisons on overall survival in patients without distal metastasis.



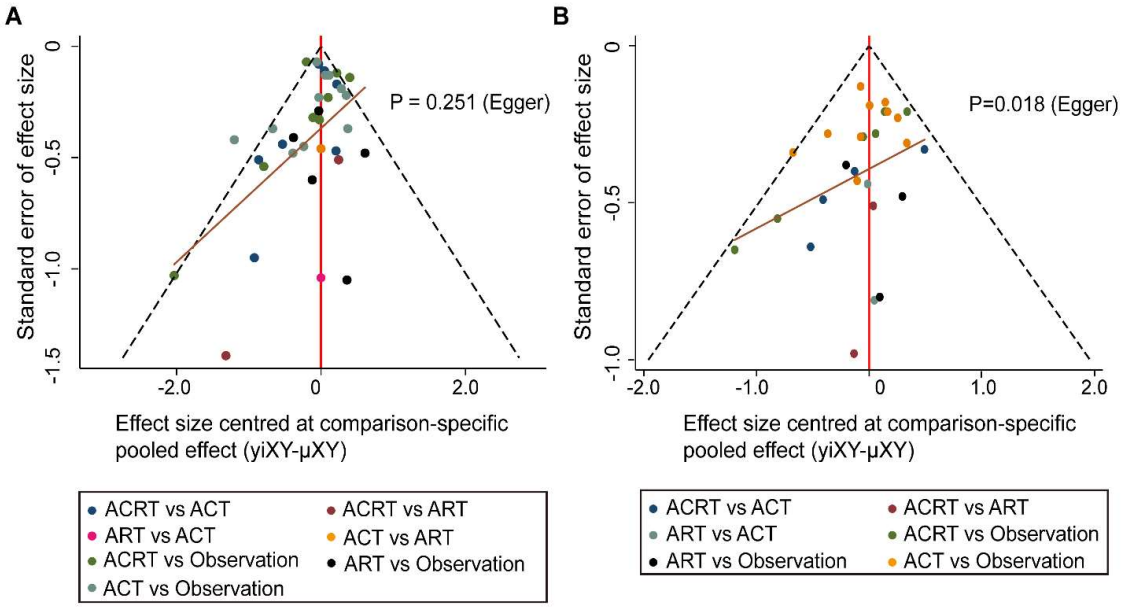
Supplementary Figure 4. League tables of the network meta-analysis in subgroup analyses. (A) League table of overall survival in subgroups of study patients with R0 and R1 resection margin; **(B)** and **(E)** League tables of overall survival and disease-free survival in subgroups of study patients with GBC and CCA; **(C)** and **(F)** League tables of overall survival and disease-free survival in subgroups of study patients in Asia and Western; **(D)** League table of overall survival and disease-free survival in subgroups of study patients without distal metastasis. Pooled hazard ratios (HRs) and 95% credible intervals (95% CIs) are listed in each cell. The estimate in each cell is for the comparison of row-defining treatment versus column-defining treatment. In the left lower half (DFS results), HR >1 favours the column-defining treatment, and in the upper right half (OS results), HR <1 favours the row-defining treatment.



Supplementary Figure 5. Network plots of comparisons on disease-free survival of treatments in subgroups analyses (patients stratified into GBC, CCA, Asia, Western and non-distal metastasis). (A) Comparisons on disease-free survival in subgroups of study patients with GBC and CCA; **(B)** Comparisons on disease-free survival in subgroups of study patients in Asia and Western; **(C)** Comparisons on disease-free survival in the subgroup of study patients without distal metastasis.



Supplementary Figure 6. Pooled estimates of the sensitivity analysis. (A) League tables of the network meta-analysis in sensitivity analyses. The estimate in each cell is for the comparison of row-defining treatment versus column-defining treatment. In the left lower half (DFS results), HR >1 favours the column-defining treatment, and in the upper right half (OS results), HR <1 favours the row-defining treatment. **(B)** Forest plots of the network meta-analysis in sensitivity analyses. Adjuvant treatments are ranked according to their surface under the cumulative ranking curve and compared with observation. Effect sizes are presented as hazard ratios (HRs) with 95% confidence intervals (95% CI). OS: overall survival; DFS: disease-free survival. First sensitivity analysis: excluding RCT studies; Second sensitivity analysis: removing low-and moderate-quality observational studies; Third sensitivity analysis: only including the studies for which HRs were reported in the original articles.



Supplementary Figure 7. The 'comparison-adjusted' funnel plot in network meta-analysis to assess funnel plot asymmetry on the efficacy outcomes. (A) Funnel plot asymmetry on the overall survival; **(B)** Funnel plot asymmetry on the disease-free survival. Funnel-plot asymmetry was tested b Egger's regression tests. No publication bias is detected when the P-value is larger than 0.05.