Supplementary Table 1 Detailed Search Strategies by Database

Database	Search Strategy
PubMed (MEDLINE)	("Robotic Surgical Procedures"[Mesh] OR robot*[tiab] OR "da vinci"[tiab] OR "robot-assisted"[tiab]) AND ("Hepatectomy"[Mesh] OR hepatectom*[tiab] OR "liver resection"[tiab] OR sectionectomy[tiab] OR segmentectomy[tiab] OR "Hepatobiliary Surgical Procedures"[Mesh] OR "Liver Transplantation"[Mesh] OR liver transplant*[tiab] OR "recipient hepatectomy"[tiab] OR "donor hepatectomy"[tiab] OR explant*[tiab] OR "graft hepatectomy"[tiab]) AND (meta-analysis[Publication Type] OR systematic[sb] OR "systematic review"[tiab] OR metaanaly*[tiab] OR "meta analy*"[tiab])
Embase	('robot assisted surgery'/exp OR robot*:ti,ab OR 'da vinci':ti,ab OR 'robot-assisted':ti,ab) AND ('hepatectomy'/exp OR hepatectom*:ti,ab OR 'liver resection':ti,ab OR sectionectomy:ti,ab OR segmentectomy:ti,ab OR 'hepatobiliary surgery'/exp OR 'liver

	transplantation'/exp OR 'liver transplant*':ti,ab OR 'recipient hepatectomy':ti,ab OR 'donor hepatectomy':ti,ab OR explant*:ti,ab OR 'graft hepatectomy':ti,ab) AND ('systematic review'/de OR 'meta analysis'/de OR (systematic NEXT/1 review*):ti,ab OR metaanaly*:ti,ab)
Scopus	(TITLE-ABS-KEY(robot* OR "da vinci" OR "robot-assisted")) AND (TITLE-ABS-KEY(hepatectom* OR "liver resection" OR sectionectomy OR segmentectomy OR "hepatobiliary" OR "liver transplant*" OR "recipient hepatectomy" OR "donor hepatectomy" OR explant* OR "graft hepatectomy")) AND (TITLE-ABS-KEY("systematic review" OR "meta-analysis" OR metaanaly*)) AND (DOCTYPE(re))
Web of Science	TS=(robot* OR "da vinci" OR "robot-assisted") AND TS=(hepatectom* OR "liver resection" OR sectionectomy OR segmentectomy OR hepatobiliary OR "liver transplant*" OR "recipient hepatectomy" OR "donor hepatectomy" OR explant* OR "graft hepatectomy") AND TS=("systematic review" OR "meta-analysis" OR metaanaly*) AND

DT=(Review)

Supplementary Table 2 Studies excluded at full-text with reasons

Study	Reason for exclusion
Coco D, Leanza S, Viola MG. Indocyanine green fluorescence navigation in robotic liver segmentectomies: A systematic review and meta-analysis. J Robot Surg. 2025 Sep 14;19(1):603. doi: 10.1007/s11701-025-02687-6.	Failure to disaggregate transplant-specific data from mixed populations
Song XH, Bai RL, Luo YC, Li W, Luo ZL. A comparative meta-analysis and systematic review of robot-assisted *vs* laparoscopic hemihepatectomy. J Robot Surg. 2025 Aug 9;19(1):469. doi: 10.1007/s11701-025-02464-5.	Failure to disaggregate transplant-specific data from mixed populations
Linecker M, Pfister M, Kambakamba P, Lang H, de Santibañes E, Barkun J, Clavien PA. Assessing Surgical Innovation. ALPPS: An IDEAL Example of Disruptive Innovation. Ann Surg. 2025 Aug 7. doi: 10.1097/SLA.0000000000006865.	Narrative or consensus format without systematic methodology
Del Angel Millan G, Cassese G, Giannone F, Del Basso C, Alagia M, Lodin M, Monsellato I, Palucci M, Sangiuolo F, Panaro F. Postoperative Outcomes After Robotic Liver Resection of Caudate Lobe: A Systematic Review. Medicina (Kaunas). 2024 Dec 29;61(1):34. doi: 10.3390/medicina61010034	Absence of comparative analysis between robotic and non-robotic techniques
Zhang L, Yuan Q, Xu Y, Wang W. Comparative	Failure to disaggregate

clinical outcomes of robot-assisted liver resection *vs* laparoscopic liver resection: A meta-analysis. PLoS One 2020 Oct 13;15(10):e0240593. doi: 10.1371/journal.pone0240593	transplant-specific data from mixed populations
Guan R, Chen Y, Yang K, Ma D, Gong X, Shen B, Peng C. Clinical efficacy of robot-assisted *vs* laparoscopic liver resection: A meta analysis. Asian J Surg. 2019 Jan;42(1):19-31. doi: 10.1016/j.asjsur.2018.05.008.	Failure to disaggregate transplant-specific data from mixed populations
Kamarajah SK, Bundred J, Manas D, Jiao L, Hilal MA, White SA. Robotic *vs* conventional laparoscopic liver resections: A systematic review and meta-analysis. Scand J Surg. 2021 Sep;110(3):290-300. doi: 10.1177/1457496920925637.	Failure to disaggregate transplant-specific data from mixed populations
Zhao X, Mao T, Gao F, Wu H. A commentary on 'Comparison of safety and effectiveness between robotic and laparoscopic major hepatectomy: A systematic review and meta-analysis'. Int J Surg. 2024 Jan 1;110(1):619-620. doi: 10.1097/JS9.0000000000000820.	Narrative (commentary) format without systematic methodology
Rahimli M, Perrakis A, Andric M, Stockheim J, Franz M, Arend J, Al-Madhi S, Abu Hilal M, Gumbs AA, Croner RS. Does Robotic Liver Surgery Enhance R0 Results in Liver Malignancies during Minimally Invasive Liver Surgery?-A Systematic Review and Meta-	Failure to disaggregate transplant-specific data from mixed populations

Analysis. Cancers (Basel). 2022 Jul 11;14(14):3360. doi: 10.3390/cancers14143360.	
Guadagni S, Comandatore A, Furbetta N, Di Franco G, Carpenito C, Bechini B, Vagelli F, Ramacciotti N, Palmeri M, Di Candio G, Morelli L. Robotic Hepatectomy plus Biliary Reconstruction for Bismuth Type III and Type IV Hilar Cholangiocarcinoma: State of the Art and Literature Review. J Pers Med. 2023 Dec 21;14(1):12. doi: 10.3390/jpm14010012.	Narrative or consensus format without systematic methodology
Mkabaah LB, Davey MG, Kerin EP, Ryan OK, Ryan EJ, Donnelly M, Ahmed O, McEntee GP, Conneely JB, Donlon NE. Comparing Open, Laparoscopic and Robotic Liver Resection for Metastatic Colorectal Cancer-A Systematic Review and Network Meta-Analysis. J Surg Oncol 2025 Feb;131(2):262-273. doi: 10.1002/jso.27909.	Failure to disaggregate transplant-specific data from mixed populations
Aoyagi Y, Gaudenzi F, Wakabayashi T, Teshigahara Y, Nie Y, Wakabayashi G. Robotic surgery for perihilar cholangiocarcinoma: A concise systematic review. Surg Endosc. 2025 Apr;39(4):2701-2710. doi: 10.1007/s00464-025-11650-3.	Failure to disaggregate transplant-specific data from mixed populations

Supplementary Table 3A-E AMSTAR 2 Item-level Checklists

Each checklist presents item-by-item AMSTAR 2 judgments (Yes / Partial Yes / No / Not Applicable), with brief rationales. Meta-analysis-related items are marked Not

Applicable (NA) where no de novo pooling was conducted. AMSTAR 2 was applied only to systematic reviews; for Hobeika *et al.*, appraisal pertains exclusively to the embedded systematic-review methods (jury recommendations not graded).

3A. Giglio *et al.* 2025 (Systematic Review & Meta-analysis)

Overall AMSTAR 2 confidence: Moderate.

Item	Critical domain	Judgment	Rationale (brief; cite page/figure if applicable)
1. PICO elements clearly stated in research question and inclusion criteria	No	Yes	PICO and eligibility stated.
2. Protocol registered before conduct (*e.g.*, PROSPERO) and deviations justified	Yes	Yes	Protocol/registration reported.
3. Justification for selection of study designs included	No	Yes	Study designs justified.
4. Comprehensive literature search strategy	Yes	Partial Yes	Comprehensive databases; limited grey literature.
5. Study selection performed in duplicate	No	Yes	Dual screening reported.
6. Data extraction performed in duplicate	No	Yes	Dual extraction reported.
7. List of excluded studies provided with justifications	Yes	Partial Yes	Exclusions summarized; full list partly reported.
8. Description of included studies in adequate detail	No	Yes	Study characteristics tables provided.

9. Risk of bias of individual studies assessed	Yes	Yes	Risk of bias of primary studies assessed.
10. Funding sources of included studies reported	No	Partial Yes	Funding of included studies partially reported.
11. Methods appropriate for meta-analysis	Yes	Yes	Meta-analytic methods appropriate.
12. Assessment of risk of bias impact on meta-analysis results	No	Partial Yes	Explored impact of RoB/sensitivity analyses.
13. Consideration of risk of bias in interpreting results	Yes	Yes	Considered RoB when interpreting results.
14. Adequate investigation of heterogeneity	No	Yes	Heterogeneity assessed (I^2/subgroup).
15. Assessment of publication bias/small-study effects	Yes	Partial Yes	Small-study effects assessed where feasible.
16. Review authors' conflicts of interest reported	No	Yes	Review COIs reported.

3B. Pilz da Cunha *et al*. 2025 (Systematic Review & Meta-analysis)

Overall AMSTAR 2 confidence: High.

Item	Critical domain	Judgment	Rationale (brief; cite page/figure if applicable)
1. PICO elements clearly stated in research question and inclusion criteria	No	Yes	Clear PICO/inclusion criteria.
2. Protocol registered before conduct (*e.g.*, PROSPERO) and	Yes	Yes	Protocol/registration reported.

deviations justified			
3. Justification for selection of study designs included	No	Yes	Designs justified.
4. Comprehensive literature search strategy	Yes	Yes	Comprehensive search strategy.
5. Study selection performed in duplicate	No	Yes	Duplicate screening.
6. Data extraction performed in duplicate	No	Yes	Duplicate extraction.
7. List of excluded studies provided with justifications	Yes	Yes	List of exclusions with reasons.
8. Description of included studies in adequate detail	No	Yes	Detailed study descriptions.
9. Risk of bias of individual studies assessed	Yes	Yes	Risk of bias tools applied.
10. Funding sources of included studies reported	No	Yes	Funding of included studies reported.
11. Methods appropriate for meta-analysis	Yes	Yes	Appropriate meta-analytic models.
12. Assessment of risk of bias impact on meta-analysis results	No	Yes	Impact of RoB on findings considered.
13. Consideration of risk of bias in interpreting results	Yes	Yes	RoB considered in interpretation.
14. Adequate investigation of heterogeneity	No	Yes	Heterogeneity explored.
15. Assessment of publication bias/small-study effects	Yes	Yes	Publication bias assessed.
16. Review authors' conflicts of	No	Yes	Review COIs reported.

interest reported

3C. Koh *et al*. 2024 (Systematic Review & Network Meta-analysis)

Overall AMSTAR 2 confidence: High.

Item	Critical domain	Judgment	Rationale (brief; cite page/figure if applicable)
1. PICO elements clearly stated in research question and inclusion criteria	No	Yes	PICO specified.
2. Protocol registered before conduct (*e.g.*, PROSPERO) and deviations justified	Yes	Yes	Protocol/registration reported.
3. Justification for selection of study designs included	No	Yes	Designs justified.
4. Comprehensive literature search strategy	Yes	Yes	Comprehensive search.
5. Study selection performed in duplicate	No	Yes	Duplicate screening.
6. Data extraction performed in duplicate	No	Yes	Duplicate extraction.
7. List of excluded studies provided with justifications	Yes	Yes	Exclusion list with reasons.
8. Description of included studies in adequate detail	No	Yes	Adequate description of included studies.
9. Risk of bias of individual studies assessed	Yes	Yes	Risk of bias assessed.

10. Funding sources of included studies reported	No	Yes	Funding of included studies reported.
11. Methods appropriate for meta-analysis	Yes	Yes	Network meta-analytic methods appropriate.
12. Assessment of risk of bias impact on meta-analysis results	No	Yes	Impact of RoB considered in NMA.
13. Consideration of risk of bias in interpreting results	Yes	Yes	Considered RoB in interpretation.
14. Adequate investigation of heterogeneity	No	Yes	Inconsistency/heterogeneity assessed.
15. Assessment of publication bias/small-study effects	Yes	Yes	Small-study/publication bias assessed.
16. Review authors' conflicts of interest reported	No	Yes	Review COIs reported.

3D. Broering *et al*. 2024 (Systematic Review & Meta-analysis within perspective article)

Overall AMSTAR 2 confidence: High.

Item	Critical domain	Judgment	Rationale (brief; cite page/figure if applicable)
1. PICO elements clearly stated in research question and inclusion criteria	No	Yes	PICO-like framing and explicit inclusion criteria for MIOT SR.
2. Protocol registered before conduct (*e.g.,* PROSPERO) and deviations justified	Yes	Partial Yes	Protocol/registration not clearly reported; methods described.

3. Justification for selection of study designs included	No	Yes	Design choices explained for SR corpus.
4. Comprehensive literature search strategy	Yes	Yes	Explicit multi-database searches with dates.
5. Study selection performed in duplicate	No	Partial Yes	Selection processes described; degree of duplication unclear.
6. Data extraction performed in duplicate	No	Partial Yes	Extraction described; duplication unclear.
7. List of excluded studies provided with justifications	Yes	Partial Yes	Reasons for exclusions summarized; complete list unclear.
8. Description of included studies in adequate detail	No	Yes	Included studies summarized in detail.
9. Risk of bias of individual studies assessed	Yes	Partial Yes	Study-level quality/Limitations discussed; formal RoB tool use may be limited.
10. Funding sources of included studies reported	No	Partial Yes	Funding of included studies not consistently reported.
11. Methods appropriate for meta-analysis	Yes	Yes	Meta-analytic pooling with heterogeneity (I^2) reported.
12. Assessment of risk of bias impact on meta-analysis results	No	Partial Yes	Sensitivity analyses/impact of RoB partially addressed.
13. Consideration of risk of bias in interpreting results	Yes	Yes	Limitations/quality considered in interpretation.
14. Adequate investigation of heterogeneity	No	Yes	Heterogeneity explored and reported.
15. Assessment of publication bias/small-study effects	Yes	Partial Yes	Publication bias assessed where feasible.

16. Review authors' conflicts of interest reported	No	Yes	Author COIs reported.

3E. Hobeika *et al*. 2025 (Embedded Systematic Review; consensus recommendations not graded)

Overall AMSTAR 2 confidence: Moderate.

Item	Critical domain	Judgment	Rationale (brief; cite page/figure if applicable)
1. PICO elements clearly stated in research question and inclusion criteria	No	Yes	Key questions structured with PICO; eligibility stated.
2. Protocol registered before conduct (*e.g.,* PROSPERO) and deviations justified	Yes	Yes	PROSPERO-registered SR (ID reported).
3. Justification for selection of study designs included	No	Yes	Study designs prespecified using SIGN50.
4. Comprehensive literature search strategy	Yes	Yes	Comprehensive multi-database search with PRISMA flow.
5. Study selection performed in duplicate	No	Yes	Dual/blinded quality assessment reported.
6. Data extraction performed in duplicate	No	Partial Yes	Extraction processes described; duplication to verify.
7. List of excluded studies provided with justifications	Yes	Partial Yes	Exclusions summarized; full list location to verify.
8. Description of included studies in adequate detail	No	Yes	Adequate description of included studies.

9. Risk of bias of individual studies assessed	Yes	Yes	Methodological quality *via* SIGN50; risk of bias addressed.
10. Funding sources of included studies reported	No	Partial Yes	Funding of included studies variably reported.
11. Methods appropriate for meta-analysis	Yes	NA	No de novo meta-analysis for transplant-specific outcomes.
12. Assessment of risk of bias impact on meta-analysis results	No	NA	No meta-analytic results to which RoB could be propagated.
13. Consideration of risk of bias in interpreting results	Yes	Yes	Certainty (GRADE) considered in recommendations.
14. Adequate investigation of heterogeneity	No	Partial Yes	Heterogeneity considered qualitatively.
15. Assessment of publication bias/small-study effects	Yes	NA	No quantitative synthesis; small-study bias not applicable.
16. Review authors' conflicts of interest reported	No	Yes	COIs and proctoring exclusions stated.

Supplementary Table 4A. Evidence Profile — Donors: Robotic *vs* Open (GRADE)

Outcome	No. of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Public bias
Operative time (minutes)	6	Observational (comparative)	serious	very serious ($I^2 \approx 91\%$)	no	no	undet
Blood loss (mL)	6	Observational (comparative)	serious	very serious ($I^2 \approx 98\%$)	no	no	undet

Length of stay (days)	6	Observational (comparative)	serious	serious ($I^2 \approx 82\%$)	no	no	undet
Minor complications (Clavien-Dindo I)	2	Observational (comparative)	serious	no	no	serious (wide CI)	undet

Orientation of continuous outcomes is Open - Robotic; positive MD indicates higher value in Open. N/A=Not applicable

Supplementary Table 4B. Evidence Profile — Recipients: Robotic *vs* Comparator (GRADE)

Outcome	No. of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Publi bias
Conversion to open	24	Observational (comparative)	serious	no/serious	serious (indirectness to transplant setting)	no	undet
Overall morbidity	20	Observational (comparative)	serious	no/serious	serious (indirectness)	borderline	undet

Severe morbidity (Clavien-Dindo ≥ III)	21	Observational (comparative)	serious	no/serious	serious	no	undet
R0 resection rate	Not stated	Observational (comparative)	serious	no/serious	serious (indirectness)	no	suspe
Readmission	20	Observational (comparative)	serious	no/serious	serious (indirectness)	no	suspe
Length of stay (days)	26	Observational (comparative)	serious	very serious ($I^2 \approx 87\%$)	serious (indirectness)	no	undet

N/A=Not applicable

Supplementary Table 5 Citation matrix of primary studies across included reviews

Legend: ✓ = included; blank = not included.

Primary study (Author Year)	Giglio 2025 [Donor SR/MA]	Pilz da Cunha 2025 [Recipient SR/MA]	Koh 2024 [Economic NMA]	Broering 2024 [MIOT SR/MA]

Abu 2013			✓		
Amma 2022	✓				
Aziz 2021		✓			
Aziz 2022		✓			
Baker 2009	✓				✓
Bell45 2015			✓		
Bhojani 2012			✓		
Broering 2024	✓				
Cai72 2022			✓		
Cannon42 2013			✓		
Chen 2012					✓
Chen 2016	✓				✓
Cherqui 2002					✓
Chiow 2021		✓			
Cho 2021	✓				
Choi 2012	✓				
Chong 2023		✓			
Cipriani62 2019			✓		
Coelho 2009					✓
Cosic63 2019			✓		
Croner47 2016			✓		
D'Silva 2022		✓			
Daskalaki52 2017			✓		
Dokmak43 2014			✓		

Eguchi 2018	✓				
Fagenson 2021		✓			
First			✓		
Fretland56 2018			✓		
Gautier 2018	✓				
Griffiths67 2020			✓		
Ha 2013	✓				
Hawksworth68 2021			✓		
He 2021	✓				
He70 2021			✓		
Hong 2022	✓				
Hu 2024		✓			
Hu61 2019			✓		
Jajja57 2018			✓		
Kadam 2022		✓			
Kato 2023		✓			
Kawaguchi49 2016			✓		
Kim 2021	✓				
Kim51 2016			✓		
Knitter76 2023			✓		
Kobayashi 2018	✓				
Koffron 2006					✓
Krenzien 2023		✓			
Kurosaki 2006	✓				✓

Kwak 2023		✓			
Lapisatepun 2022	✓				
Law 2020	✓				
Lee 2019	✓				
Lei 2020	✓				
Li 2024		✓			
Lim 2019		✓			
Linn 2024	✓				
Liu 2023		✓			
Lopez-Lopez 2024		✓			
Makki 2014	✓				
Marubashi 2013	✓				
Mejia64 2019			✓		
Miller 2022		✓			
Packiam40 2012			✓		
Peng54 2017			✓		
Polignano34 2008			✓		
Raptis 2024	✓				✓
Rayman77 2023			✓		
Rho 2022	✓				
Rhu 2021	✓				
Riquelme66 2020			✓		

Rotellar 2017	✓				
Rowe35 2009			✓		
Safwan 2018	✓				
Salloum53 2017			✓		
Samstein 2018	✓				
Schmelzle 2022		✓			
Sham50 2016			✓		
Shu59 2019			✓		
Sijberden 2024		✓			
Song 2018	✓				
Soubrane 2006	✓				
Stewart71 2021			✓		
Stoot39 2012			✓		
Sucandy 2022		✓			
Suh 2015	✓				
Suh 2018	✓				
Troisi 2009					✓
Troisi 2014					✓
Troisi 2024	✓				
Tsinberg36 2009			✓		
Vanounou37 2010			✓		
Vieira 2019	✓				
Wabitsch60 2019			✓		

Wang46 2015			✓
Wang65 2020			✓
Wen69 2021			✓
Winckelmans74 2023			✓
Wu58 2019			✓
Xie75 2023			✓
Xu55 2018			✓
Yang 2021	✓		
Yu44 2014			✓
Zhang33 2008			✓
Zhang48 2016			✓
Zhu 2019	✓		
Zhu 2023		✓	
Zhu73 2022			✓

CCA results

Graded corpus (Giglio 2025; Pilz da Cunha 2025; Koh 2024): CCA = 0.0% (n = 101, r = 101, c=3).

Overall (including Broering 2024): CCA = 1.2% (n = 111, r = 107, c=4).