Robotic-Assisted vs. Standard Laparoscopic Surgery for Rectal Cancer Resection: A Systematic Review and Meta-Analysis of 19,731 Patients

Supplementary Digital File

CONTENT

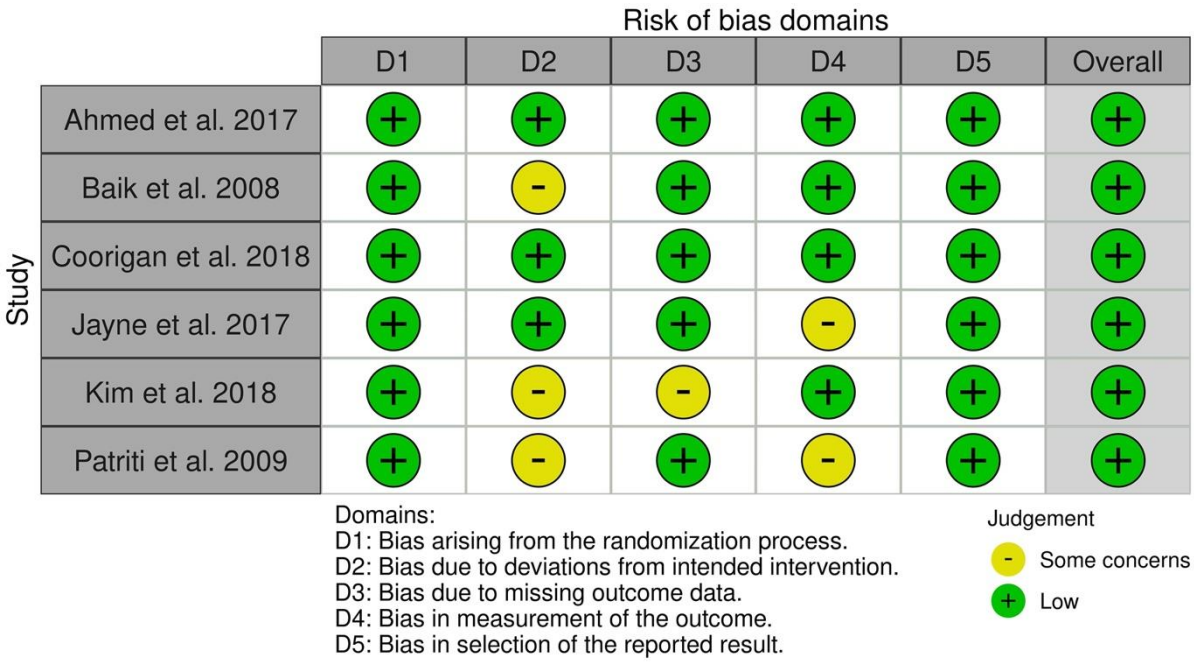

Figure S1. A summary table of review authors' judgements for each risk of bias item for each randomized study.

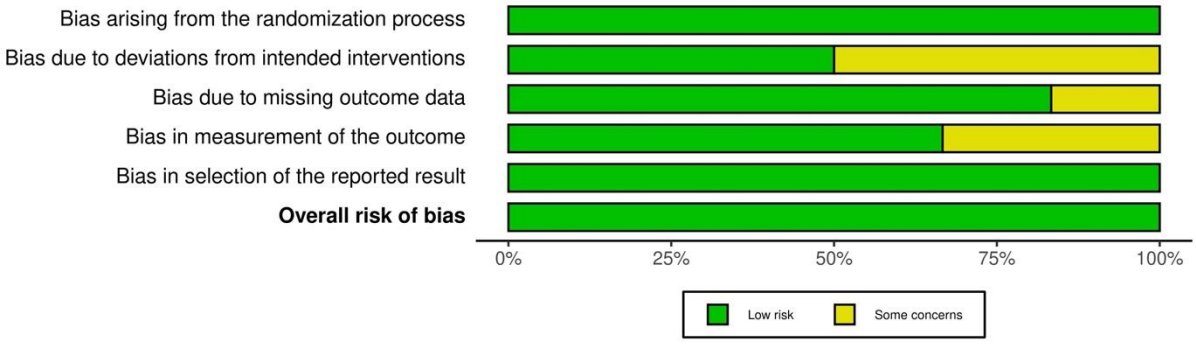

Figure S2. A plot of the distribution of review authors' judgements across randomized studies for each risk of bias item.

Figure S3. A summary table of review authors' judgements for each risk of bias item for each non-randomized study.

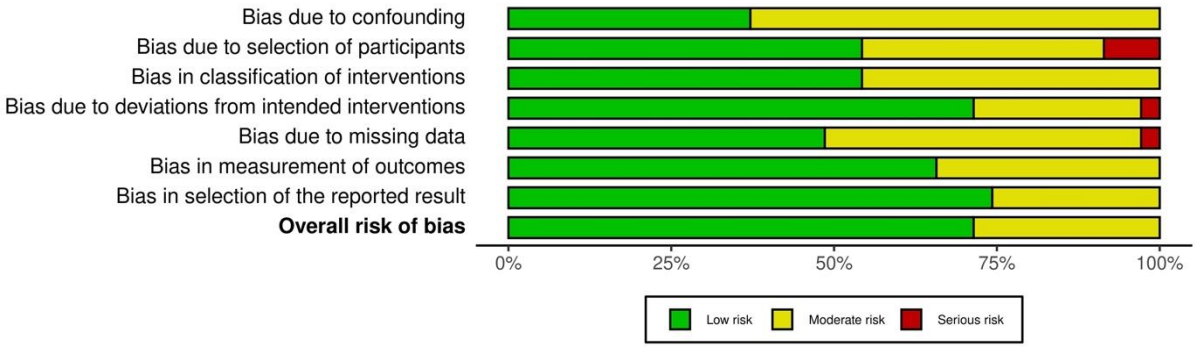

Figure S4. A plot of the distribution of review authors' judgements across non-randomized studies for each risk of bias item.

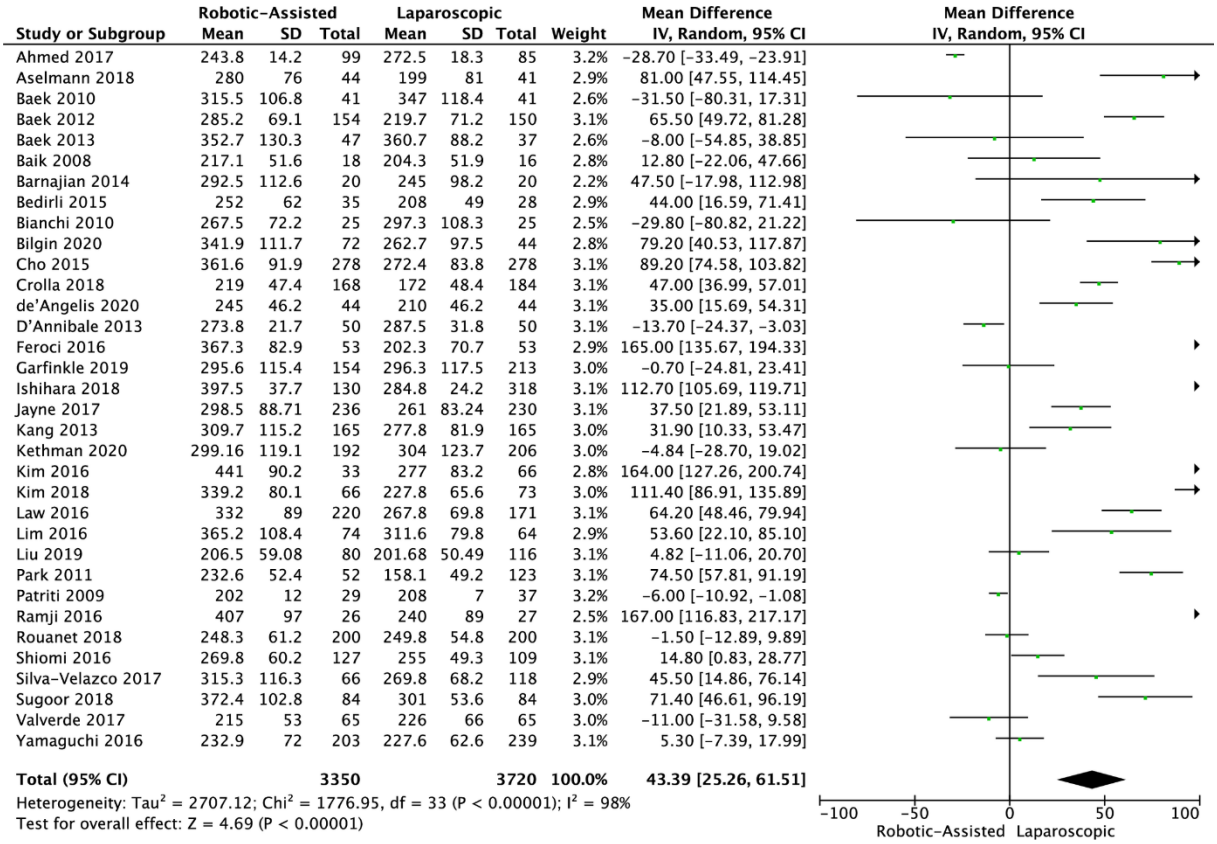

Figure S5. Forest plot of operative time in the robotic-assisted and laparoscopic groups. The center of each square represents the weighted mean difference for individual trials, and the corresponding horizontal line stands for a 95% confidence interval. The diamonds represent pooled results. Legend: CI = confidence interval.

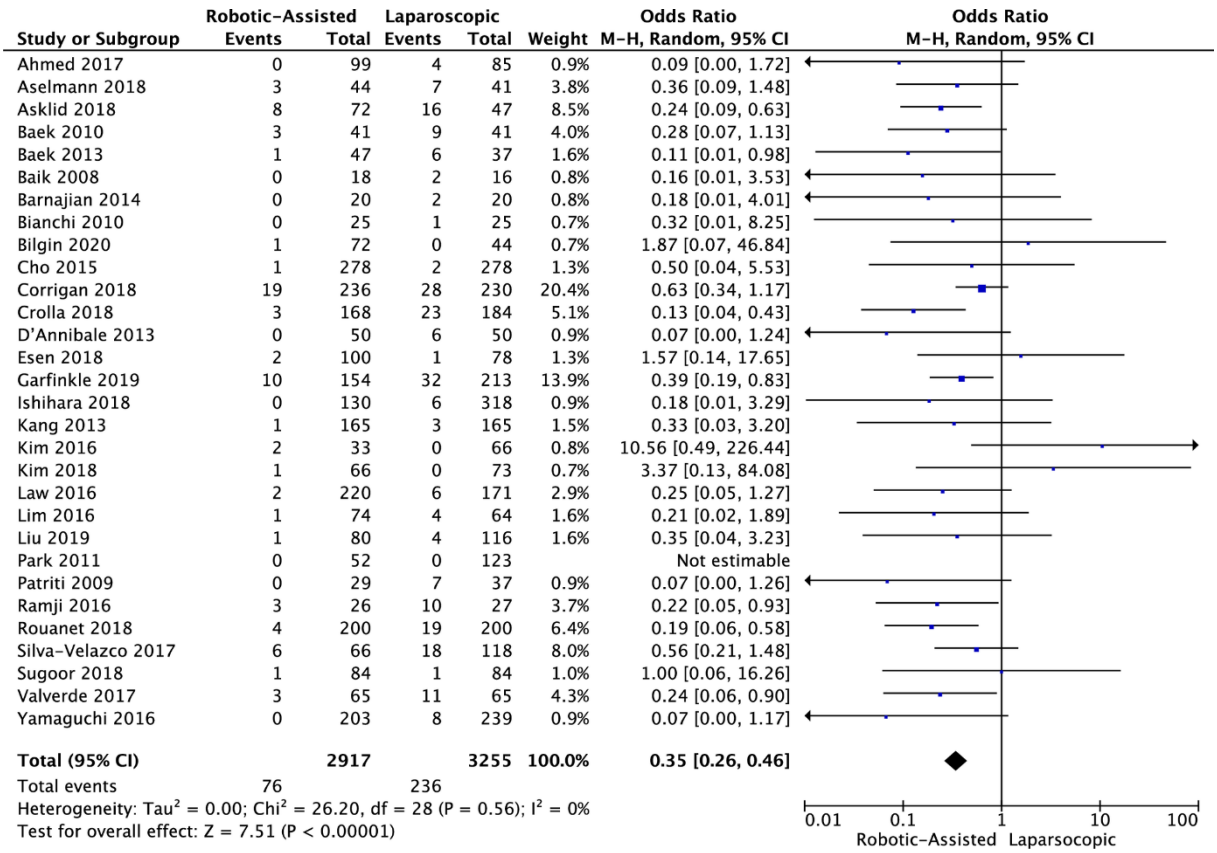

Figure S6. Forest plot of conversion to open surgery rate in the robotic-assisted and laparoscopic groups. The center of each square represents the weighted odds ratio for individual trials, and the corresponding horizontal line stands for a 95% confidence interval. The diamonds represent pooled results. Legend: CI = confidence interval.

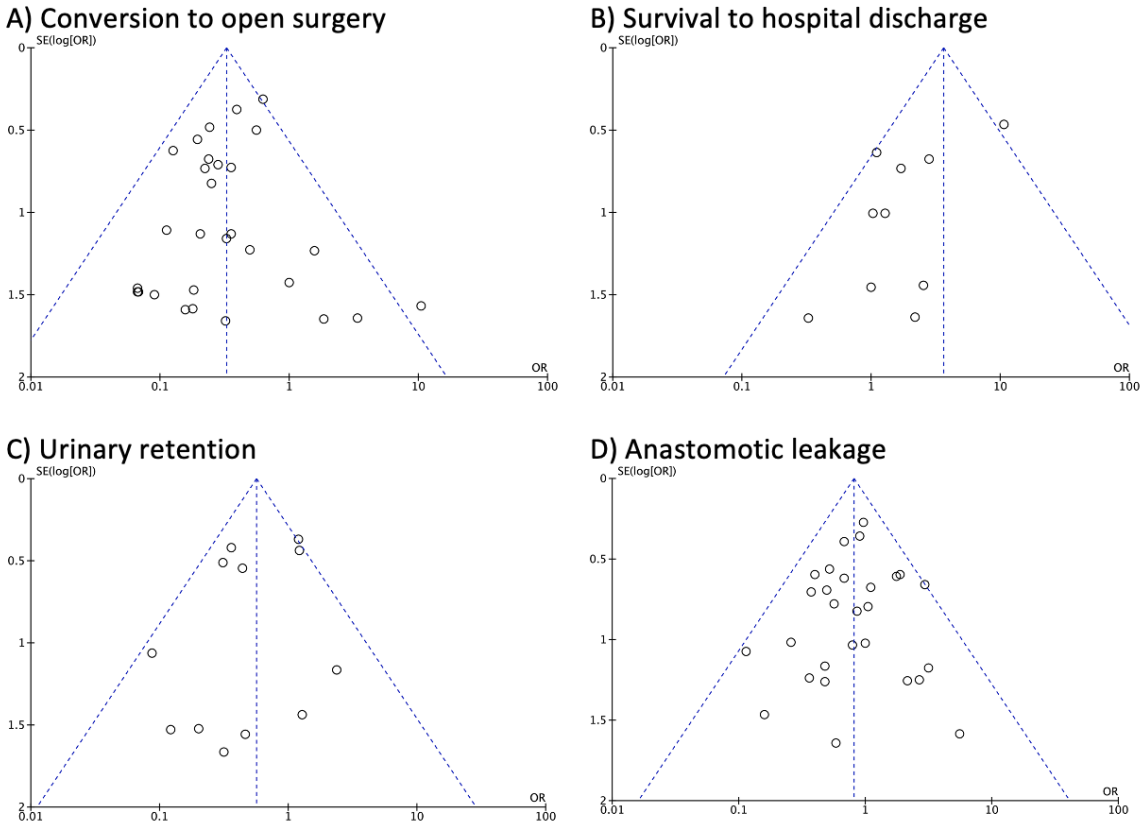

Figure S7. Funnel plot with 95% confidence limits for publication bias in the studies investigating: (A) conversion to open surgery, (B) survival to hospital discharge, (C) urinary retention occurrence, (D) anastomotic leakage occurrence.

Study or Subgroup	Robotic-Assisted Mean	SD	Total	Laparoscopic Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Ahmed 2017	8.1	2.1	99	105.6	33.8	85	5.3%	−97.50 [−104.70, −90.30]
Baek 2010	605	571.6	41	404.3	283.8	41	1.6%	200.70 [5.36, 396.04]
Baek 2012	167.8	26.1	154	126	267.7	150	4.8%	41.80 [−1.24, 84.84]
Baek 2013	190.9	284.7	47	302.7	305.3	37	2.6%	−111.80 [−239.48, 15.88]
Barnajian 2014	237.5	173.2	20	325	245.4	20	2.6%	−87.50 [−219.14, 44.14]
Bedirli 2015	120	15	35	165	40	28	5.3%	−45.00 [−60.63, −29.37]
Cho 2015	179	236.5	278	147	295.3	278	4.8%	32.00 [−12.47, 76.47]
de'Angelis 2020	130	57.7	44	163.8	73.6	44	5.1%	−33.80 [−61.43, −6.17]
Esen 2018	134	62	100	83	46	78	5.3%	51.00 [35.13, 66.87]
Feroci 2016	130.4	115.5	53	123.7	115.5	58	4.8%	6.70 [−36.32, 49.72]
Ishihara 2018	56	23	130	36.3	15.7	318	5.3%	19.70 [15.39, 24.01]
Kang 2013	133	192.3	165	140.1	216.4	165	4.8%	−7.10 [−51.27, 37.07]
Kim 2016	232	180	33	205	163.8	66	4.0%	27.00 [−46.03, 100.03]
Kim 2018	300	288.7	66	100	86.6	73	4.0%	200.00 [127.57, 272.43]
Law 2016	677.5	415	220	552.5	331.7	171	4.0%	125.00 [50.98, 199.02]
Liu 2019	175.06	110.77	80	123.91	99.61	116	5.1%	51.15 [20.86, 81.44]
Patriti 2009	137.4	156	29	127	169	37	3.9%	10.40 [−68.27, 89.07]
Ramji 2016	296	155	26	524	501	27	1.5%	−228.00 [−426.14, −29.86]
Rouanet 2018	300	133.3	200	450	266.7	200	4.8%	−150.00 [−191.32, −108.68]
Shiomi 2016	39.5	23	127	129.8	81.5	109	5.3%	−90.30 [−106.11, −74.49]
Silva-Velazco 2017	876.3	856	66	853.8	497.5	118	1.3%	22.50 [−202.68, 247.68]
Sugoor 2018	213.5	251.1	84	208.5	215.5	84	4.1%	5.00 [−65.76, 75.76]
Valverde 2017	143	180	65	92	112	65	4.6%	51.00 [−0.54, 102.54]
Yamaguchi 2016	15.4	26.4	203	39.1	85.1	239	5.3%	−23.70 [−35.08, −12.32]
Total (95% CI)			**2365**			**2607**	**100.0%**	**−0.94 [−30.11, 28.22]**

Heterogeneity: Tau² = 4138.44; Chi² = 1063.61, df = 23 (P < 0.00001); I² = 98%
Test for overall effect: Z = 0.06 (P = 0.95)

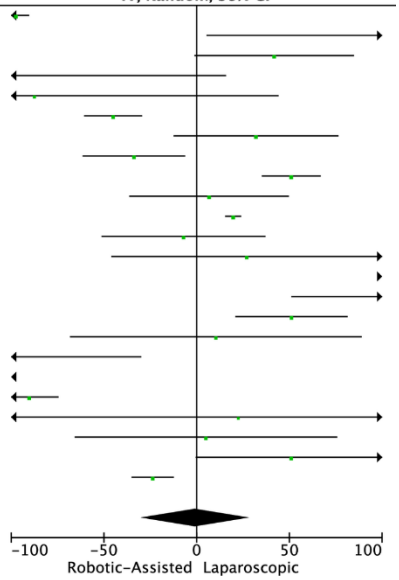

Figure S8. Forest plot of intraoperative blood loss in the robotic-assisted and laparoscopic groups. The center of each square represents the weighted mean difference for individual trials, and the corresponding horizontal line stands for a 95% confidence interval. The diamonds represent pooled results. Legend: CI = confidence interval.

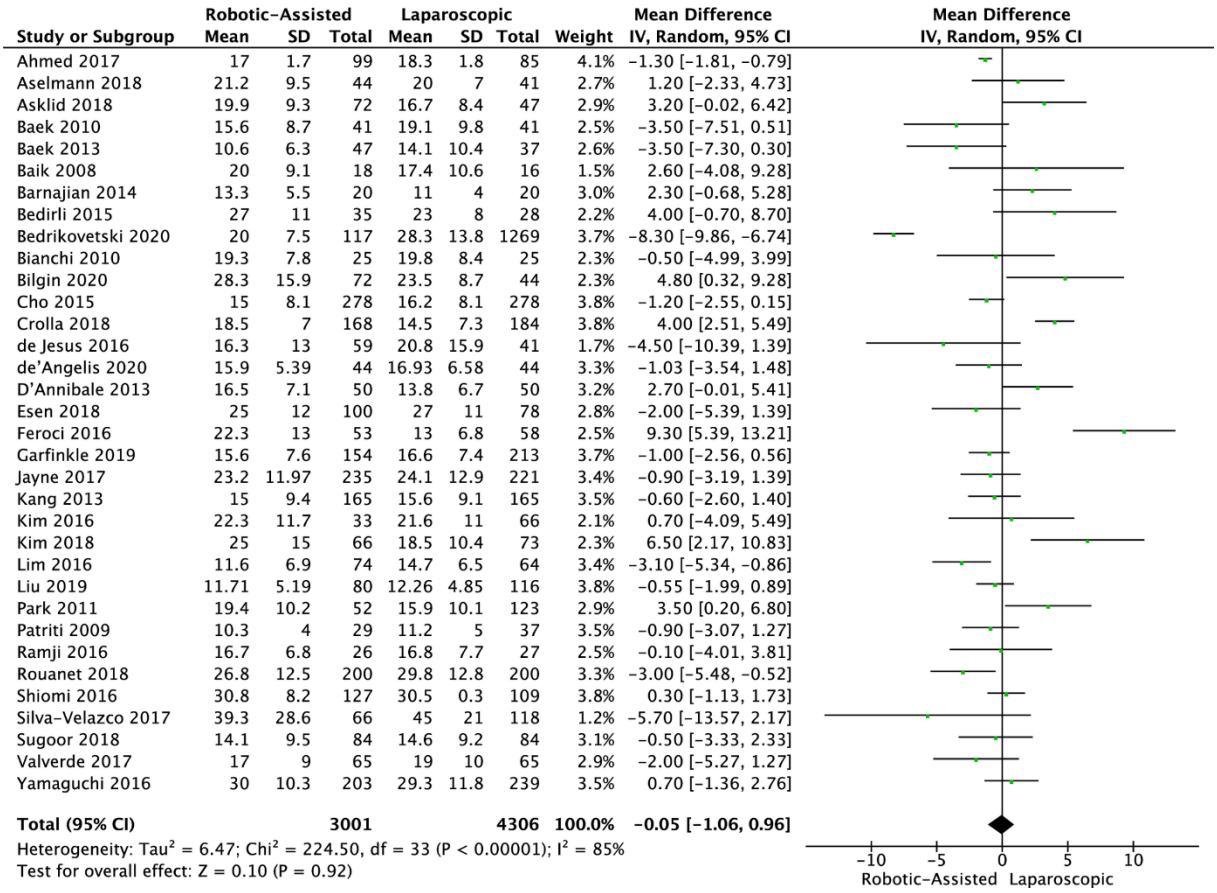

Figure S9. Forest plot of lymph nodes harvested in the robotic-assisted and laparoscopic groups. The center of each square represents the weighted mean difference for individual trials, and the corresponding horizontal line stands for a 95% confidence interval. The diamonds represent pooled results. Legend: CI = confidence interval.

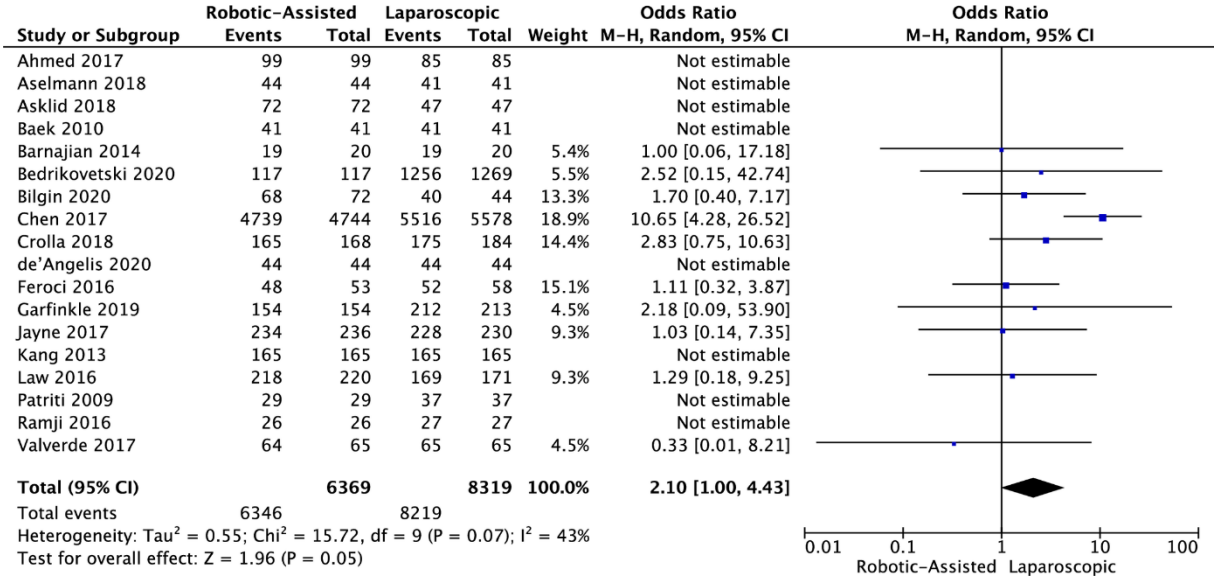

Figure S10. Forest plot of survival to hospital discharge in the robotic-assisted and laparoscopic groups. The center of each square represents the weighted odds ratio for individual trials, and the corresponding horizontal line stands for a 95% confidence interval. The diamonds represent pooled results. Legend: CI = confidence interval.

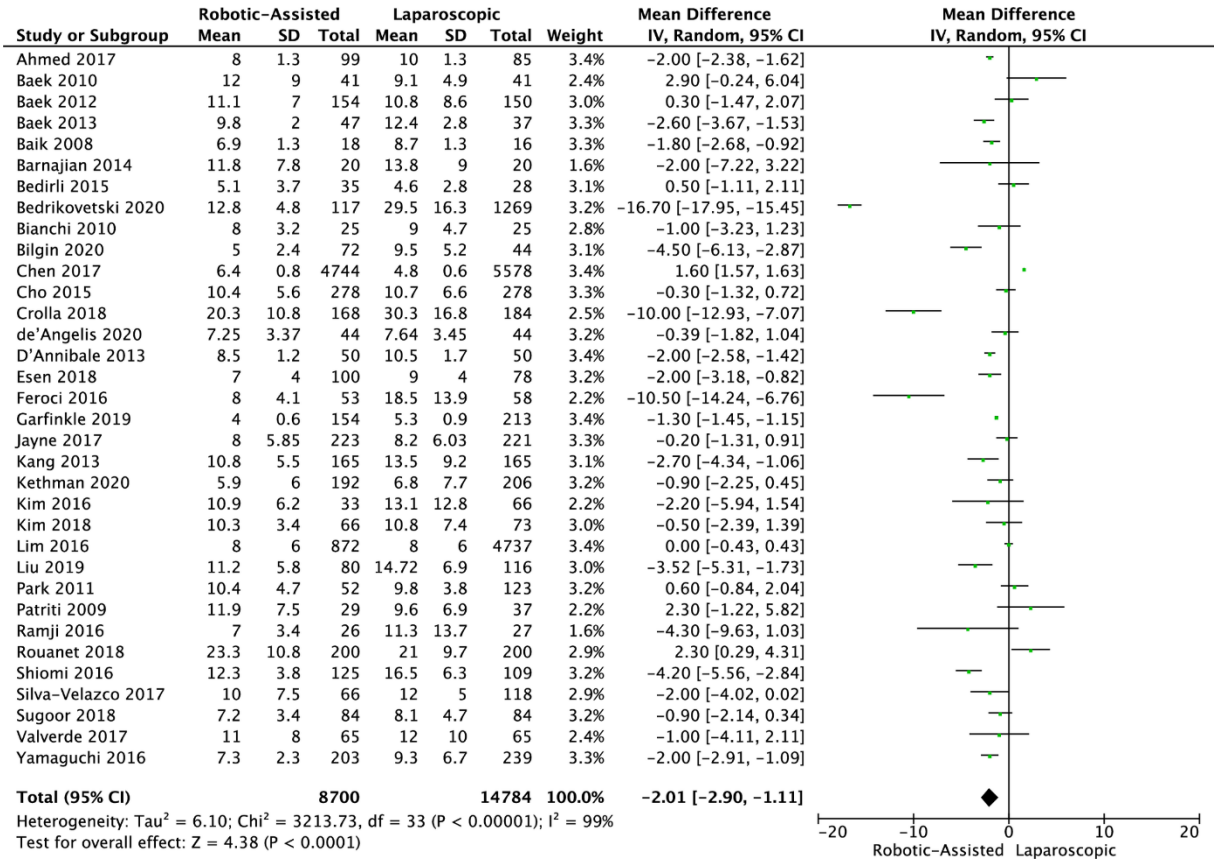

Figure S11. Forest plot of hospital length of stay in the robotic-assisted and laparoscopic groups. The center of each square represents the weighted mean difference for individual trials, and the corresponding horizontal line stands for a 95% confidence interval. The diamonds represent pooled results. Legend: CI = confidence interval.

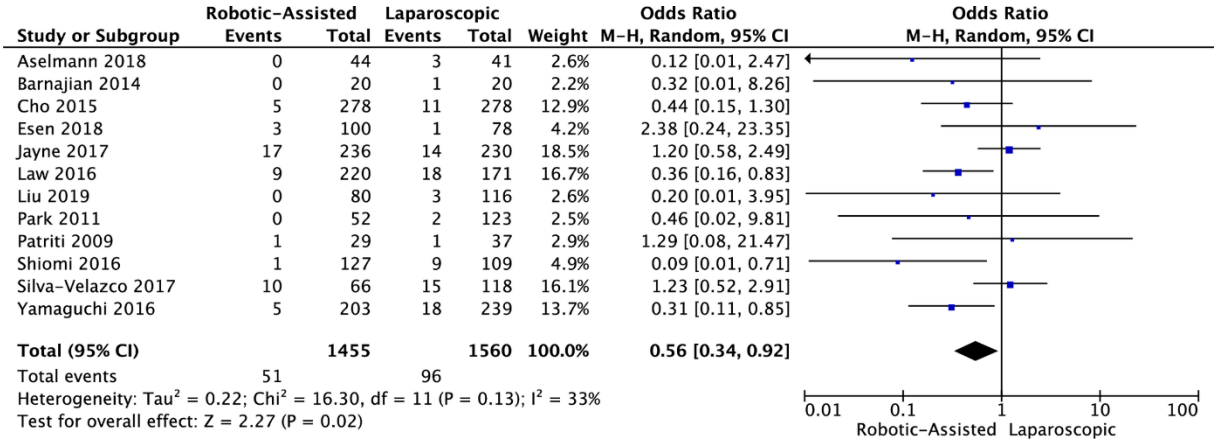

Figure S12. Forest plot of urinary retention rate in the robotic-assisted and laparoscopic groups. The center of each square represents the weighted odds ratio for individual trials, and the corresponding horizontal line stands for a 95% confidence interval. The diamonds represent pooled results. Legend: CI = confidence interval.

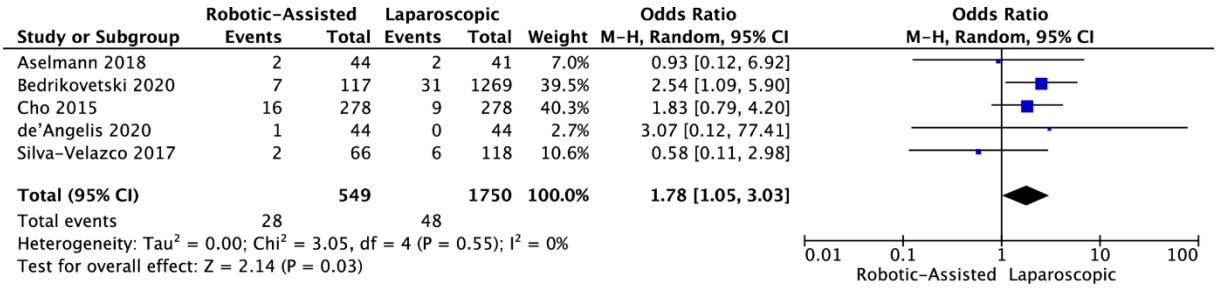

Figure S13. Forest plot of bowel obstruction rate in the robotic-assisted and laparoscopic groups. The center of each square represents the weighted odds ratio for individual trials, and the corresponding horizontal line stands for a 95% confidence interval. The diamonds represent pooled results. Legend: CI = confidence interval.

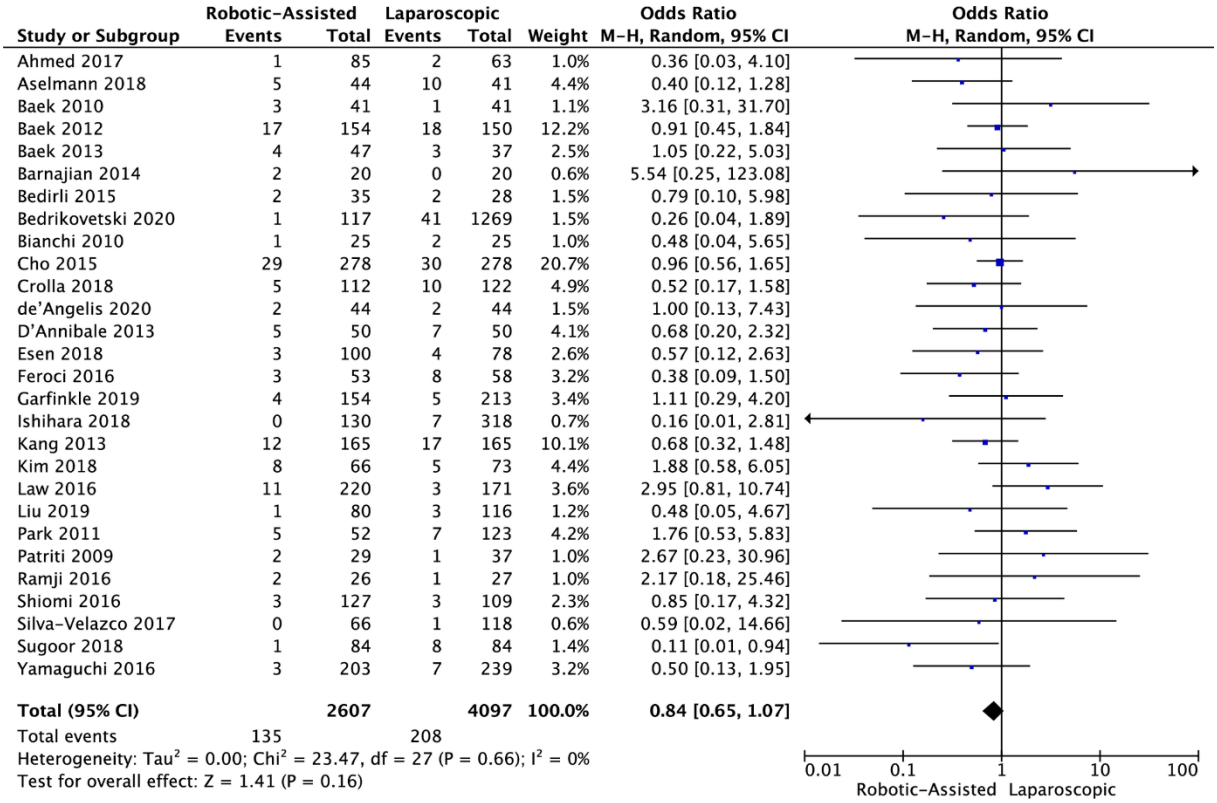

Figure S14. Forest plot of anastomotic leakage rate in the robotic-assisted and laparoscopic groups. The center of each square represents the weighted odds ratio for individual trials, and the corresponding horizontal line stands for a 95% confidence interval. The diamonds represent pooled results. Legend: CI = confidence interval.

Table S1. PRISMA checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	2
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	2
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	3
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	3
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	3
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	3
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	3
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	3
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	3
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	3
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	3
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	3
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	3
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	3
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the	3

Section and Topic	Item #	Checklist item	Location where item is reported
		model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	3
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	3
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	3
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	3
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	4
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	4
Study characteristics	17	Cite each included study and present its characteristics.	4,5
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	4
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	5
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	5-11
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	5-11
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	5-11
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	5-11
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	5-11
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	4
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	11,12
	23b	Discuss any limitations of the evidence included in the review.	12
	23c	Discuss any limitations of the review processes used.	12
	23d	Discuss implications of the results for practice, policy, and future research.	11-13
OTHER INFORMATION			

Section and Topic	Item #	Checklist item	Location where item is reported
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	2
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	2
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	-
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	13
Competing interests	26	Declare any competing interests of review authors.	13
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	13