

A Systematic Review of Robotic-assisted Surgery in Esophageal Cancer: Comparison with Open Esophagectomy

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Objective

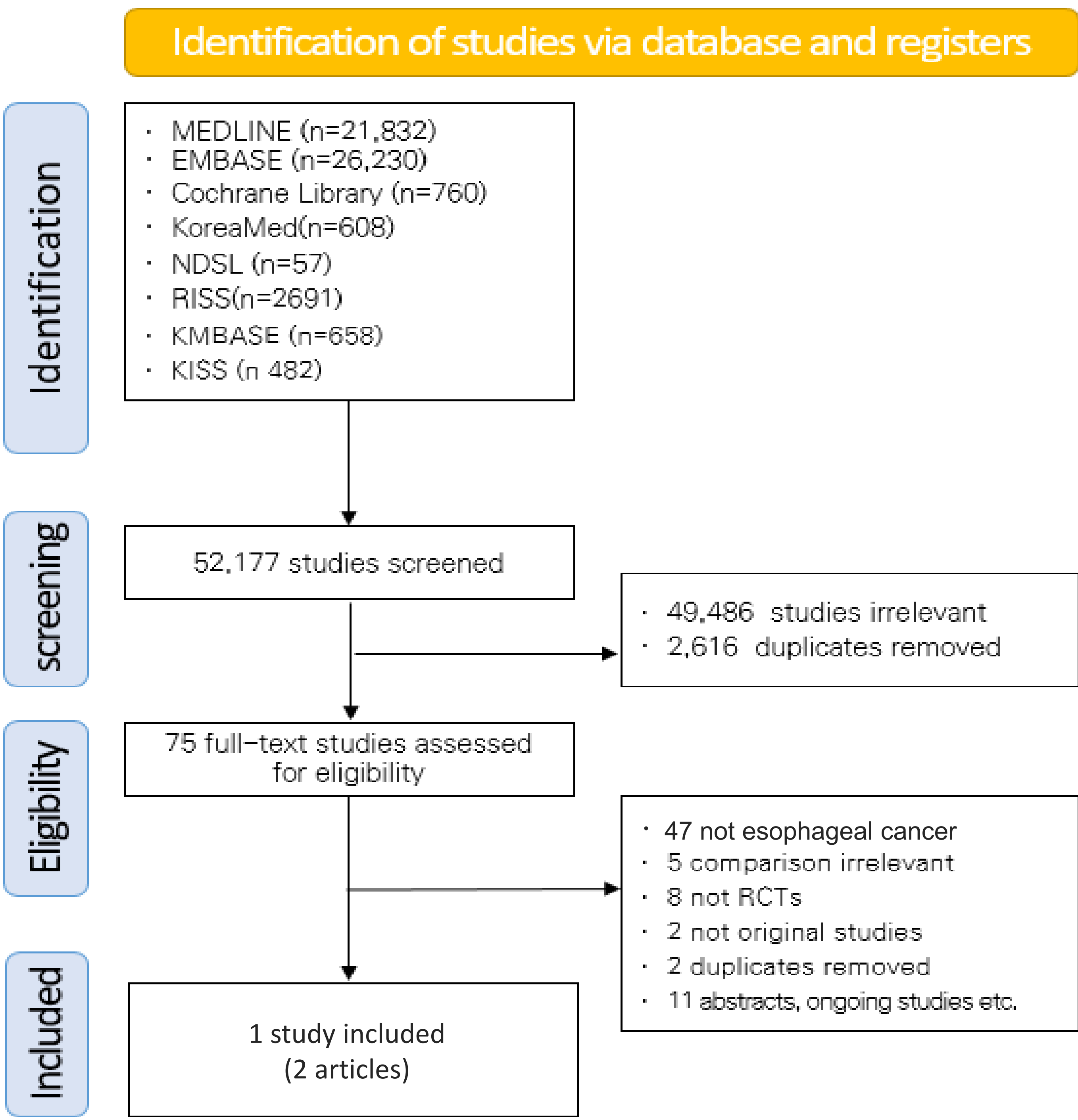
Robot-assisted surgery (RAS) is a newer technology compared with the open surgical approaches used in esophageal cancer. RAS requires rigorous evaluation but high-quality evidence of RAS is insufficient. This study assess the safety and effectiveness of robotic-assisted esophagectomy (RAE) compared with open esophagectomy (OE) for esophageal cancer patients.

Methods

We searched the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, and EMBASE via Ovid, on 12 April 2022 for randomized clinical trials (RCTs) according to key question. Two authors independently selected studies for inclusion, assessed the risk of bias, and extracted study data. We included complications, conversion to OE in safety related outcome, and operation time, bleeding loss, pain, recurrence, resection lymph nodes, length of stay, 5-year overall survival rate, 5-year disease-free survival, and quality of life in effectiveness related outcome.

Results

A total of two articles(one RCT study) were included(de Groot et al., 2020; der Sluis et al., 2019(ROBOT trial)).



Overall, we considered studies to be at moderate risk of bias. But ‘Performance bias’ were high, and ‘Detection bias-Subjective outcomes’ were high.

Results: Safety

In complications for patients with modified Clavien-Dindo classification 2 or higher, RAE reported lower complications than OE. Among the postoperative complications, RAE was reported to be lower than OE in lung complications (p=0.005) and cardiovascular disease (p=0.006). Conversion from RAE to OE was reported to have occurred in 3 of 54 (5.56%) patients(Table 1).

Table 1. Complications

Outcome	Robot-assisted			Open			p-value
	Total	Event	%	Total	Event	%	
Total complication							
MCDC ≥2	54	32	59.26	55	44	80.00	0.02
MCDC < 1	54	22	40.74	55	11	20.00	–
Operative complication							
	54	17	31.48	55	9	16.36	0.62
Postoperative complication							
pulmonary	54	17	31.48	55	32	58.18	0.005
cardiovascular	54	12	22.22	55	26	47.27	0.006
wound infection	54	2	3.70	55	8	14.55	0.09
anastomosis leak	54	13	24.07	55	11	20.00	–
mediastinitis	54	12	22.22	55	11	20.00	0.42
empyema	54	2	3.70	55	3	5.45	1.00
Conversion to OS							
	54	3	5.56		NA		–

MCDC, modified Clavien-Dindo classification; NA, not applicable

Results: Effectiveness

RAE was a significantly longer operation time (p<0.001), but RAE was significantly lower bleeding loss (p<0.001), pain (p<0.001) than OE. There was no statistically significant difference in recurrence, resection lymph nodes.

Table 2. Operation related Outcomes

Outcome	Robot-assisted			Open			p-value
	Total	Mean (median)	SD (IQR)	Total	Mean (median)	SD (IQR)	
operative time(min)	54	349	56.9	55	296	33.9	<0.001
bleeding loss(ml)	54	(400)	(258-581)	55	(568)	(428-800)	<0.001
length of stay(day)	54	(14)	(11-25)	55	(16)	(11-27)	0.33
resection lymph nodes(n)	54	(27)	(17-33)	55	(25)	(17-31)	0.41
mean pain(VAS) *POD1~POD14	54	1.86	-	55	2.62	-	SE 0.13 <0.001
recurrence(n)	50	28	-	54	29	-	0.814

IQR, interquartile range; POD, postoperative day

At Discharge and after 6 week, RAE was a significantly better health related quality of life (p<0.05) but there was no statistically difference in 5-year overall survival rate, and 5-year disease-free survival.

Table 2. QoL and Survival related Outcomes

Outcome		Robot-assisted			Open			p-value	
		Total	% (mean)	95%CI	Total	% (mean)	95%CI		
5-year overall survival rate		54	41	27–55	55	40	26–53	0.827	
5-year disease-free survival		54	42	28–55	55	43	29–57	0.749	
QoL	Health-related	discharge	31	57.9	49.9–66.1	33	44.6	36.7–52.5	0.02
		6 week	31	68.7	61.5–75.9	33	57.6	50.6–64.6	0.03
	Physical functioning	discharge	31	54.5	45.8–63.3	33	41	32.4–49.6	0.03
		6 week	31	69.3	61.6–76.9	33	58.6	51.1–66.0	0.049

QoL, quality of life

Conclusion

RAE is a feasible and safe alternative to OE for esophageal cancer on the basis of current data. Additionally, more studies are required to provide evidence regarding the benefits and cost-effectiveness of RAE.

References

- Mederos de Virgilio MJ, Shenoy R, Ye L, Toste PA, Mak SS, Girgis, MD. et al. Comparison of Clinical Outcomes of Robot-Assisted, Video-Assisted, and Open Esophagectomy for Esophageal Cancer: A Systematic Review and Meta-analysis. JAMA network open, 2021;4(11): e2129228-e2129228.
- Rustgi AK, El-Serag, HB. Esophageal carcinoma. New England Journal of Medicine, 2014;371(26):2499-2509.