Appendix 1. Search query in MeSH terms of PubMed interface:

((((((((("esophageal"[All Fields] OR "esophagic"[All Fields]) OR "esophagitis"[MeSH Terms]) OR "esophagitis"[All Fields]) OR "esophagitides"[All Fields]) OR "oesophagal"[All Fields]) OR "oesophageal"[All Fields]) OR "oesophagic"[All Fields]) OR "oesophagitis"[All Fields]) AND ((((("endoscopic mucosal resection"[MeSH Terms] OR (("endoscopic"[All Fields] AND "mucosal"[All Fields]) AND "resection"[All Fields])) OR "endoscopic mucosal resection"[All Fields]) OR (("endoscopic"[All Fields] AND "submucosal"[All Fields]) AND "dissection"[All Fields])) OR "endoscopic submucosal dissection"[All Fields])

PRISMA Checklist 2009

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.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4
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.	4-5
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.	4
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.	4

Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	4
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).	4
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
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	5
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.	5
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	5
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.	6

Section/topic	#	Checklist item	Reported on page #
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).	6
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	6
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.	6
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.	6-8
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).	7-8 & 12
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.	7-11
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	7-11
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	11
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	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).	12
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.	14-16
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.	1

For more information, visit: **www.prisma-statement.org**.

Supplementary Table 1. Baseline characteristics of patients underwent endoscopic submucosal dissection (ESD) and primary surgery for superficial esophageal squamous cell cancer

	Reference	ESD	Surgery	P value
Case Number	[21,22,29-31]	638	546	
Age (median)	[21,22,30,31]	64.1	62.6	0.136
Gender (Male %)	[21,22,30,31]	82.5	78.7	0.069
Lesion size (Median, mm)	[21,22,30,31]	17 - 45	16 - 52	0.163
Location	[21,22,30,31]			0.842
Upper		74	42	0.043*
Middle		332	264	0.332
Lower		176	189	0.687
Invasion depth	[21,22,30,31]			0.057†
T1a (mucosa)		425	207	
T1b (submucosa)		159	288	
Lesions > 3/4 Circumference (%)	[30,31]	21.8	44.5	< 0.001*
Lymphovascular Invasion (%)	[21,22,30,31]	7.7	15.3	0.132†
Poorly differentiated (%)	[21,30]	2.1	2.3	0.678
R0 resection (%)	[22,30,31]	89.8	97.0	< 0.001*
Recurrence & metastasis (%)	[22,30,31]	9.4	12.2	0.646†
Metachronous recurrence (%)	[21,30]	7.4	0	0.028*
Procedure time (min, median)	[22]	53	240	< 0.001*
Hospital stay (days)	[22,30]	4.3	12.2	0.02*

* = $p < 0.05$

† = random effects model owing to significant heterogeneity

Supplementary table 2. Comorbidity in studies compared the outcomes of ESD and esophagectomy

	Min (2018)		Takeuchi (2018)		Zhang (2018)	
	ESD	OP	ESD	OP	ESD	OP
Case Number	120†	120†	73	54	322	274
Comorbidity						
ASA score						
1			34	22		
2			34	31		
≥3			5	1		
CCI index						
0-1	112	114				
2-4	8	6	19 (≥3)	14 (≥3)		
Diabetes mellitus					20	13
Hypertension					83	89
Heart disease					15	11
Lung disease					10	8
Secondary cancer					31	15

ASA: American Society of Anesthesiologists; CCI: Charlson comorbidity index
† = after propensity score matching

Supplementary Table 3. Adverse events by timing and severity in patients

underwent endoscopic submucosal dissection (ESD) and primary esophagectomy

	Reference	ESD	Surgery	P value
Overall events (%)	[21,22,29-31]	19.8	44.0	< 0.001*†
Early events (%)	[21,31]	9.5	44.0	< 0.001*†
Late events (%)	[21]	10.2	16.8	0.107
Severe events (%)	[22,30]	12.5	20.5	0.256†
Pulmonary (%)	[21,22,31]	0.1	8.0	< 0.001*
Perforation (%)	[21,22,30,31]	3.3	0	0.014*
Stricture (%)	[21,22,30,31]	12.5	10.6	0.295
Fistula/leakage (%)	[21,22,30,31]	0.4	12.0	< 0.001*
Death (%)	[21,22,30,31]	0.1	1.0	0.076

* $= p < 0.05$

† = random effects model owing to significant heterogeneity

Supplementary Table 4. Survival outcomes of the included studies

Study	Overall survival		Disease-specific survival (5-year)		Recurrence free survival (5-year)	
	ESD	Esophagectomy	ESD	Esophagectomy	ESD	Esophagectomy
Yamauchi (2017) †	ESD versus esophagectomy: Hazard ratio = 0.76 (0.26-2.2)		NA	NA	NA	NA
Yuan (2018)	3y = 98.6% 5y = 97.1%	3y = 93.6% 5y = 91.5%	NA	NA		NA
Min (2018)	3y = 96.5% 5y = 93.9%	3y = 92.4% 5y = 91.2%	100%	97.4%	92.8%	95.3%
Takeuchi (2018)	5y = 91.7%	5y = 91.7%	NA	NA	85.8%	89.5%
Zhang (2019)	5y = 79.4%	5y = 71.5%	96.6%	92.6%	NA	NA

ESD: endoscopic submucosal dissection; NA: not available

† only hazard ratio of overall survival for ESD versus esophagectomy was recorded

Supplementary Table 5. Newcastle-Ottawa score for risk of bias assessment among the included studies

Study	Selection				Comparability	Outcome/Exposure			Score
	1	2	3	4	1	1	2	3	
Ono (2009)	*	*				*	*		4
Takahashi (2010)	*	*	*	*	*	*	*	*	8
Toyonaga (2013)	*	*	*	*		*	*	*	7
Joo (2014)	*	*	*	*		*	*	*	7
Nakagawa (2014)	*	*	*	*		*	*	*	7
Ikeda (2014)	*	*	*	*	*	*	*	*	8
Probst (2015)	*	*	*	*		*	*	*	7
Kim (2015)	*	*	*	*	*	*	*	*	8
Tsujii (2015)	*	*	*	*		*	*	*	7
Park HC (2016)	*	*	*	*		*	*	*	7
Park JS (2016)	*	*	*	*		*	*	*	7
Lizuka (2017)	*	*	*	*	*	*	*	*	8
Nagami (2017)	*	*	*	*		*	*	*	7
Yamauchi (2017)	*	*	*	*	*	*	*		7
Yuan (2018)	*	*	*	*	*	*	*	*	8
Burger (2018)	*	*	*	*	*	*	*	*	8
Furue (2018)	*	*	*	*	*	*	*	*	8
Min (2018)	*	*	*	*	*	*	*	*	8
Qi (2018)	*	*	*	*		*	*	*	7
Takeuchi (2018)	*	*	*	*	*	*	*	*	8
Zhang (2018)	*	*	*	*	*	*	*	*	8

Supplementary Figure 1

Study name	Statistics for each study			Hazard ratio and 95% CI	Relative weight
	Hazard ratio	Lower limit	Upper limit		
Min, 2018	1.700	0.817	3.537		55.33
Zhang, 2019	0.840	0.372	1.898		44.67
	1.241	0.719	2.140		

0.01   0.1   1   10   100

Favors ESD   Favors surgery