

Supplementary material

Supplementary Table 1 Detailed search strategy

Database	Search	Query	Items
PubMed	#1	((("peroral"[All Fields] OR "perorally"[All Fields] OR "per-oral"[All Fields]) AND ("endoscopes"[All Fields] OR "endoscoped"[All Fields] OR "endoscopes"[MeSH Terms] OR "endoscopes"[All Fields] OR "endoscope"[All Fields] OR "endoscopic"[All Fields] OR "endoscopically"[All Fields] OR "endoscopy"[MeSH Terms] OR "endoscopy"[All Fields] OR "endoscopic"[All Fields]) AND ("myotomy"[MeSH Terms] OR "myotomy"[All Fields] OR "myotomies"[All Fields])) OR "POEM"[All Fields]	1954
	#2	"esophageal achalasia"[MeSH Terms] OR ("esophageal"[All Fields] AND "achalasia"[All Fields]) OR "esophageal achalasia"[All Fields] OR "achalasia"[All Fields]	8677
	#3	"short"[All Fields] OR "shorts"[All Fields] OR "shorter"[All Fields]	983,747
	#4	#1 AND #2 AND #3	170
	#5	#4 NOT ("case reports"[Publication Type] OR "editorial"[Publication Type] OR "guideline"[Publication Type] OR "introductory journal article"[Publication Type] OR "meta analysis"[Publication Type] OR "news"[Publication Type] OR "practice guideline"[Publication Type] OR "review"[Publication Type] OR "systematic review"[Publication Type])	113
Embase	#1	(peroral OR 'per oral') AND endoscopic AND ('myotomy'/exp OR myotomy) OR poem	3792
	#2	achalasia	13522
	#3	short OR shorter	1927915
	#4	#1 AND #2 AND #3	476
	#5	#4 NOT ('animal cell'/de OR 'animal experiment'/de OR 'animal model'/de OR 'animal tissue'/de OR 'case report'/de OR 'clinical protocol'/de OR 'diagnostic test accuracy study'/de OR 'meta analysis'/de OR 'methodology'/de OR 'nonhuman'/de OR 'practice guideline'/de OR 'questionnaire'/de OR 'systematic review'/de OR 'chapter'/it OR 'editorial'/it OR 'erratum'/it OR 'note'/it OR 'review'/it OR 'short survey'/it)	340
	#6	#5 AND [embase]/lim NOT ([embase]/lim AND [medline]/lim)	254
Web of science	#1	(((((peroral OR per-oral) AND endoscopic AND myotomy) OR POEM) AND (achalasia)) AND (short OR shorter)) Refined by: [excluding] DOCUMENT TYPES: (REVIEW OR EDITORIAL MATERIAL OR LETTER)	137
Cochrane	#1	(poem OR myotomy) AND achalasia AND (short OR shorter)	64

Supplementary Table 2 Summary of pooled effect estimates of preoperative, perioperative, and postoperative outcomes

Outcome	Studies	Participants	Statistical method	Estimate [95%CI]	P-value	I ²
Preoperative Eckardt score	4	401	MD (IV, Random, 95%CI)	-0.03 [-0.67, 0.61]	0.92	73%
Preoperative basal LES pressure	3	330	MD (IV, Random, 95%CI)	0.75 [-1.05, 2.55]	0.41	0%
Preoperative 4sIRP	2	165	MD (IV, Random, 95%CI)	0.86 [-2.23, 3.95]	0.59	31%
Preoperative barium column diameter	3	275	MD (IV, Random, 95%CI)	0.33 [-0.03, 0.69]	0.08	0%
Operation time	5	474	MD (IV, Random, 95%CI)	-15.01 [-20.34, -9.67]	<0.001	63%
Length of hospital stay	3	275	MD (IV, Random, 95%CI)	0.25 [-0.14, 0.63]	0.21	37%
Perioperative complications	4	401	RR (MH, Random, 95%CI)	0.68 [0.26, 1.75]	0.42	63%
Clinical success	5	474	RR (MH, Random, 95%CI)	1.02 [0.97, 1.09]	0.40	0%
Postoperative Eckardt score	5	474	MD (IV, Random, 95%CI)	0.05 [-0.07, 0.16]	0.45	0%
Change in Eckardt score	4	401	MD (IV, Random, 95%CI)	-0.02 [-0.60, 0.57]	0.95	63%
Postoperative basal LES pressure	4	403	MD (IV, Random, 95%CI)	-1.00 [-3.93, 1.93]	0.50	85%
Postoperative 4sIRP	3	238	MD (IV, Random, 95%CI)	-0.13 [-1.88, 1.61]	0.88	75%
Postoperative barium column diameter	2	165	MD (IV, Random, 95%CI)	0.09 [-0.37, 0.55]	0.71	31%
Reflux symptoms	4	403	RR (MH, Random, 95%CI)	0.94 [0.51, 1.74]	0.84	48%
Reflux esophagitis on endoscopy	4	401	RR (MH, Random, 95%CI)	0.61 [0.39, 0.98]	0.04	0%
Pathologic acid exposure on pH monitoring	2	165	RR (MH, Random, 95%CI)	0.58 [0.36, 0.94]	0.03	0%

4sIRP, 4-sec integrated relaxation pressure; CI, confidence interval; GERD, gastroesophageal reflux disease; IV, inverse variance; LES, lower esophageal sphincter; MH, Mantel-Haenszel; MD, mean difference; RR, risk ratio

Supplementary Table 3 Technical details of POEM in individual studies

Author, year [Suppl. Ref.]	Orientation of myotomy	Depth of myotomy	PPI use	
			Inpatient	Outpatient
Familiari, 2016 [1]	NR	NR	NR	NR
Gu, 2020 [2]	Posterior approach	Circular myotomy	IV PPI	Oral PPI for 2 weeks
Huang, 2020 [3]	NR	Circular myotomy	NR	Oral PPI for 2 weeks
Li, 2019 [4]	Variable	Progressively increased from circular myotomy at the upper end of myotomy to full-thickness myotomy at the lower end	IV PPI	Oral PPI for 4 weeks
Nabi, 2020 [5]	Anterior approach	Circular myotomy in the upper part of myotomy and full-thickness myotomy from 2-3 cm above the gastroesophageal junction until the lower end	NR	NR

IV, intravenous; NR, not reported; POEM, peroral endoscopic myotomy; PPI, proton pump inhibitor

Supplementary Table 4 Specific perioperative complications that occurred in individual studies

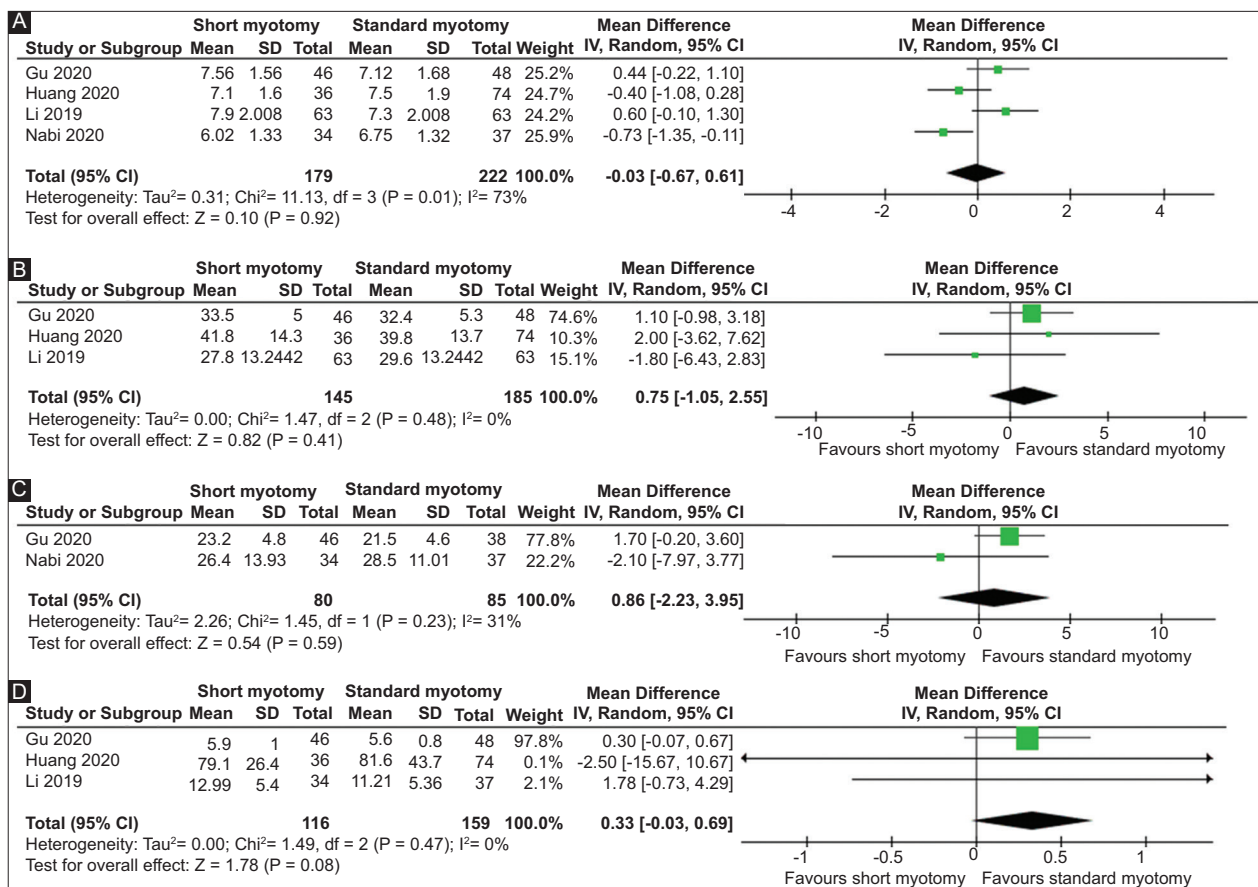
Author, year [Suppl. Ref.]	Complication	Short myotomy	Standard myotomy
Familiari, 2016 [1]	NR	NR	NR
Gu, 2020 [2]	Mucosal injury	0	1
Huang, 2020 [3]	Mucosal perforation	0	1
	Major bleeding	2	3
	Pneumothorax	1	2
Li, 2019 [4]	Mucosal injury	4	5
	Pneumothorax	0	1
	Pneumoperitoneum	2	3
	Pneumomediastinum	0	1
	Subcutaneous emphysema	0	14
Nabi, 2020 [5]	Mucosal injury requiring clipping	1	1
	Minor bleeding	12	17
	Subcutaneous emphysema	4	4
	Capnoperitoneum requiring decompression	3	3
	Retroperitoneal CO ₂	4	2

NR, not reported

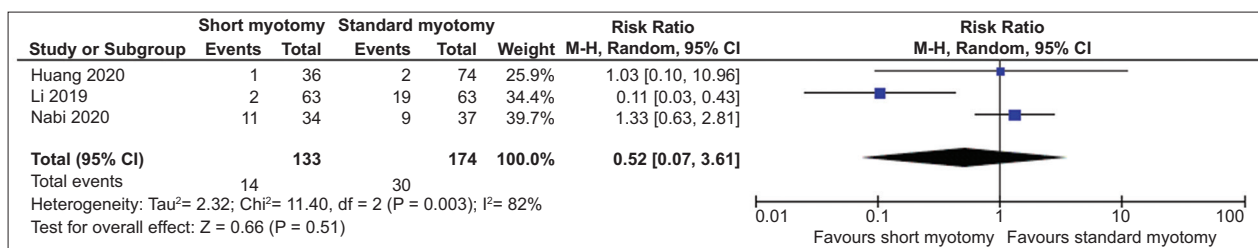
Supplementary Table 5 Grades of reflux esophagitis in individual studies based on the LA classification of esophagitis

Author, year [Suppl. Ref.]	LA grade	Total	Short myotomy	Standard myotomy
Familiari, 2016 [1]	NR	NR	NR	NR
Gu, 2020 [2]	A and B	10	NR	NR
	C	1	NR	NR
Huang, 2020 [3]	A	5	1	4
	B	2	0	2
Li, 2019 [4]	NR	NR	NR	NR
Nabi, 2020 [5]	A	13	5	8
	B	14	5	9
	C	1	0	1

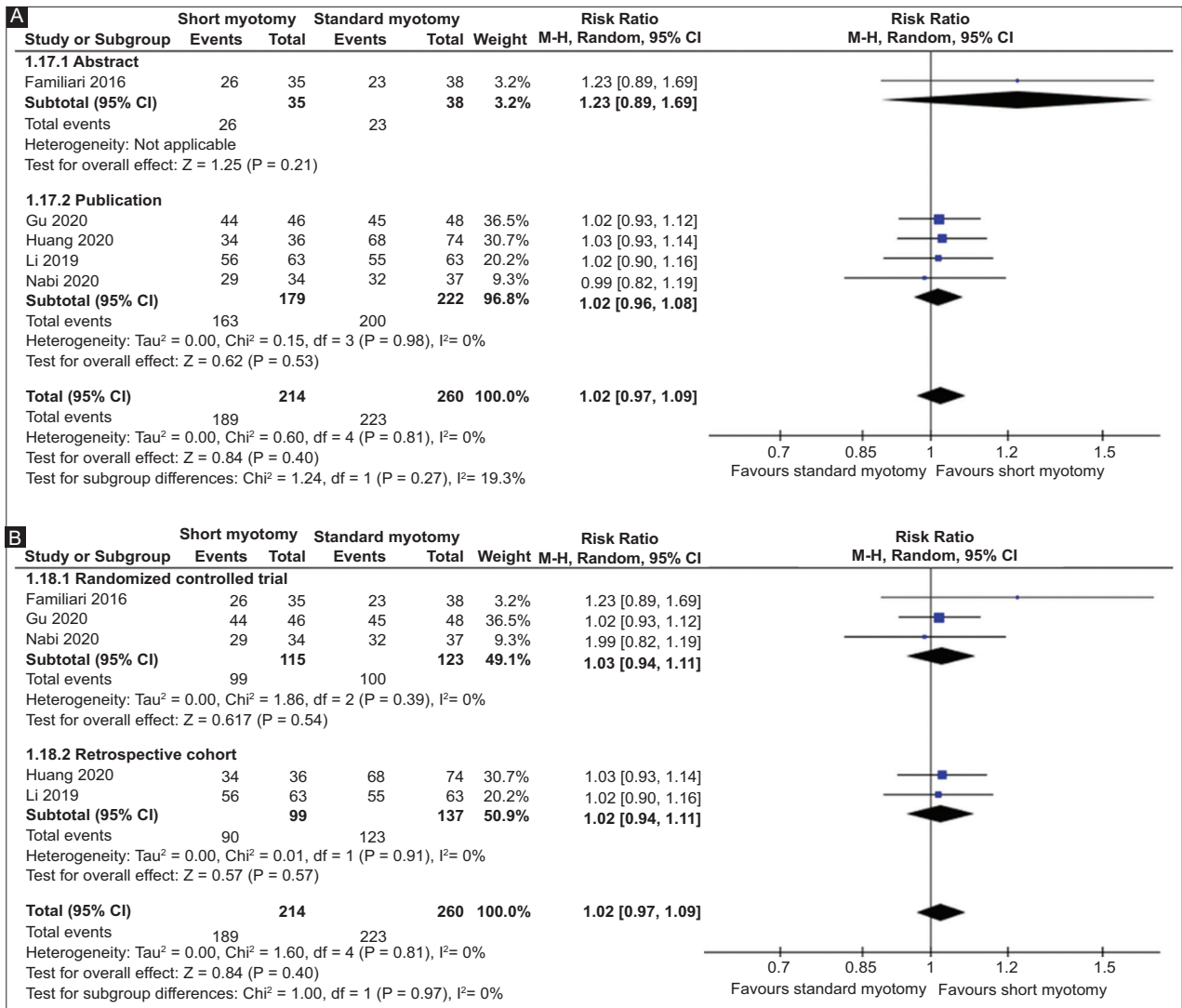
LA, Los Angeles; NR, not reported



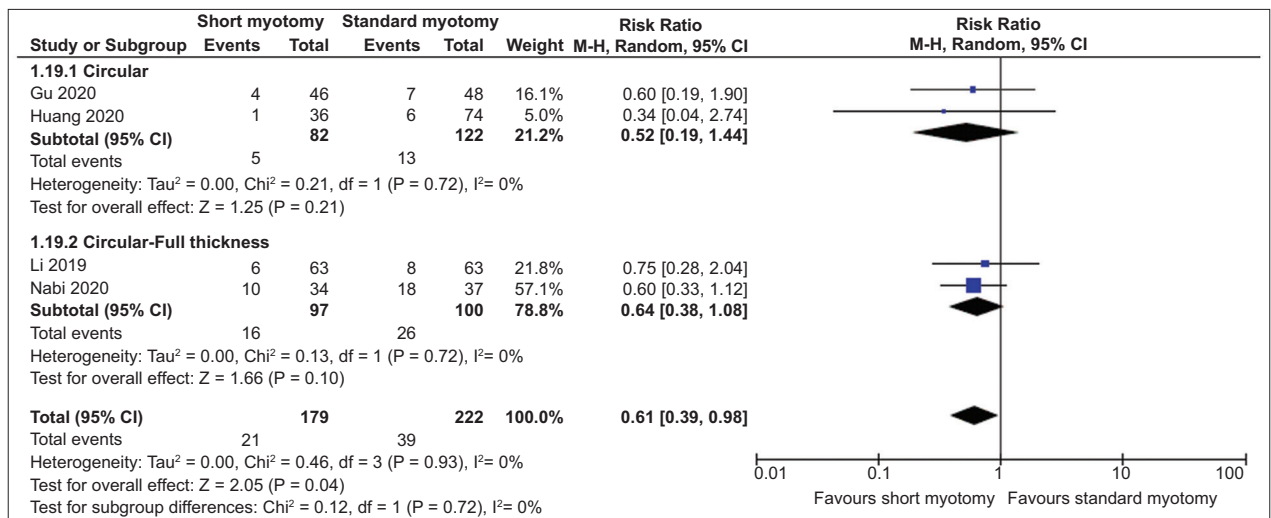
Supplementary Figure 1 Forest plots comparing short myotomy and standard myotomy regarding preoperative characteristics. (A) Preoperative Eckardt score. (B) Preoperative basal lower esophageal sphincter pressure. (C) Pre-operative 4-sec integrated relaxation pressure. (D) Preoperative barium column diameter
CI, confidence interval



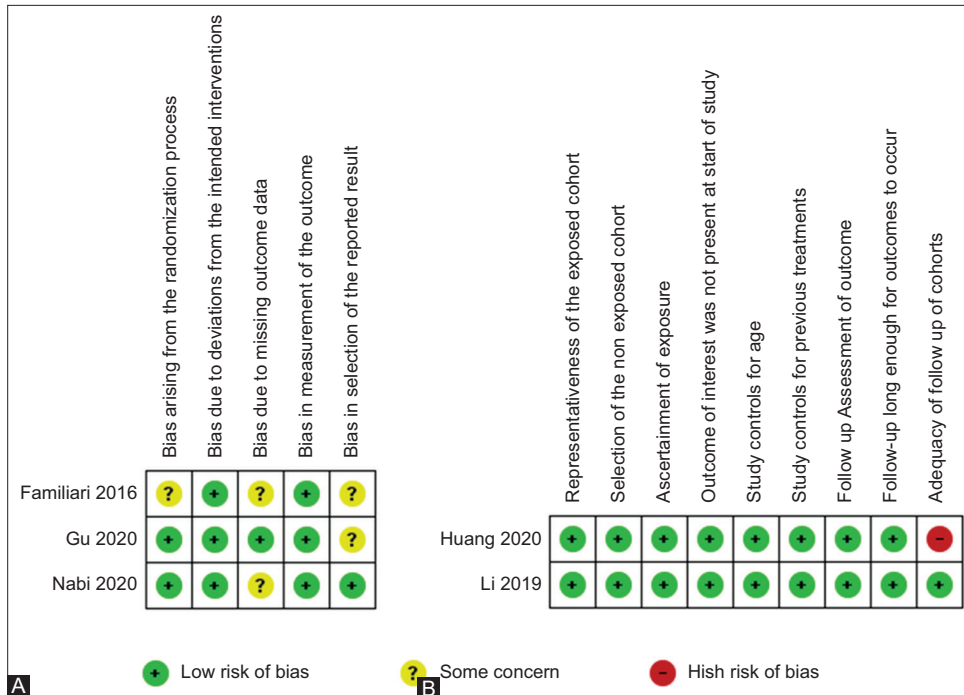
Supplementary Figure 2 Forest plot comparing short myotomy and standard myotomy regarding perioperative gas-related complications
CI, confidence interval



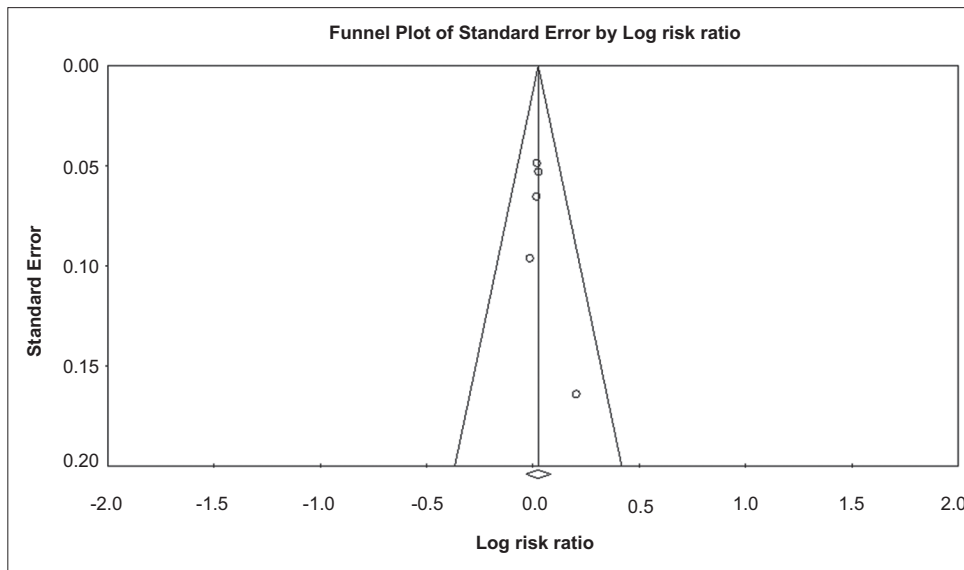
Supplementary Figure 3 Subgroup analysis comparing short myotomy and standard myotomy regarding clinical success rate based on (A) publication status and (B) study design
CI, confidence interval



Supplementary Figure 4 Subgroup analysis comparing short myotomy and standard myotomy regarding reflux esophagitis based on depth of myotomy
CI, confidence interval



Supplementary Figure 5 Quality assessment of the included studies using (A) revised Cochrane risk of bias tool for randomized controlled trials and (B) Newcastle-Ottawa scale for cohort studies



Supplementary Figure 6 Funnel plot showing publication bias analysis for clinical success rate

Supplementary References

1. Familiari P, Cali A, Landi R, et al. Long vs short POEM for the treatment of achalasia. Interim analysis of a randomized controlled trial. *Dig Liver Dis* 2016;**48**:e90.
2. Gu L, Ouyang Z, Lv L, Liang C, Zhu H, Liu D. Safety and efficacy of peroral endoscopic myotomy with standard myotomy versus short myotomy for treatment-naïve patients with type II achalasia: a prospective randomized trial. *Gastrointest Endosc* 2021;**93**:1304-1312.
3. Huang S, Ren Y, Peng W, et al. Peroral endoscopic shorter versus longer myotomy for the treatment of achalasia: a comparative retrospective study. *Esophagus* 2020;**17**:477-483.
4. Li L, Chai N, Linghu E, et al. Safety and efficacy of using a short tunnel versus a standard tunnel for peroral endoscopic myotomy for Ling type IIc and III achalasia: a retrospective study. *Surg Endosc* 2019;**33**:1394-1402.
5. Nabi Z, Ramchandani M, Sayyed M, et al. Comparison of short versus long esophageal myotomy in cases with idiopathic achalasia: a randomized controlled trial. *J Neurogastroenterol Motil* 2020.