Supplementary Tables

Supplementary Table 1: Literature search strategy

Databases searched:	MEDLINE, EMBASE, EMB Reviews, CINAHL
Terms for MEDLINE:	colo[4] AND ((endoscopic AND mucosal) OR (EMR OR polypectomy OR ESD OR (endoscopic submucosal dissection)) AND (recurrence OR incomplete OR margin OR resection)
Search period:	2011 – 22.07.2021

Supplementary Table 2 Quality assessment of prospective case series

Ref.	Was the study question or objective clearly stated?	Was the study population clearly and fully described, including a case definition?	Were the cases consecutive?	Were the subjects comparable?	Was the intervention clearly described?	Were the outcome measures clearly defined, valid, reliable, and implemented consistently across all study participants?	Was the length of follow-up adequate?	Were the statistical methods well-described?	Were the results well described?	Points	Final rating
Akahoshi, 2019[38]	Yes	Yes	Yes	N/A	Yes	Yes	c/d	No	Yes	6	FAIR
Alexandrino, 2020[39]	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	Yes	8	GOOD
Binmoeller, 2012[8]	Yes	Yes	Yes	N/A	Yes	No	No	No	No	4	FAIR
Carvalho, 2013[40]	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	Yes	8	GOOD
Draganov, 2021[19]	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	Yes	8	GOOD

Jung, 2018[41]	Yes	Yes	c/d	N/A	Yes	Yes	N/A	Yes	Yes	6	FAIR
Kimoto, 2020[21]	Yes	Yes	Yes	N/A	Yes	Yes	N/A	Yes	Yes		GOOD
Masci, 2013[42]	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	8	GOOD
Moss, 2015[43]	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	Yes	8	GOOD
Pellise, 2017[14]	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	7	GOOD
Pohl, 2020[31]	Yes	Yes	c/d	N/A	Yes	Yes	N/A	Yes	Yes	6	FAIR
Repici, 2013[44]	Yes	Yes	Yes	N/A	Yes	Yes	Yes	No	No	6	FAIR
Rodríguez, 2019[45]	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	6	FAIR
Sidhu, 2021[28]	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	Yes	8	GOOD
Tutticci, 2018[22]	Yes	No	c/d	N/A	Yes	No	Yes	No	No	3	POOR
Yabuuchi, 2020[18]	Yes	Yes	c/d	N/A	Yes	Yes	Yes	Yes	Yes	7	GOOD
Yoshida, 2013[46]	Yes	No	Yes	N/A	Yes	Yes	N/A	Yes	Yes	6	FAIR

Yoshida, 2014[16]	Yes	No	Yes	Yes	Yes	Yes	N/A	Yes	Yes	7	GOOD
Youk, 2016[47]	Yes	Yes	Yes	N/A	Yes	Yes	N/A	Yes	Yes	7	GOOD
Yue, 2019[48]	Yes	Yes	c/d	Yes	Yes	No	Yes	Yes	Yes	7	GOOD

c/d: Cannot determine; N/A: Not applicable.

Supplementary Table 3 Quality assessment of randomized controlled trials

Ref.	Was the study described as randomized, a randomized trial, a randomized clinical trial, or an RCT?	Was the method of randomization adequate (i.e. use of randomly generated assignment)?	Was the treatment allocation concealed (so that assignments could not be predicted)?	Were study participants and providers blinded to treatment group assignment?	Were the people assessing the outcomes blinded to the participants' group assignments?	Were the groups similar at baseline on important characteristics that could affect outcomes (e.g. demographics, risk factors, co-morbid conditions)?	Was the overall drop-out rate from the study at endpoint 20% or lower of the number allocated to treatment?	Was the differential drop-out rate (between treatment groups) at endpoint 15 percentage points or lower?
Bae, 2016[49]	Yes	Yes	Yes	No	c/d	Yes	Yes	Yes
Han, 2018[15]	Yes	Yes	Yes	No	c/d	Yes	c/d	c/d
Harada, 2019[50]	Yes	Yes	Yes	No	c/d	Yes	Yes	Yes

Horiuchi, 2016[51]	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Klein, 2019[9]	Yes	c/d	Yes	No	No	Yes	Yes	Yes
Li, 2020[17]	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Nakajima, 2021[52]	Yes	Yes	Yes	No	c/d	Yes	Yes	Yes
Pohl, 2020[31]	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Woodward, 2015[13]	Yes	Yes	Yes	No	c/d	Yes	Yes	Yes
Yamasaki, 2018[53]	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Yamashina, 2020[54]	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Yamashina, 2019[20]	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Yen, 2020[55]	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Yoshida,	Yes	Yes	Yes	No	c/d	Yes	Yes	Yes

2012[56]								

c/d: Cannot determine.

Continuation of Supplementary Table 3 Quality assessment of randomized controlled trials

Ref.	Was there high adherence to the intervention protocols for each treatment group?	Were other interventions avoided or similar in the groups (e.g. similar background treatments)?	Were outcomes assessed using valid and reliable measures, implemented consistently across all study participants?	Did the authors report that the sample size was sufficiently large to be able to detect a difference in the main outcome between groups with at least 80% power?	Were outcomes reported or subgroups analyzed prespecified (i.e. identified before analyses were conducted)?	Were all randomized participants analyzed in the group to which they were originally assigned (i.e. did they use an intention-to-treat analysis)?	Points	Final rating
Bae, 2016[49]	Yes	c/d	Yes	Yes	Yes	Yes	11	GOOD
Han, 2018[15]	Yes	Yes	Yes	No	c/d	Yes	8	FAIR
Harada, 2019[50]	Yes	c/d	Yes	Yes	Yes	No	10	FAIR
Horiuchi,	Yes	c/d	Yes	Yes	Yes	Yes	12	GOOD

2016[51]								
Klein, 2019[9]	Yes	c/d	Yes	Yes	Yes	Yes	10	FAIR
Li, 2020[17]	Yes	Yes	Yes	Yes	Yes	Yes	12	GOOD
Nakajima, 2021[52]	Yes	c/d	Yes	Yes	Yes	Yes	11	GOOD
Pohl, 2020[31]	Yes	c/d	Yes	Yes	Yes	Yes	11	GOOD
Woodward, 2015[13]	Yes	c/d	Yes	Yes	Yes	Yes	11	GOOD
Yamasaki, 2018[53]	Yes	c/d	Yes	Yes	Yes	Yes	11	GOOD
Yamashina, 2020[54]	Yes	c/d	Yes	Yes	Yes	No	11	GOOD
Yamashina, 2019[20]	Yes	c/d	Yes	Yes	Yes	No	11	GOOD
Yen, 2020[55]	Yes	c/d	Yes	Yes	Yes	Yes	12	GOOD
Yoshida, 2012[56]	Yes	c/d	Yes	Yes	Yes	Yes	11	GOOD

c/d: Cannot determine.

Supplementary Table 4 Studies reporting local recurrence rate

Ref.	Country	Study design	Study quality	Resection method	Margin ablation[1]	Polyp size[2] [mm]	Polyps, n	Range FU1 (< 12 mo) in months[3]	Range FU2 (12–24 months) in months[3]	Range FU3 (≥24 months) in months[3]	Endoscopist experience
Alexandrino, 2020[39]	Portugal	Single center Prospective	Good	H-EMR	n.d. / 0%	20;50	158	4;9 (med: 6)	N/A[6]	N/A	Incl. non-experts
Binmoeller, 2012[8]	United States	Single center Prospective	Fair	U-EMR	Some	20; >	62	med: 3.5	N/A	N/A	Not defined
Carvalho, 2013[40]	Portugal	Single center Prospective	Good	H-EMR	Some	20;30	73	3[4]	12[4]	36[4]	Incl. non-experts
Jung, 2018[41]	South	Multicente	Fair	ESD	n.d. /	20; >	78	11.9 ± 6.4[5]	N/A	N/A	Incl. non-

	Korea	r Prospectiv e			0%						experts (ESD)
Klein, 2019[9]	Austra lia	Multicente r RCT	Fair	H-EMR	100%; 0%	20; >	416	med: 5.9	med: 18.5	N/A	Incl. non- experts
Masci, 2013[42]	Italy	Multicente r Prospectiv e	Good	H-EMR	n.d. / 0%	10; 30	427	3;12 (med: 12)	N/A	N/A	Not defined
Moss, 2015[43]	Austra lia	Multicente r Prospectiv e	Good	H-EMR	Some	20; >	1000	4[4]	16[4]	N/A	Only experts
Nakajima, 2021[52]	Japan	Multicente r RCT	Good	H-EMR	Some	20; >	180	3[4] and 6[4]	12[4]	18[4] and 24[4]	Incl. non- experts
Pellise, 2017[14]	Austra lia	Multicente r Prospectiv	Good	H-EMR	Some	20; >	1850	6[4]	12[4]; 18[4]	24[4]	Incl. non- experts

		e									
Pohl, 2020[31]	United States, Canada, Spain	Multicenter RCT	Good	H-EMR	Some	20; >	857	4;7 (med: 6)	N/A	N/A	Incl. non-experts
Repici, 2013[44]	Italy	Single center Prospective	Fair	ESD	n.d. / 0%	30; >	40	1;12[4]	N/A	N/A	Only experts (ESD)
Rodríguez, 2019[45]	Spain	Multicenter Prospective	Fair	H-EMR, U-EMR	n.d. / 0%	15;70	162	3;6[4]	12[4]	N/A	Incl. non-experts
Sidhu, 2021[28]	Australia	Multicenter Prospective	Good	H-EMR	100%	20; >	1049	5;7	N/A	N/A	Incl. non-experts
Woodward,	United	Single	Good	H-EMR	Some	16;80	140	3.2;5.9	N/A	N/A	Not defined

2015[13]	States	center RCT									
Yue, 2019[48]	China	Single center Prospective	Good	ESD	n.d. / 0%	10;30	138	3;12[4]	16;18[4]	N/A	Not defined

[1]% of all polyp margins ablated.

[2]Size range of polyps included in mm [smallest; largest].

[3]Time range of follow-up examinations in months [earliest; latest].

[4]Scheduled date, no more precise data available.

[5]mean ± SD.

[6]Available data insufficient.

ESD: Endoscopic submucosal dissection; FU: Follow-up; HSP: Hot snare polypectomy; H-EMR: Hot endoscopic mucosal resection; med: Median; n.d.: Not defined; RCT: Randomized controlled trial; U-EMR: Underwater endoscopic mucosal resection.

Supplementary Table 5 Definitions of local recurrence rate as given in the original studies

Ref.	Definition / clarification of local recurrence rate
Alexandrino, 2020[39]	Residual or recurrent adenoma was defined as adenomatous tissue at the place of previous EMR or at the identified scar. If endoscopy features were unclear, biopsies were performed and residual or recurrent adenoma was considered if the histology confirmed adenoma.
Binmoeller, 2012[8]	Biopsy of the postresection scar was performed. Any tissue suspicious for recurrent or residual adenoma underwent biopsy. Recurrence was defined as adenoma at the resection site. Residual was defined as adenoma outside of the resection site.
Carvalho, 2013[40]	Recurrence was defined as reappearance of adenomatous tissue in an apparently previous complete resection scar, while persistence or residual polyp was defined as the persistence of adenomatous tissue on follow-up, when the previous resection hadn't been complete. Both were demonstrated by pathology.
Jung, 2018[41]	Not defined
Klein, 2019[9]	The primary endpoint was the presence of endoscopically visible residual/recurrent polyp tissue at surveillance colonoscopy. […] At surveillance colonoscopy, the post-EMR scar was carefully interrogated with high-definition white light and narrow band imaging. Meticulous photo documentation was performed and biopsies were obtained.
Masci, 2013[42]	Residual/recurrence was defined as evidence of visible adenomatous tissue at the site of the previous EMR, with or without tattoo, confirmed by histology.

Moss, 2015[43]	If the endoscopic impression at surveillance colonoscopy was that of recurrent/residual adenoma, this was recorded as such and the area treated.
Nakajima, 2021[52]	If a residual tumor was observed in the p-EMR scar region confirmed by magnification NBI or chromoscopy, the patient was indicated for additional treatment […] If magnification colonoscopy was not available and the endoscopist could not detect recurrent lesions, a biopsy specimen was obtained and evaluated histopathologically.
Pellise, 2017[14]	Recurrence was defined by the presence of endoscopic or histological evidence of residual polyp on the post-EMR scar site.
Pohl, 2020[31]	Recurrence was defined as biopsy proven recurrence of neoplasia at the prior resection site. Endoscopists were instructed to sequentially examine the resection site with white light and image-enhanced endoscopy (eg, NBI) and to obtain biopsy specimens. In some instances, biopsies were deferred because of the lack of any visible tissue that could represent polyp regrowth (ie, flat scar without identifiable tissue that could represent polyp tissue).
Repici, 2013[44]	Local recurrence was defined as positive when recurrent/residual neoplastic tissue was endoscopically and histologically verified at the ESD site.
Rodríguez, 2019[45]	All the scars were assessed (using white light and I-scan optical enhancement). All of these were biopsied even without visible residual tissue. In case of finding macroscopic recurrence, endoscopic treatment was performed at the same time using cold forceps avulsion or EMR.
Sidhu, 2021[28]	During surveillance colonoscopy, patients undergo a standardized evaluation of the EMR scar to assess for residual or recurrent adenoma. Biopsies are routinely performed. Any suspected recurrence is sampled and then treated

	endoscopically.
Woodward, 2015[13]	Not defined
Yue, 2019 [48]	Recurrence was defined as visible tumour at or adjacent to a previous ESD site. Biopsy and further ESD were performed if recurrence was suspected.

Supplementary Table 6 Studies reporting incomplete resection rate

Ref.	Country	Study design	Study quality	Resection method	Margin ablation	Polyp size[1] (mm)	Polyps, *n*	SSA/P	Assessment	Endoscopist experience
Akahoshi, 2019[38]	Japan	Single center Prospective	Fair	ESD	n.d.	21; >	262	0%	MA	Incl. non-experts (ESD)
Bae, 2016[49]	Korea	Single center RCT	Good	ESD	n.d.	20; >	65	0%	MA+E	Only experts (ESD)
Draganov, 2021[19]	USA, Canada	Multicenter Prospective	Good	ESD	n.d.	n.d.	399	Some	MA+E	Incl. non-experts (ESD)
Han, 2018[15]	Korea	Single center RCT	Fair	H-EMR	n.d.	10;20	51	Some	MA	Only experts
Harada, 2019[50]	Japan	Single center	Fair	ESD	n.d.	20;50	91	0%	MA+E	Only experts (ESD)

		RCT								
Horiuchi, 2016[51]	Japan	Single center RCT	Good	HSP, H-EMR	n.d.	10;25	125	Some	MA	Only experts
Jung, 2018[41]	Korea	Multicenter Prospective	Fair	ESD	n.d.	20; >	78	0%	MA+E	Incl. non-experts (ESD)
Kimoto, 2020[21]	Japan	Single center Prospective	Good	CSP	n.d.	10; >	474	100 %	MB	Only experts
Li, 2020[17]	China	Single center RCT	Good	CSP, C-EMR, H-EMR	n.d.	11;20	487	Some	MB	Only experts
Pohl, 2013[4]	US	Multicenter Prospective	Fair	HSP	n.d.	10;20	116	Some	MB	Incl. non-experts
Repici, 2013[44]	Italy	Single center Prospective	Fair	ESD	n.d.	30; >	40	n.d.	MA+E	Only experts (ESD)

Tutticci, 2018[22]	Australia	Single center Prospective	Poor	C-EMR	n.d.	20; >	163	100 %	MB	Only experts (non-ESD)
Yabuuchi, 2020[18]	Japan	Single center Prospective	Good	C-EMR	n.d.	10;14	80	n.d.	MA+E	Incl. non-experts
Yamasaki, 2018[53]	Japan	Single center RCT	Good	ESD	n.d.	20;60	84	n.d.	MA	Incl. non-experts (ESD)
Yamashina, 2019[20]	Japan	Multicenter RCT	Good	H-EMR, U-EMR	n.d.	10;20	210	Some	MA+E	Incl. non-experts
Yamashina, 2020[54]	Japan	Multicenter RCT	Good	ESD	n.d.	18;80	114	Some	MA+E	Incl. non-experts (ESD)
Yen, 2020[55]	US	Single center RCT	Good	H-EMR, U-EMR	some	10;30	118	Some	MB	Only experts
Yoshida,	Japan	Single center	Good	H-EMR	n.d.	11;20	46	0%	MA	Incl. non-experts

2012[56]		RCT								
Yoshida, 2013[46]	Japan	Multicenter Prospective	Fair	H-EMR	n.d.	10;20	108	0%	MA	Incl. non-experts
Yoshida, 2014[16]	Japan	Multicenter Prospective	Good	H-EMR	n.d.	10;20	133	0%	MA	Incl. non-experts
Youk, 2016[47]	Korea	Multicenter Prospective	Good	ESD	n.d.	20; >	319	n.d.	MA+E	Incl. non-experts (ESD)

[1]Size range of polyps included in mm [smallest; largest].

CSP: Cold snare polypectomy; C-EMR: Cold endoscopic mucosal resection; ESD: Endoscopic submucosal dissection; HSP: Hot snare polypectomy; H-EMR: Hot endoscopic mucosal resection; MA: Margin assessment; MA+E: Margin assessment + *en bloc* resection; MB: Margin biopsy; n.d: Not defined; RCT: Randomized controlled trial; U-EMR: Underwater endoscopic mucosal resection.

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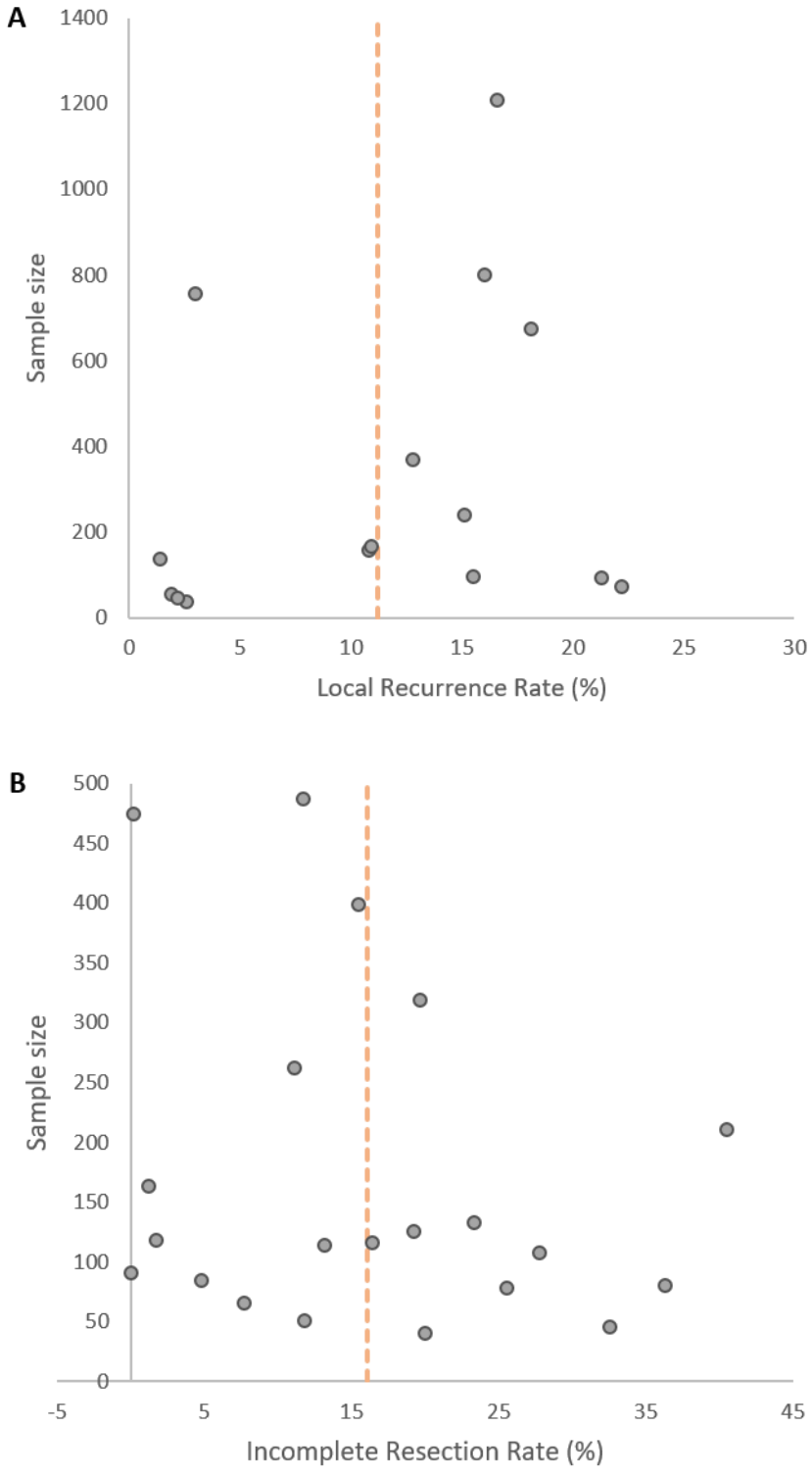
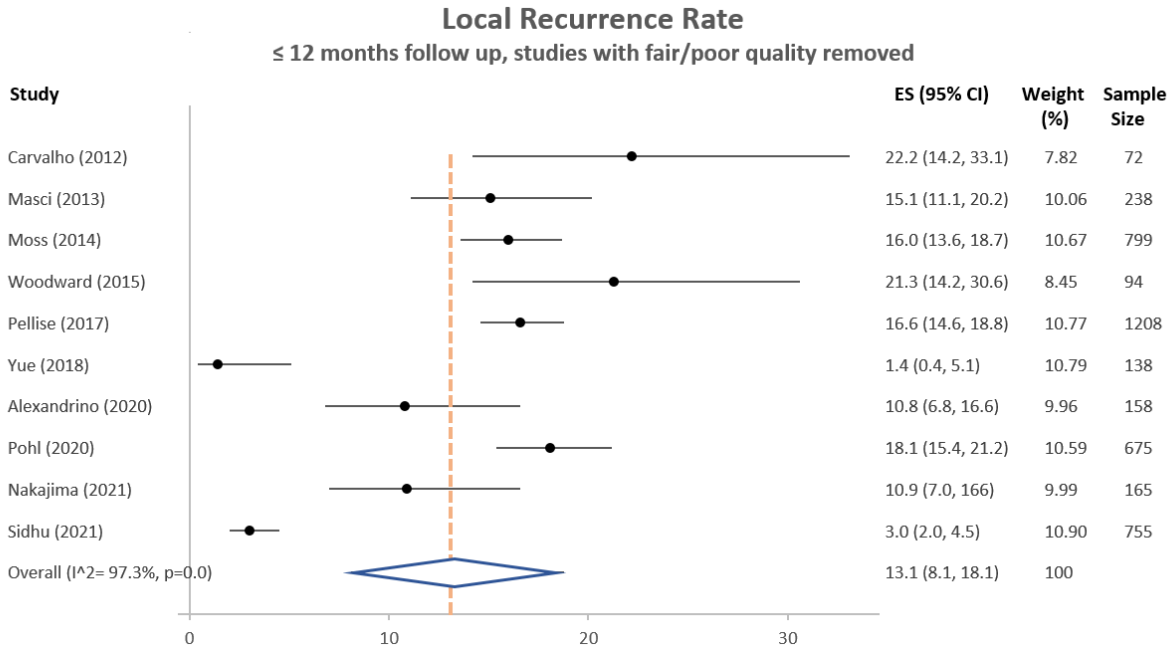
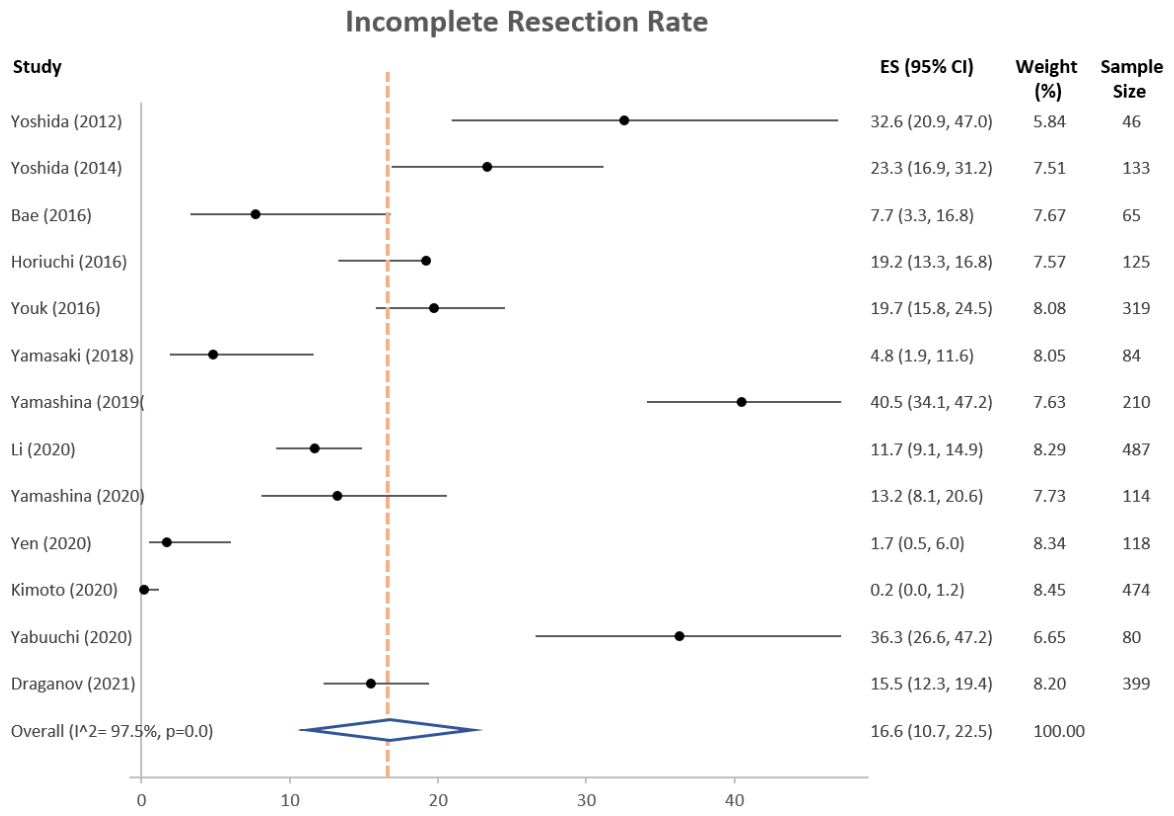
Supplementary Figures



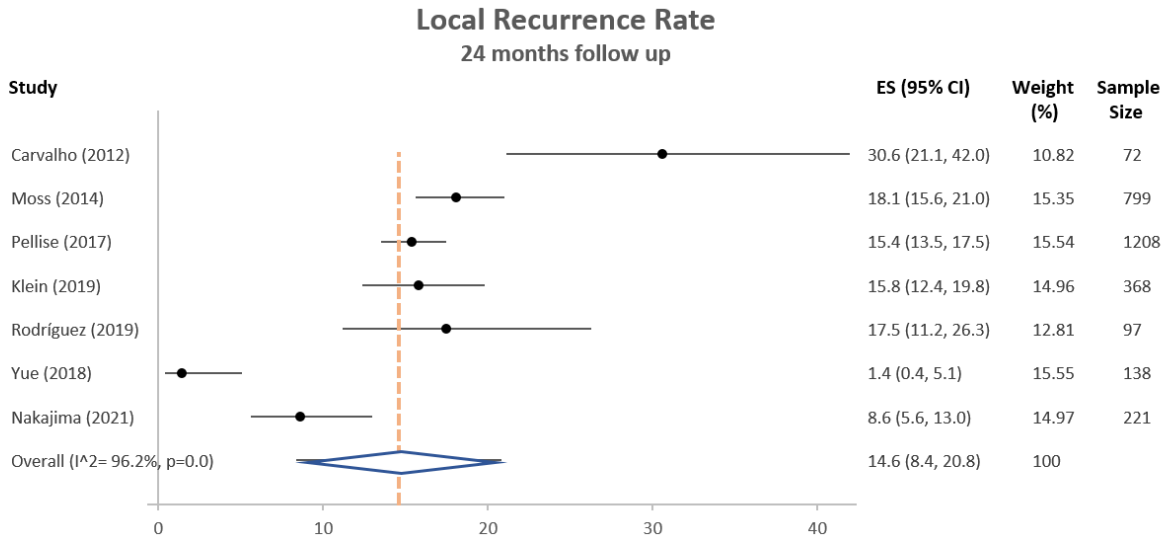
Supplementary Figure 1 Publication bias of evaluated studies on local recurrence rate (A) and incomplete resection rate (B).



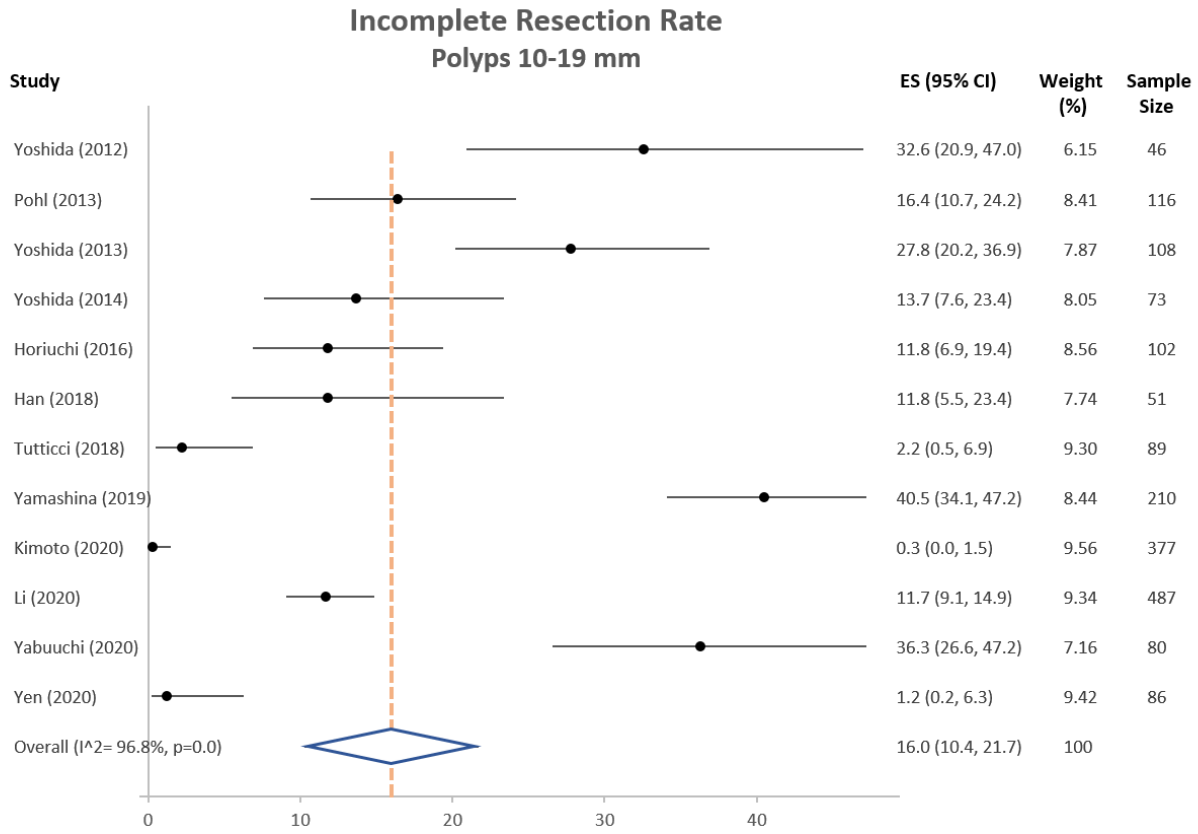
Supplementary Figure 2 Local recurrence rate at <12 mo' follow-up for polyps ≥ 10 mm, after removal of publications with fair or poor quality.



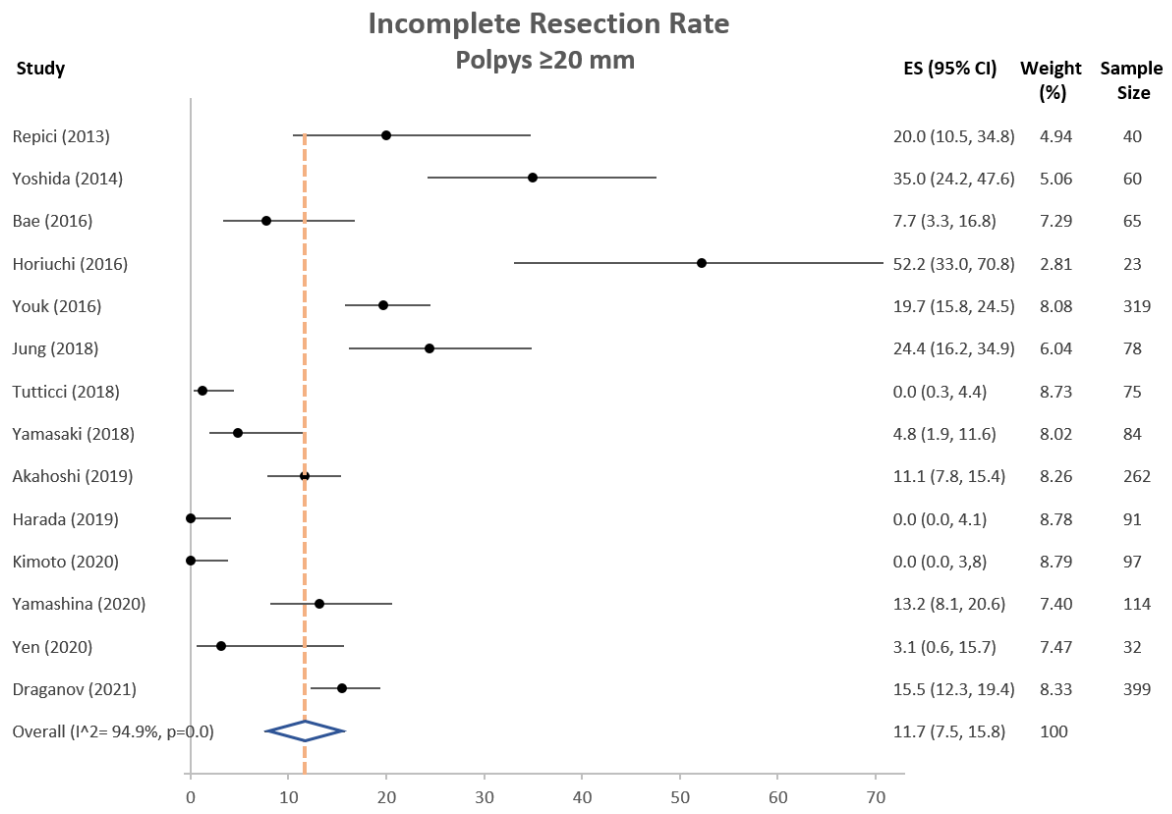
Supplementary Figure 3 Incomplete resection rate for polyps ≥ 10 mm, after removal of publications with fair or poor quality.



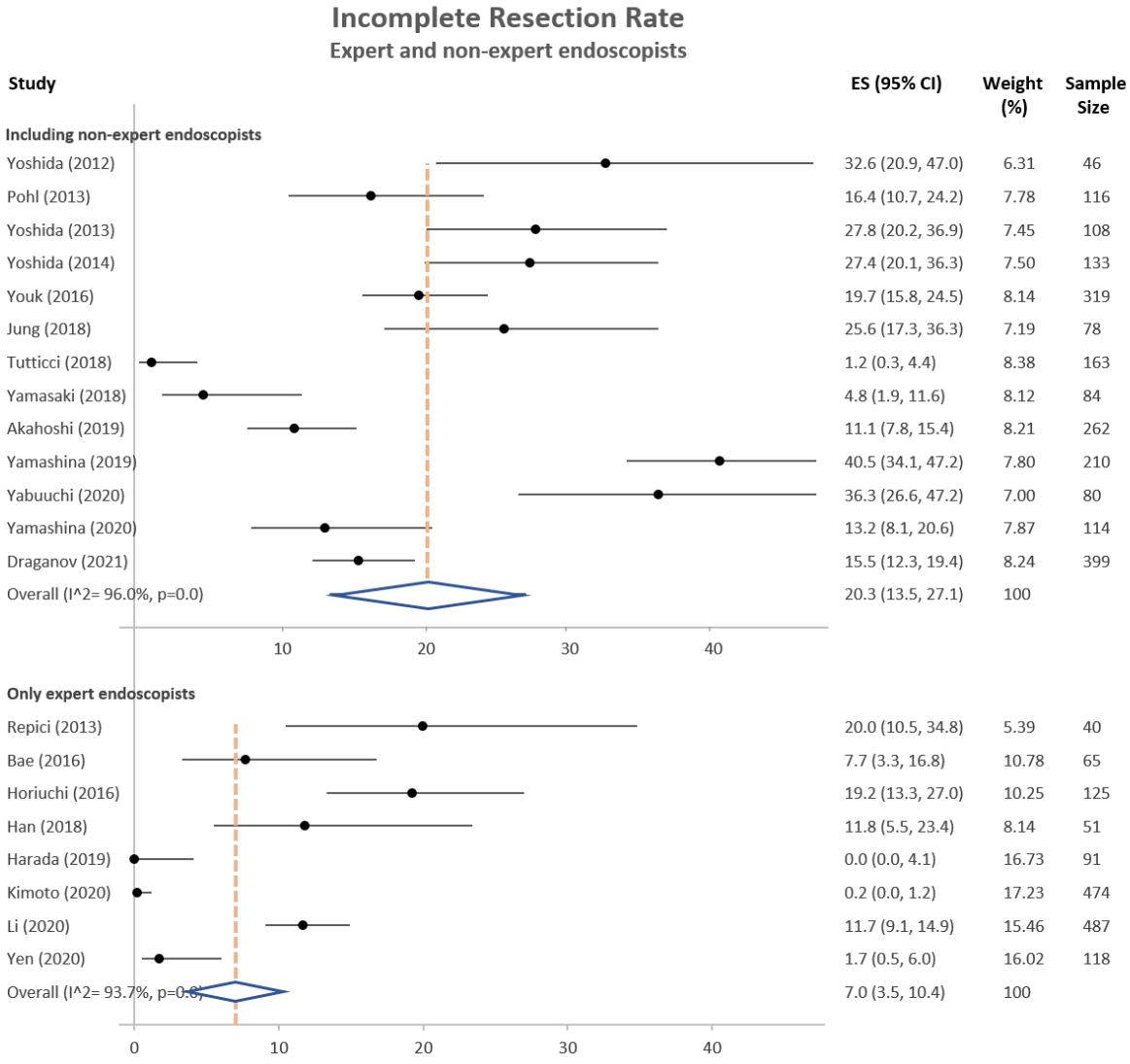
Supplementary Figure 4 Local recurrence rate at < 24 mo' follow-up for polyps ≥10 mm, independent of resection method.



Supplementary Figure 5 Incomplete resection rate for polyps 10–19 mm, independent of resection method.



Supplementary Figure 6 Incomplete resection rate for polyps ≥ 20 mm, independent of resection method.



Supplementary Figure 7 Incomplete resection rate for polyps ≥ 10 mm, for studies with only expert endoscopists and for studies in which non-expert endoscopists were involved.