

Outcomes of thin versus thick-wire snares for cold snare polypectomy: a systematic review and meta-analysis

Suprabhat Giri¹, Vaneet Jearth², Harish Darak³, Sridhar Sundaram⁴

¹Nizam's Institute of Medical Sciences, Hyderabad; ²Postgraduate Institute of Medical Education and Research, Chandigarh; ³Seth GS Medical College and KEM Hospital, Mumbai; ⁴Department of Digestive Diseases and Clinical Nutrition, TATA Memorial Hospital, Mumbai, India

Background/Aims: Cold snare polypectomy (CSP) is commonly used for the resection of colorectal polyps ≤ 10 mm. Data regarding the influence of snare type on CSP effectiveness are conflicting. Hence, this meta-analysis aimed to compare the outcomes and safety of thin- and thick-wire snares for CSP.

Methods: A comprehensive search of the literature published between 2000 and 2021 was performed of various databases for comparative studies evaluating the outcomes of thin- versus thick-wire snares for CSP.

Results: Five studies with data on 1,425 polyps were included in the analysis. The thick-wire snare was comparable to the thin-wire snare with respect to complete histological resection (risk ratio [RR], 1.03; 95% confidence interval [CI], 0.97–1.09), overall bleeding (RR, 0.98; 95% CI, 0.40–2.40), polyp retrieval (RR, 1.01; 95% CI, 0.97–1.04), and involvement of submucosa in the resection specimen (RR, 1.28; 95% CI, 0.72–2.28). There was no publication bias and a small study effect, and the relative effects remained the same in the sensitivity analysis.

Conclusions: CSP using a thin-wire snare has no additional benefit over thick-wire snares in small colorectal polyps. Factors other than snare design may play a role in improving CSP outcomes.

Keywords: Cold snare polypectomy; Colorectal polyp; Dedicated snare; Histological resection; Meta-analysis

INTRODUCTION

The risk of colorectal cancer development and its associated mortality can be reduced by the endoscopic resection of colorectal polyps.¹ The majority of these procedures are performed of diminutive (≤ 5 mm) or small (6–9 mm) lesions.^{2,3} Traditional hot snare polypectomy (HSP) is useful for removing these lesions.¹ However, HSP is associated with a small but significant

risk of serious adverse events, including post-polypectomy bleeding (PPB) and perforation.⁴ The American Society for Gastrointestinal Endoscopy and the European Society of Gastrointestinal Endoscopy recommend cold snare polypectomy (CSP) for colorectal lesions < 10 mm in diameter.^{5,6} In a recent large-scale propensity score-matched study of polypectomy outcomes for colorectal lesions < 10 mm, CSP had a significantly lower risk of PPB than HSP.⁷ Endoscopic lesion resection is the second factor that determines polypectomy efficacy, as residual lesions can be associated with post-colonoscopy interval cancer.⁸ The presence of residual or recurrent tissue following snare polypectomy is reportedly 3% to 14%.^{9,10} A recent randomized controlled trial by the POLIPEC HOT-COLD study group showed no differences in complete resection rates (CRRs) between HSP and CSP, with reduced intensity and duration of post-colonoscopy abdominal pain.¹¹ Hence, polypectomy aims to ensure complete resection in an *en bloc* manner while mini-

Received: April 27, 2022 **Revised:** May 28, 2022 **Accepted:** June 27, 2022

Correspondence: Sridhar Sundaram

Department of Digestive Diseases and Clinical Nutrition, TATA Memorial Hospital, Homi Bhabha National Institute, Dr. E Borges Road, Parel, Mumbai 400012, India

E-mail: drsridharsundaram@gmail.com

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mizing complications.

Cold snaring requires *en bloc* capture of polyps with mechanical tissue transection. A snare wire is the major determinant of effective tissue transection. Considerable variations are seen in the resection techniques for these subcentimetric lesions owing to the availability of a large selection of snares. Traditional snares have thicker braided current-carrying wires and oval-shaped snare loops, while newer dedicated cold snares have thinner monofilament wires and diamond-shaped snare loops. There is no consensus regarding the best snare type for CSP. Hence, the present systematic review and meta-analysis (SRMA) was conducted to compare the efficacy and safety of thin and thick wires for cold snare polypectomies.

METHODS

SRMA was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and registered with PROSPERO (CRD42022306231).

Information sources and search strategy

We searched Medline and ScienceDirect for all relevant studies published between 2000 and October 2021. The following keywords were used for the search: (Cold snare OR CSP OR Cold polypectomy) AND (Wire OR Snare OR Technique) AND (Colon OR Colorectal). We also manually searched the reference lists of all identified trials, guidelines, and reviews on the topic for relevant trials.

Study selection

Two independent reviewers searched the titles and abstracts of the retrieved search records against the inclusion and exclusion criteria. The same two reviewers examined the full texts of potentially eligible citations. Disagreements were resolved by a third reviewer. Studies included in this SRMA were comparative and fulfilled the following PICO criteria: (1) Patients: colorectal polyp measuring ≤ 10 mm without endoscopic evidence of suspected submucosal invasive cancer; (2) Intervention: use of a thin-wire/dedicated snare (0.3 mm) for CSP; (3) Comparison: use of thick-wire/traditional snare (0.47 mm) for CSP; and (4) Outcomes: complete resection and adverse events. We included both original articles and conference abstracts because of the low number of retrieved studies. There was no restriction on language as long as the study outcomes were mentioned in the text. Non-comparative studies, case series, and studies

involving persons aged <18 years were excluded from the analysis. Rayyan (<http://rayyan.qcri.org>), a free web application, was used to screen the abstracts and titles.¹²

Data extraction

The data extraction was independently performed by two investigators. Disagreements were resolved by a third reviewer. Data collection was performed under the following headings: study author and year, number of patients, sex distribution, intervention used and comparator arm, follow-up duration, outcomes, and adverse events.

Definition of outcomes

The primary outcome of the analysis was the rate of complete polyp resection, which was assessed by pathological examination. Overall bleeding included both intraprocedural and PPB within 2 weeks of the index procedure. Excision depth of the resected specimens was assessed by the presence of the submucosa on pathological examination.

Risk of bias in individual studies and confidence in cumulative evidence

The risk of bias was assessed by two reviewers using the Cochrane Risk of Bias tool for randomized trials¹³ and Cochrane Collaboration's risk of bias in non-randomized studies of interventions tool for non-randomized studies.¹⁴ The quality of evidence was analyzed according to the Grading of Recommendations Assessment, Development, and Evaluation Working Group approach.¹⁵

Statistical analysis

Dichotomous variables were analyzed using the risk ratio (RR) and Mantel-Haenszel test. The random-effects model was used irrespective of the presence of heterogeneity. The Q and I^2 statistics were used to assess heterogeneity among the studies. A p -value on the Q test <0.1 or an I^2 value $>50\%$ was considered significant. Publication bias was assessed using funnel plots and Egger's test. The sensitivity analysis was performed by conducting a leave-one-out meta-analysis, which excluded one study from each analysis to investigate the influence of each on the overall effect size estimate and identify influential studies. All statistical analyses were performed using RevMan software (ver. 5.4.1; Cochrane Collaboration) and STATA software (ver. 17; StataCorp., College Station, TX, USA).

RESULTS

Figure 1 shows the PRISMA flowchart for the article selection process, which was conducted according to updated guidelines.¹⁶ A total of 220 citations were retrieved from Medline and 83 from ScienceDirect; after the removal of duplicates, 269 were screened. Finally, five studies were included in the analysis,¹⁷⁻²¹ among which four were full-text articles and one was a conference abstract. Table 1 summarizes the characteristics of the study population and polyps. The snare used in all studies were the Exacto (Exacto snare; Steris Medical, Dublin, Ireland) cold snare, with a wire diameter of 0.3 mm (thin-wire), and the SnareMaster snare (Olympus Ltd., Tokyo, Japan), with a wire diameter of 0.47 mm (thick-wire). The abstract by Jung et al.²⁰ did not mention snare names.

Outcomes

1) Complete histological resection

All five studies¹⁷⁻²¹ reported the primary outcome of histolog-

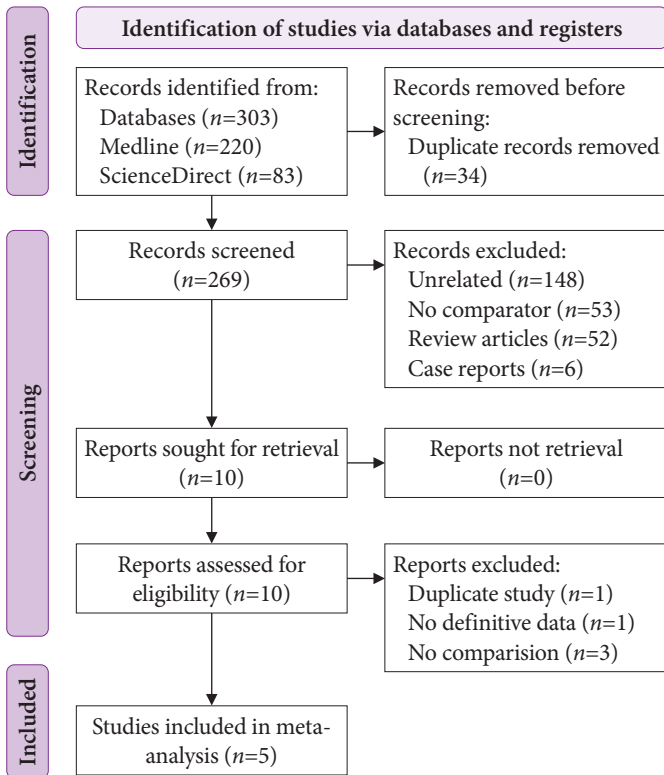


Fig. 1. Flow diagram of the study retrieval and identification process for the meta-analysis as per the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement.

Table 1. Study characteristics

Study	Country	Study design	Polyp criteria (mm)	No. of patients	M/F	Intervention	No. of polyps/ no. of patients	Patients on anti-thrombotics, n (%)	Location of polyps (P/L)	Histology (AD/SSL/HYP/O)
Horiuchi et al. (2015) ¹⁸	Japan	RCT	≤10	76	51/25	Thin-wire Thick-wire	98 (37) 112 (39)	4 (11) 4 (10)	58/40 63/49	84/5/9/0 94/6/11/1
Din et al. (2015) ¹⁷	UK	Prospective	3-7	112	74/28	Thin-wire Thick-wire	89 (56) 72 (56)	- -	38/51 23/49	55/2/19/13 39/0/22/11
Dwyer et al. (2017) ¹⁹	Australia	Prospective	≤10	181	115/66	Thin-wire Thick-wire	126 (88) 173 (93)	6 (7) 21 (23)	90/36 98/75	73/21/22/0 135/15/23/0
Jung et al. (2018) ²⁰	South Korea	RCT	5-8	-	-	Thin-wire Thick-wire	48 (-) 47 (-)	- -	- -	- -
Sidhu et al. (2022) ²¹	Multicentric	RCT	≤10	660	379/281	Thin-wire Thick-wire	339 (339) 321 (321)	36 (10.6) 35 (10.9)	240/99 223/98	217/35/41/46 187/33/45/55

M, male; F, female; P, proximal; L, left; AD, adenoma; SSL, sessile serrated lesion; HYP, hyperplastic; O, other; RCT, randomized controlled trial; -, no data available.

ical resection. The rate of complete histological resection was comparable between thin-wire and thick-wire CSP (RR, 1.03; 95% confidence interval [CI], 0.97–1.09; $I^2=69\%$; $p=0.01$), with significant interstudy heterogeneity (Fig. 2).

2) Overall bleeding and perforation rates

The incidence of bleeding (immediate and delayed) was reported by all five studies.¹⁷⁻²¹ Most episodes of bleeding were immediate, and only Horiuchi et al.¹⁸ reported delayed bleeding. The rates of overall bleeding (RR, 0.98; 95% CI, 0.40–2.40; $I^2=38\%$; $p=0.19$) (Fig. 3) and immediate bleeding (RR, 1.02; 95% CI, 0.41–2.56; $I^2=35\%$; $p=0.20$) were comparable between thin-wire

and thick-wire CSP without any significant interstudy heterogeneity. None of the studies reported any perforation associated with the use of either snare for CSP.

3) Polyp retrieval rate

The polyp retrieval rate was reported by three studies.^{17,20,21} The rates of polyp retrieval were comparable between thin-wire and thick-wire CSP (RR, 1.01; 95% CI, 0.97–1.04; $I^2=55\%$; $p=0.11$) with significant interstudy heterogeneity (Fig. 4).

4) Presence of submucosal tissue in resection specimen

The presence of submucosal tissue in the resected specimen was

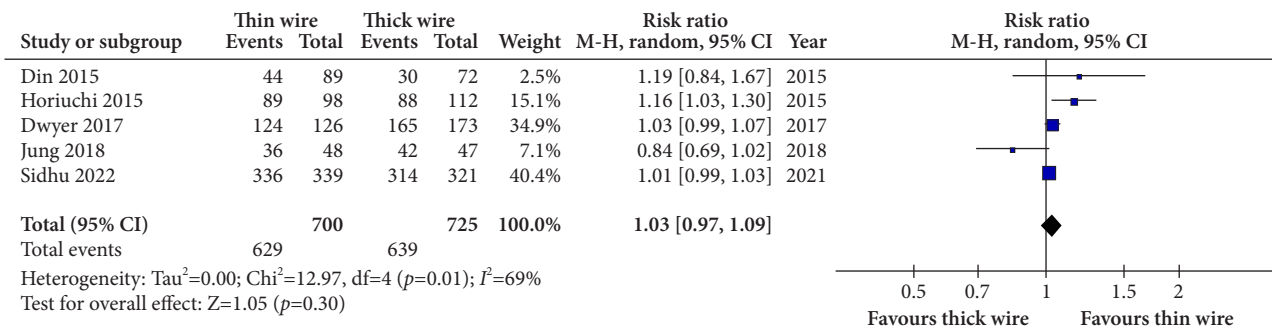


Fig. 2. Forest plot comparing histological resection rates of thin versus thick snares. M-H, Mantel-Haenszel; CI, confidence interval.

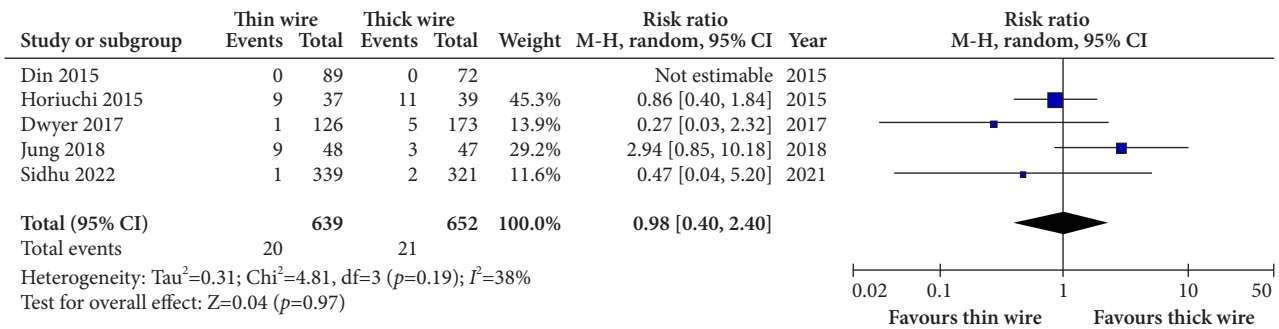


Fig. 3. Forest plot comparing overall bleeding rates of thin versus thick snares. M-H, Mantel-Haenszel; CI, confidence interval.

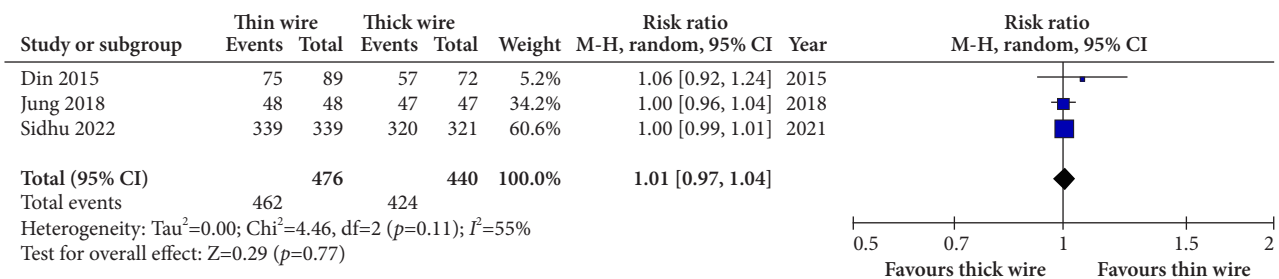


Fig. 4. Forest plot comparing polyp retrieval rates of thin versus thick snares. M-H, Mantel-Haenszel; CI, confidence interval.

reported by three studies^{18,20,21} and comparable between thin-wire and thick-wire CSP (RR, 1.28; 95% CI, 0.72–2.28; $I^2=48\%$; $p=0.14$) without any significant interstudy heterogeneity (Fig. 5).

Risk of bias assessment

Among the randomized controlled trials, two studies had a low risk of bias^{18,21} and one study had some concern regarding the risk of bias.²⁰ Both non-randomized studies had a moderate risk of bias.^{17,19} Traffic light plots for the risk of bias are shown in Figure 6.

Publication bias, sensitivity analysis, and grade of evidence

Assessment of funnel plots for all outcomes showed no evidence of publication bias (Supplementary Fig. 1). Egger’s test for all outcomes showed no evidence of a small study effect (Supplementary Table 1). A leave-one-out meta-analysis conducted for the sensitivity analysis showed no significant change in the risk of outcomes (Supplementary Fig. 2). Table 2 summarizes the study findings and level of evidence.

DISCUSSION

Apart from wire thickness, snare shape could be related to the efficacy of cold snaring of a polyp. The dedicated thin snare had a shield shape, whereas the traditional thick snare had an oval shape. Din et al.¹⁷ proposed that the shield shape might make snare positioning around tiny lesions easier than that with the oval shape. In addition, a thinner wire results in more cutting than shearing through the mucosa, thus increasing cutting ease and precision. However, the current meta-analysis showed no difference between snare types in terms of complete histological resection, polyp retrieval rate, and complications. The onus is more on operator technique than snare type for ensuring *en bloc* removal of small polyps without any attendant complications.

With respect to polyp size, Horiuchi et al.¹⁸ showed a significantly higher CRR in the thin versus thick-wire group for 8-10-mm lesions (83% vs. 45%, $p=0.014$). In contrast, the most recent study by Sidhu et al.²¹ demonstrated that all polyps 9 to 10 mm

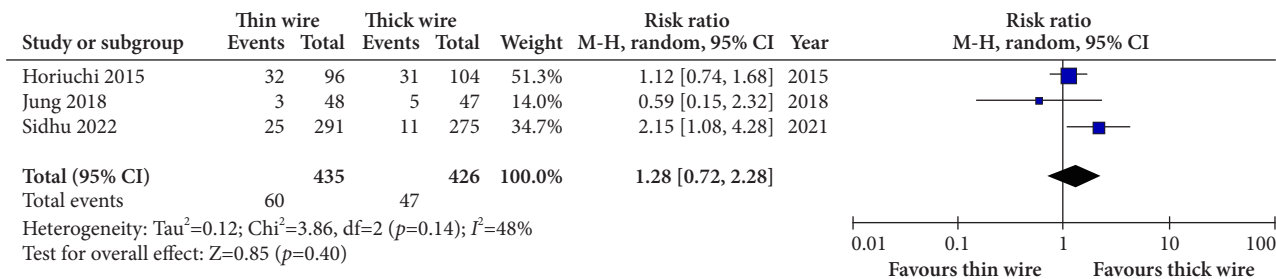


Fig. 5. Forest plot comparing the presence of submucosa in resection specimens retrieved using thin versus thick snares. M-H, Mantel-Haenszel; CI, confidence interval.

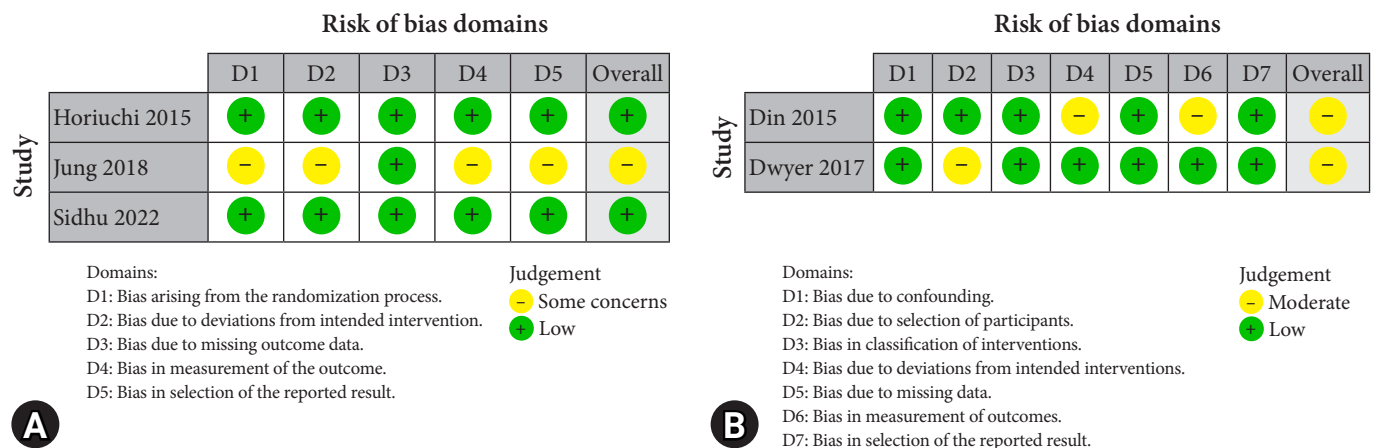


Fig. 6. Risk of bias assessment for (A) randomized controlled studies and (B) non-randomized studies.

in size could be resected entirely using either snare. The present meta-analysis also showed no difference in CRR irrespective of size.

In an analysis of predictors of incomplete resection, Dwyer et al.¹⁹ reported that polyps with serrated or hyperplastic histology have a higher rate of incomplete resection than adenomatous polyps (7% vs. 2%, $p=0.03$). Other studies reported that sessile serrated lesions and a proximal polyps location are risk factors for incomplete resection.²²⁻²⁴ Regarding snare type, Horiuchi et al.¹⁸ reported a higher rate of complete resection with a dedicated snare in cases of adenomatous polyps. Since hyperplastic or serrated polyps tend to appear similar to the neighboring colonic mucosa without significant contrast, there is a possibility of higher CRR.²⁵ In addition, the proximal location may require significant manipulation of the endoscope to position the polyp, which may affect the rates of complete resection.

Incomplete resection may be associated with polyp recurrence rate and increase colorectal cancer risk.²⁶ In the study by Jung et al.,²⁰ endoscopist experience was associated with CRR in univariate analysis (odds ratio [OR], 4.037; $p=0.012$).

However, on multiple logistic regression analyses, there was no association between snare type, endoscopist experience, polyp size, polyp shape, polyp location, and pathologic findings and CRR. CSP was performed by ten senior consultants and seven advanced endoscopy fellows in the study by Sidhu et al.²¹ There was no significant difference in the incomplete resection rate between the individual endoscopists in both the groups. Dwyer et al.¹⁹ also reported no difference in CRR with respect to endoscopist experience.

The difference in histological resection reported between the two CSP methods could be a result of differences in the definition of outcomes for each study. Sidhu et al.²¹ and Dwyer et al.¹⁹ defined complete histological resection based on examination of both resection specimens and biopsies from the resection margin. Din et al.¹⁷ obtained biopsies from areas of residual tissue, margins, and bases only when excision was judged as incomplete or uncertain based on chromoendoscopy. In contrast, Horiuchi et al.¹⁸ defined complete histological resection based on a pathological examination of the resected specimen.

In the management of diminutive polyps, complete resection is more important than tissue retrieval. In a meta-analysis, it was reported that narrow-band imaging can allow post-polypectomy surveillance intervals to be determined in a “resect and discard” strategy in patients with small/diminutive polyps independent of histopathology.²⁷ Thus, even in cases of tissue

Table 2. Summary of study findings and grade of evidence

Outcomes ^{a)}	Anticipated absolute effects (95% CI)		Relative effect (95% CI)	No. of polyps/no. of studies	Certainty assessment			Overall certainty of evidence
	Risk with thick snare	Risk with thin snare			Risk of bias	Inconsistency	Indirectness	
Histological resection	881 per 1,000	907 per 1,000 (854-960)	RR, 1.03 (0.97-1.09)	1,425/5	+	-	-	Low ●●○○
Overall bleeding	32 per 1,000	31 per 1,000 (13-77)	RR, 0.98 (0.40-2.40)	1,291/5	-	-	+	Low ●●○○
Polyp retrieval	964 per 1,000	974 per 1,000 (935-1,002)	RR, 1.01 (0.97-1.04)	916/3	+	-	-	Low ●●○○
Presence of submucosa in resection specimen	110 per 1,000	141 per 1,000 (79-251)	RR, 1.28 (0.72-2.28)	861/3	-	-	+	Low ●●○○

PICO criteria: Population, colorectal polyps ≤ 10 mm; Intervention, cold snare polypectomy using thick-wire/traditional snare; Comparison, cold snare polypectomy using thin-wire/dedicated snare;^{b)} Outcomes.

CI, confidence interval; RR, risk ratio.

retrieval failure, optical diagnosis using chromoendoscopy or image-enhanced endoscopy may determine the appropriate surveillance intervals. Our meta-analysis further supports the notion that snare type does not affect the CRR of small polyps undergoing CSP.

Resection depth can be assessed based on the presence of submucosal tissue in the resected specimen. Although Sidhu et al.²¹ showed a significantly higher proportion of submucosal tissue in resection specimens with a thin-wire snare, the present meta-analysis showed no intergroup difference. This is important because the risk of PPB is significantly increased as resection depth increases due to the exposed deep submucosal arteries.²⁸ Thus, the bleeding risk remained the same for both snare types.

Jung et al.²⁹ conducted a network meta-analysis to compare the efficacy of cold polypectomy techniques for diminutive colorectal polyps. With respect to complete histological eradication, dedicated and traditional CSP were superior to cold forceps polypectomy, with dedicated CSP being superior to traditional CSP (OR, 1.76; 95% CI, 1.07–2.89). There was no difference between dedicated and traditional CSP regarding tissue retrieval rate (OR, 1.03; 95% CI, 0.44–2.38). However, the previous analysis included only two studies comparing thick and thick snares^{17,18}; hence, the confidence of the level of evidence was very low.

The present meta-analysis had the highest number of studies comparing the outcomes of traditional (thick-wire) and dedicated (thin-wire) snares for CSP. The results of the current meta-analysis are relevant for several reasons. First, the dedicated thin-wire snare cannot be used for HSP, as it was not designed with electrocautery attachments.¹⁸ On the other hand, traditional snares can be used for both CSP and HSP in cases of multiple polyps of different sizes in the same patient, thus reducing the need for multiple snares. There are no data on the perception of ease of use of different snares among endoscopists.

The present meta-analysis has several limitations. First, it included a small number of studies and non-randomized studies. Second, it could not assess whether there was a difference in outcomes with respect to polyp size (<5 mm vs. 5–10 mm). In addition, we could not analyze the predictors of incomplete resection because the incomplete resection rate was low owing to the small size of the polyps.

Despite these limitations, the present meta-analysis provides better insight into the efficacy of various CSP techniques for

diminutive polyps. Compared to the traditional belief that thin-snare CSP is superior, the current analysis showed comparable efficacy and safety of thin- and thick-wire snares for CSP. Other factors, such as polyp morphology, polyp location, operator experience, and use of standardized techniques, may have impacted the CSP outcomes; therefore, further studies are required to validate our findings.

Supplementary Material

Supplementary Fig. 1. Funnel plot for assessment of publication bias.

Supplementary Fig. 2. Leave-one-out meta-analysis for sensitivity analysis of all outcomes.

Supplementary Table 1. Egger's test for assessment of small study effect.

Supplementary Table 2. PRISMA checklist for systematic review and meta-analysis.

Supplementary materials related to this article can be found online at <https://doi.org/10.5946/ce.2022.141>.

Ethical Statements

Not applicable.

Conflicts of Interest

The authors have no potential conflicts of interest.

Funding

None.

Author Contributions

Conceptualization: SG, SS; Methodology: SG, VJ, HD, SS; Formal analysis: SG, VJ, HD; Project administration: SG, SS; Visualization: SG, VJ, HD; Software: SG; Validation: SG, HD, SS; Writing-original draft: SG, VJ, HD, SS; Writing-review and editing: SG, VJ, HD, SS.

ORCID

Suprabhat Giri	https://orcid.org/0000-0002-9626-5243
Vaneet Jearth	https://orcid.org/0000-0002-5633-0338
Harish Darak	https://orcid.org/0000-0002-7902-7390
Sridhar Sundaram	https://orcid.org/0000-0002-2946-8534

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