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Hot versus cold snare for colorectal polypectomies sized up to 10mm: a systematic review and meta-analysis of randomized controlled trials

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ABSTRACT – Background – Colorectal cancer is the third most common cancer, and prevention relies on screening programs with resection complete resection of neoplastic lesions. **Objective** – We aimed to evaluate the best snare polypectomy technique for colorectal lesions up to 10 mm, focusing on complete resection rate, and adverse events. **Methods** – A comprehensive search using electronic databases was conducted to identify randomized controlled trials comparing hot versus cold snare resection for polyps sized up to 10 mm, and following PRISMA guidelines, a meta-analysis was performed. Outcomes included complete resection rate, en bloc resection rate, polypectomy, procedure times, immediate, delayed bleeding, and perforation. **Results –** Nineteen RCTs involving 8720 patients and 17588 polyps were included. Hot snare polypectomy showed a higher complete resection rate (RD, 0.02; 95%CI [+0.00,0.04]; P=0.03; I^2=63%), but also a higher rate of delayed bleeding (RD 0.00; 95%CI [0.00, 0.01]; P=0.01; I^2=0%), and severe delayed bleeding (RD 0.00; 95%CI [0.00, 0.00]; P=0.04; I^2=0%). Cold Snare was associated with shorter polypectomy time (MD -46.89 seconds; 95%CI [-62.99, -30.79]; P<0.00001; I^2=90%) and shorter total colonoscopy time (MD -7.17 minutes; 95%CI [-9.10, -5.25]; P<0.00001; I^2=41%). No significant differences were observed in en bloc resection rate or immediate bleeding. **Conclusion –** Hot snare polypectomy presents a slightly higher complete resection rate, but, as it is associated with a longer procedure time and a higher rate of delayed bleeding compared to Cold Snare, it cannot be recommended as the gold standard approach. Individual analysis and personal experience should be considered when selecting the best approach.

Keywords – Cancer; colorectal; polyps; polypectomy; colonoscopy; colon.

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INTRODUCTION

Colorectal cancer (CRC) is the third most common cancer, and the second most common cause of cancer death worldwide, excluding nonmelanoma skin cancer(1). Previous studies have shown that the adequate identification and resection of superficial neoplastic lesions can prevent CRC, which is the cornerstone of its prevention(2). According to the most recent guidelines from the U.S. Preventive Services Task Force, individuals should begin screening for colorectal cancer at the age of 45(3).

Endoscopic polypectomy is a safe, minimally invasive procedure for removing colorectal polyps. Several endoscopic resection methods are currently available for the treatment of polyps including hot snare polypectomy (HSP), cold snare (CSP), endoscopic mucosal resection (EMR), cold endoscopic mucosal resection (C-EMR), but the best resection method is still under investigation(4). HSP has traditionally been the procedure of choice for polypectomies, as thermal ablation may be associated with a higher complete resection rate, although recent studies demonstrated a higher rate of adverse events, such as perforation and delayed bleeding(5-7).

Recently, a 'cold revolution' has evolved, with CSP being recommended as the procedure of choice in current guidelines(4,8), as previous studies have shown comparable resection rates with a better safety profile, mainly because it induces less damage to the submucosal vessels, consequently reducing the risk of post-polypectomy bleeding, and is associated with a shorter procedure time(5,6,9). The use of EMR techniques, including C-EMR, which usually was indicated for larger polyps, also has been growing recently for smaller polyps, even the ones up to 10mm, with studies showing it can be associated with a higher complete resection rate(10,11), as the submucosal lift may help to define a clear margin and facilitate the snare resection.

In recent years, many randomized controlled trials addressing the best polypectomy technique have been published. So, we conducted a systematic review and meta-analysis of RCTs to investigate the best practice in this scenario. Our goal was to evaluate the best polypectomy method for colorectal lesions up to 10 mm, and if the use of electrical current achieves better outcomes, including complete resection rate, en bloc resection, immediate bleeding, delayed bleeding, and perforation.

METHODS

Protocol and registration

This study was performed in conformity with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines(12) and was registered in the International Prospective Register of Systematic Reviews (PROSPERO) under the file number CRD42022370494. The study was approved by the Hospital das Clinics Ethics Committee of the University of Sao Paulo.

Search and study selection

We searched electronic databases (MEDLINE and EMBASE) from inception to August 2023. Our search strategies were:

- MEDLINE / PubMed: (adenomatous OR adenoma OR adenomatosis OR polyps OR polyp) AND (colon OR colorectal OR colonic OR rectal OR rectum OR colorectum OR intestinal OR intestine) AND (surgery OR snare OR forceps OR resection OR surgical instruments OR polypectomy) AND random*;
- Embase: (adenomatous OR adenoma OR adenomatosis OR polyps OR polyp) AND (colon OR colorectal OR colonic OR rectal OR rectum OR colorectum OR intestinal OR intestine) AND (surgery OR snare OR forceps OR resection OR surgical instruments OR polypectomy) – only randomized controlled trials.

Data collection process

Two independent investigators (Cavassola PRP and Landim DL) searched titles and abstracts to access eligibility. Then, a full-text evaluation confirmed that the studies fulfilled all eligibility criteria. Any disagreements were resolved by consultation with a third reviewer.

Eligibility criteria

We included only randomized controlled trials (RCTs), that assessed patients with colorectal polyps sized up to 10 mm and underwent polypectomy comparing hot versus cold snare methods. Outcomes included complete resection rate, en bloc resection, immediate bleeding, delayed bleeding, severe delayed bleeding, perforation, total colonoscopy time, and polypectomy time.

In the studies that included polyps bigger than 10mm, we only used the data available of polyps ≤10 mm. We excluded studies that were not written in English and excluded from the bleeding analysis studies with exclusively anticoagulated patients[7,13].

Definitions

- Complete resection rate: complete histologic resection, using biopsy of margins or direct evaluation of margins on the specimen (R0);
- Immediate bleeding (intraprocedural bleeding that occurred immediately after the polypectomy and persisted for at least 30 seconds, or that required hemostatic treatment);
- Delayed bleeding (all bleeding cases reported after the patient left the endoscopy room to 30 days after the procedure);
- Severe delayed bleeding (bleeding that occurred after the patient left the endoscopy room, to 30 days after the procedure, requiring hospitalization or a repeat colonoscopy);
- Polypectomy time (time in which the polyp was visualized, and resected);
- Total procedure time (Time from the insertion of the endoscope to the end of the colonoscopy).

Data extraction

The data were extracted by two investigators (Cavassola PRP and Landim DL), with the following data being extracted: name and year of the study, number of patients, age, gender, type of polypectomy, number of polyps, size of polyps, morphology, histology, location, complete resection rate, adverse events, polyp retrieval rate, immediate bleeding, delayed bleeding, severe delayed bleeding, total colonoscopy time, and polypectomy time. When insufficient data were presented in the published articles, the corresponding authors were consulted via e-mail for further elucidation.

Risk of bias and quality of studies

The risk of bias was assessed using the Cochrane risk-of-bias tool for randomized trials (RoB2)[14]. We analyzed the risk of bias for all included studies. The quality of evidence was assessed using the grading of recommendations assessment, development, and evaluation (GRADE)[15].

Data synthesis and statistical analysis

Statistical analyses were conducted using the RevMan software Version 5.4 (Cochrane, London, UK). We used a random effects model to balance the heterogeneity of the result for all forest plots. When there was high heterogeneity, we performed a sensitivity analysis using a funnel plot and by omitting one study at a time to assess the influence of each study on the overall effect size of the outcomes. If the sample became homogeneous (I^2<50%) after excluding possible outliers, the studies were permanently excluded and considered true outliers. Outcome measures are described as risk difference (RD), and mean difference (MD), with their corresponding 95% confidence intervals (CI).

RESULTS

Study selection

The initial search identified 3298 studies. After removing duplicates, 2705 articles were identified and screened through title and abstract evaluation. Among them, 40 were selected for full-text assessment. Subsequently, we excluded 21 studies that were not randomized or did not compare hot versus cold methods for polypectomies. Finally, 19 studies were selected for this meta-analysis (FIGURE 1).

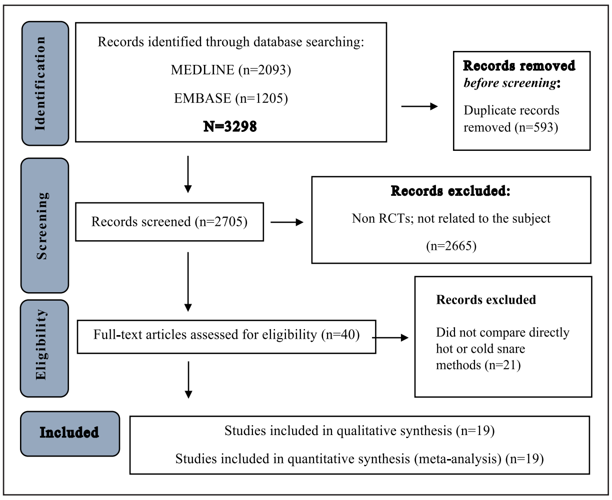


FIGURE 1. Study selection flowchart.

Study characteristics

All 19 studies were RCTs. A total of 8720 patients accounted for 17588 polypectomies. All studies reported analysis or sub-analysis of polyps ≤10 mm. A summary of the characteristics of the included trials is shown in TABLE 1.

Risk of Bias and quality of studies

The overall risk of bias is shown in FIGURE 2. There were no high-risk studies identified through Rob2[14]. The quality of the included studies was assessed using GradePRO and was considered adequate (FIGURE 3).

Meta-analysis

Complete resection rate

In total, 13689 polypectomies from 14 studies were analyzed. HSP presented a higher complete resection rate than CSP (RD, 0.02; 95%CI [+0.00,0.04]; P=0.03; I^2=63%) (FIGURE 4). We conducted a sensitivity analysis to investigate heterogeneity, however, it was not resolved by sensitivity analysis.

En bloc resection rate

A total of 13034 polypectomies from seven studies were analyzed. En bloc resection rate was similar between groups (RD, 0.00; 95%CI [-0.01, 0.01]; P=0.20; I^2=30%) (FIGURE 5).

Immediate bleeding

A total of 3688 polypectomies from 12 studies were included in this analysis. The study from Aizawa[16] was detected as an outlier in the funnel plot analysis and was excluded. Immediate bleeding was similar between groups. (RD -0.00; 95%CI [-0.01, 0.00]; P=0.34; I^2=11%) (FIGURE 6).

Delayed Bleeding

We conducted the bleeding analyses including all delayed bleeding cases and a group of severe delayed bleeding. Regarding all cases of delayed bleeding, there were significantly more bleeding cases in the HSP group (RD 0.00; 95%CI [0.00, 0.01]; P=0.01; I^2=0%.) (FIGURE 7.1). When evaluating the severe bleeding rate, hot snare was also associated with a higher bleeding rate (RD 0.00; 95%CI [0.00, 0.00]; P=0.04; I^2=0%.) (FIGURE 7.2)

Perforation

In total, 15412 polypectomies from 17 studies were analyzed. No polypectomy-associated perforation was described in either group (RD 0.00; 95%CI [-0.00, 0.00]; P=1.00; I^2=0%)[5].

Polypectomy time and total procedure time

When evaluating the polypectomy time, cold snare was associated with a shorter polypectomy time in seconds (MD -46.89; 95%CI [-62.99, -30.79]; P<0.00001 I^2=90%) (FIGURE 8.1). We conducted a sensitivity analysis to investigate heterogeneity, however, it was not resolved by sensitivity analysis.

In the evaluation of total procedure time, sensitivity analysis was performed, and the study from Chang[5] was detected as an outlier and was excluded. Cold snare was associated with a shorter total procedure time in minutes (MD -7.17; 95%CI [-9.10, -5.25]; p<0.00001 I^2=41%). (FIGURE 8.2).

Subgroup analysis

Complete resection rate, without submucosal injection

When excluding all EMR procedures, 12602 polypectomies from 11 studies were analyzed. There was no statistically significant difference between groups in complete resection rate (RD 0.00; 95%CI [-0.01, 0.01]; P=0.88; I^2=4%) (FIGURE 9).

Complete resection rate – Hot EMR vs CSP

A total of 1171 polypectomies from four studies were analyzed. There was no statistically significant difference between hot EMR and cold snare polypectomy regarding complete resection rate (RD 0.04; 95%CI [-0.02, 0.10]; P<0.0001; I^2=86%) (FIGURE 10). We conducted a sensitivity analysis to investigate heterogeneity, however, it was not resolved by sensitivity analysis.

Complete resection rate – Hot EMR vs C-EMR

When evaluating Hot EMR vs. C-EMR, we analyzed 408 polypectomies from three studies. There was no statistically significant difference between Hot EMR and C-EMR in terms of complete resection rate (RD 0.02; 95%CI [-0.01, 0.05]; P=0.22; I^2=0%) (FIGURE 11).

TABLE 1. Characteristics of included studies.

Author and year	Study design	Polypectomy method	Polyp size	Number of patients	Number of Polyps	Inclusion criteria	Complete resection assessment	Outcomes evaluated
Chang, 2023[5]	Multicentric RCT	CSP X HSP	4–10 mm	4270	10040	All polyp morphologies	Negative margin of the resected specimen	Complete resection rate, en bloc resection, delayed bleeding, polypectomy time, total procedure time
Rex DK, 2022[24]	Multicentric RCT	CSP X C-EMR x HSP x EMR	6–15mm	235	286	Nonpedunculated polyps	Negative margin biopsies	Complete resection rate
Koyanagi R, 2022[30]	Unicentric RCT	CSP x HSP	6–10mm	49	61	Nonpedunculated polyps	Negative margin of the resected specimen	Complete Resection rate, immediate bleeding, delayed bleeding,
Pedersen IB, 2022[25]	Multicentric RCT	CSP x HSP	4–9mm	425	601	Nonpedunculated polyps	Negative margin biopsies	Complete resection rate, en bloc resection, immediate bleeding, delayed bleeding
Fatima H, 2022[20]	Multicentric RCT	CF x CSP x HSP	4–6mm	260	318	Adenomatous Polyps	Negative margin of the resected specimen	Immediate bleeding, delayed bleeding
Varytimiadis L, 2021[34]	Unicentric RCT	CSP x HSP x APC	5–9mm	112	121	All polyps in left colon	Negative margin of the resected specimen	Complete resection rate, immediate bleeding
Ito T, 2021[35]	Unicentric RCT	CSP x HSP	6–10mm	332	332	Nonpedunculated polyps	Negative margin of the resected specimen	En Bloc resection, immediate bleeding, delayed bleeding, polypectomy time, total procedure time
De Benito Sanz M, 2020[36]	Multicentric RCT	CSP x HSP	5–9mm	488	791	All polyp morphologies	Negative margin biopsies	Complete resection rate, en bloc resection, immediate bleeding, delayed bleeding,
Li D, 2020[11]	Unicentric RCT	CSP x C-EMR x EMR	6–20mm	404	763	Any polyp type, except hyperplastic and inflammatory	Negative margin biopsies	Complete resection rate
Takeuchi Y, 2019[13]	Multicentric RCT	CSP (+CA) x HSP (+HB)	≤10 mm	168	611	Nonpedunculated polyps	NA	Polypectomy time
Aizawa M, 2019[16]	Multicentric RCT	CSP X HSP	≤10mm	273	727	All polyp morphologies	NA	Delayed Bleeding
Zhang Q, 2018[21]	Unicentric RCT	CSP x EMR	6–9mm	358	525	Nonpedunculated polyps	Negative margin biopsies	Complete resection rate, en bloc resection, immediate bleeding, delayed bleeding, polypectomy time
Suzuki S, 2018[19]	Unicentric RCT	CSP x HSP	≤10 mm	52	52	Nonpedunculated polyps	Negative margin of the resected specimen	Complete resection rate, en bloc resection, immediate bleeding, delayed bleeding
Kawamura T, 2017[29]	Multicentric RCT	CSP x HSP (+ EMR)	4–9 mm	538	687	Nonpedunculated polyps	Negative margin biopsies	Complete resection rate, en bloc resection, immediate bleeding, delayed bleeding, polypectomy time
Papastergiou V, 2017[37]	Multicentric RCT	C-EMR x EMR.	6–10 mm	155	164	Nonpedunculated polyps	Negative margin biopsies	Complete resection rate, immediate bleeding, delayed bleeding
Horiuchi A, 2015[7]	Unicentric RCT	CSP (+CA) x HSP(+ CA)	≤10 mm	70	159	Any polyp time, except hyperplastic	Negative margin of the resected specimen	Complete resection rate, total procedure time
Gomez V, 2014[38]	Unicentric RCT	CSP x HSP x CFP	<6 mm	37	62	Adenomatous and hyperplasic polyps	Negative margin biopsies or C-EMR of the resection site	Complete resection rate, immediate bleeding, delayed bleeding
Paspatis G, 2011[39]	Unicentric RCT	CSP x HSP	3–8 mm	414	1083	All polyp morphologies	Negative margin of the resected specimen	Delayed bleeding, total procedure time
Ichise Y, 2011[40]	Unicentric RCT	CSP x HSP	≤8 mm	80	205	Any polyp type except hyperplastic in rectum or sigmoid	Negative margin of resected specimen	Complete resection rate, immediate bleeding, delayed bleeding, total procedure time

RCT: randomized controlled trial; CSP: cold snare polypectomy; C-EMR: cold snare endoscopic mucosal resection; HSP: hot snare polypectomy; EMR: endoscopic mucosal resection; APC: argon plasma coagulation; CA: continuous anticoagulation; HB: heparin bridging; NA: Not available.

FIGURE 2. Overall risk of bias analyzed through Rob2.

Certainty assessment							Nº of patients		Effect		Certainty	Importance
Nº of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Hot**	**Cold Snare**	**Relative (95%CI)**	**Absolute (95% CI)**		
Perforation												
17	randomised trials	not serious	not serious	not serious	not serious	none	0/7704 (0.0%)	0/7708 (0.0%)	not estimable	**0 fewer per 1.000** (from 0 fewer to 0 fewer)	⊕⊕⊕⊕ High	IMPORTANT
Complete Resection Rate												
14	randomised trials	not serious	serious[a]	not serious	not serious	none	5974/6779 (88.1%)	6092/6910 (88.2%)	not estimable	**20 fewer per 1.000** (from 40 fewer to 0 fewer)	⊕⊕⊕◯ Moderate	CRITICAL
Complete Resection Rate - EMR x CSP												
4	randomised trials	not serious	very serious[a]	not serious	not serious	none	465/473 (98.3%)	661/698 (94.7%)	not estimable	**40 fewer per 1.000** (from 100 fewer to 20 more)	⊕⊕◯◯ Low	IMPORTANT
Complete Resection Rate - EMR x C-EMR												
3	randomised trials	not serious	not serious	not serious	not serious	none	188/191 (98.4%)	209/217 (96.3%)	not estimable	**20 fewer per 1.000** (from 50 fewer to 10 more)	⊕⊕⊕⊕ High	IMPORTANT
Complete Resection Rate - HSP x CSP												
11	randomised trials	not serious	not serious	not serious	not serious	none	5439/6233 (87.3%)	5590/6369 (87.8%)	not estimable	**0 fewer per 1.000** (from 10 fewer to 10 more)	⊕⊕⊕⊕ High	IMPORTANT
Polypectomy Time												
5	randomised trials	not serious	very serious[a]	not serious	not serious	none	5987	6092	-	MD **46.89 seconds lower** (62.99 lower to 30.79 lower)	⊕⊕◯◯ Low	IMPORTANT
Total procedure time												
3	randomised trials	not serious	not serious	not serious	not serious	none	283	281	-	MD **7.17 minutes lower** (9.10 lower to 5.25 lower)	⊕⊕⊕⊕ High	IMPORTANT
Severe Delayed Bleeding (Per Patient)												
14	randomised trials	serious[b]	not serious	not serious	serious[c]	none	11/3568 (0.3%)	3/3570 (0.1%)	not estimable	**0 fewer per 1.000** (from 0 fewer to 0 fewer)	⊕⊕◯◯ Low	CRITICAL
Delayed Bleeding (Per patient)												
14	randomised trials	serious[b]	not serious	not serious	not serious	none	35/3568 (1.0%)	15/3570 (0.4%)	not estimable	**0 fewer per 1.000** (from 10 fewer to 0 fewer)	⊕⊕⊕◯ Moderate	CRITICAL
Immediate Bleeding (Per Polyp)												
12	randomised trials	serious[d]	not serious	not serious	not serious	none	30/1825 (1.6%)	48/1863 (2.6%)	not estimable	**0 fewer per 1.000** (from 0 fewer to 10 more)	⊕⊕⊕◯ Moderate	IMPORTANT
En Bloc Resection												
7	randomised trials	not serious	not serious	not serious	not serious	none	6329/6522 (97.0%)	6286/6512 (96.5%)	not estimable	**0 fewer per 1.000** (from 10 fewer to 10 more)	⊕⊕⊕⊕ High	IMPORTANT

FIGURE 3. GradePRO quality assessment.

CI: confidence interval; **MD:** mean difference. Explanations: a: High heterogeneity. b: Different management of delayed bleeding between studies. c: Low event rate. d: Different definitions of immediate bleeding between studies. Endoscopists are not blinded.

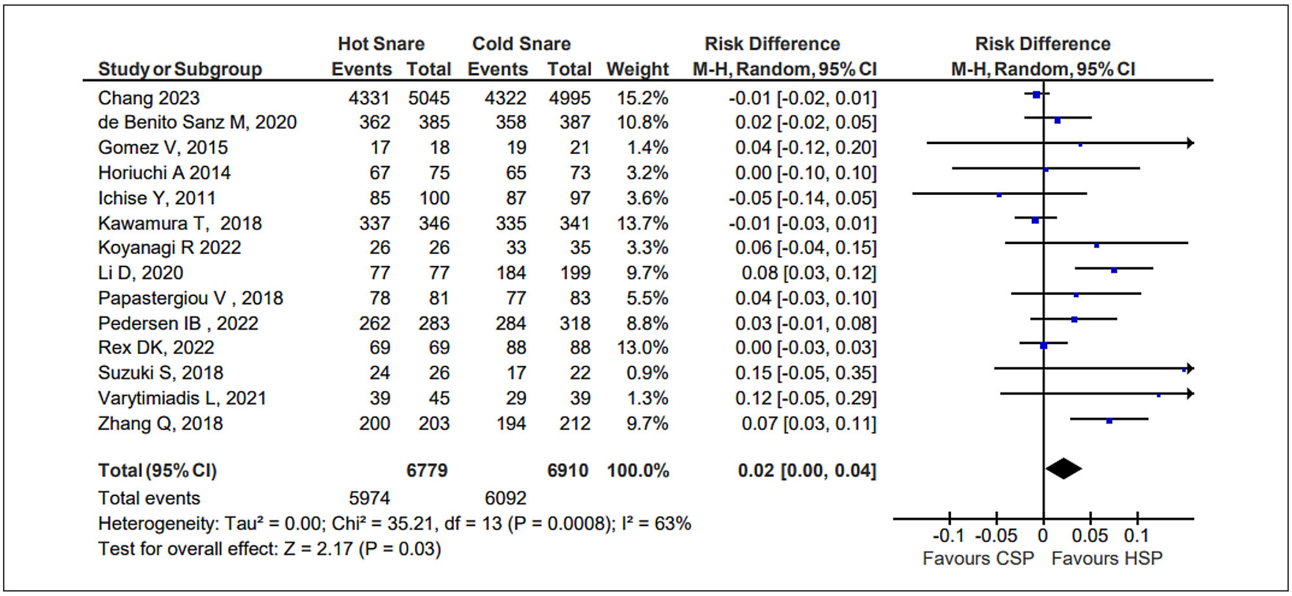


FIGURE 4. Complete resection rate.

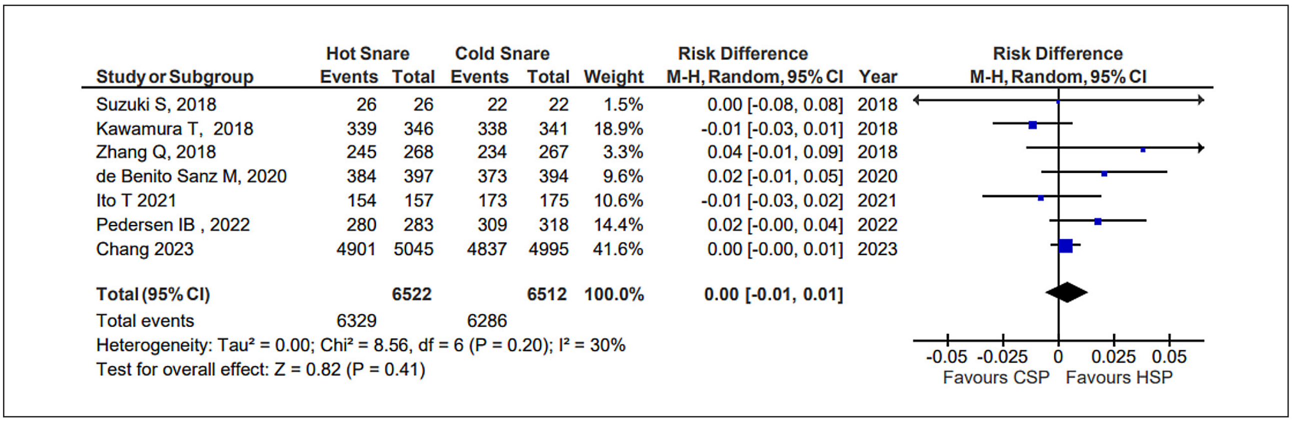


FIGURE 5. En bloc resection.

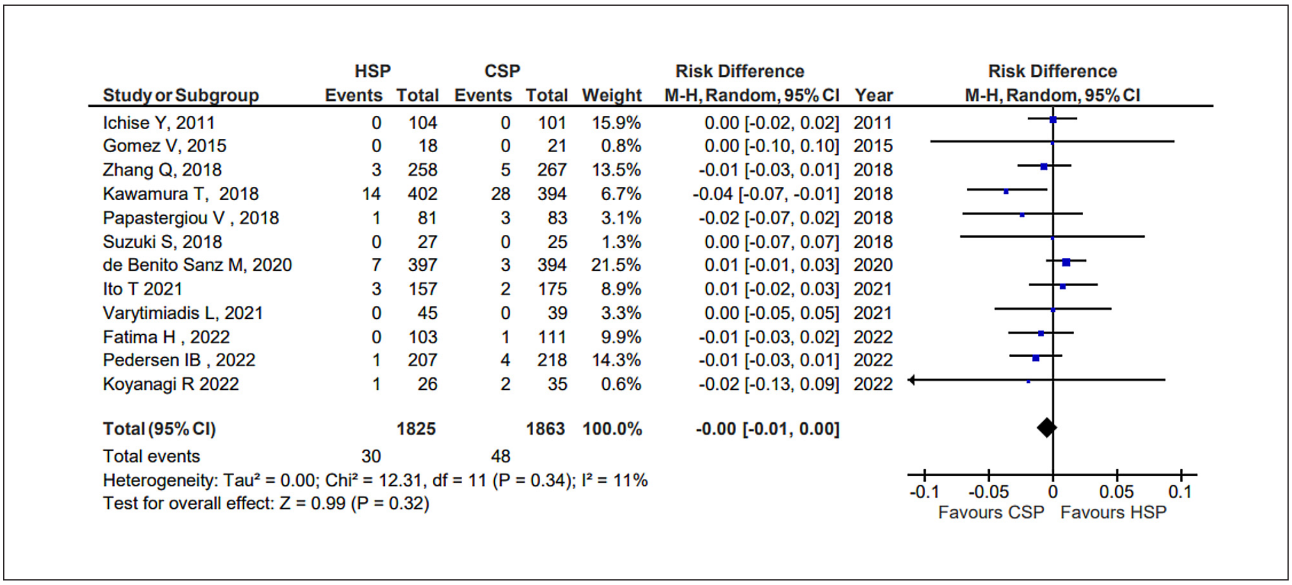
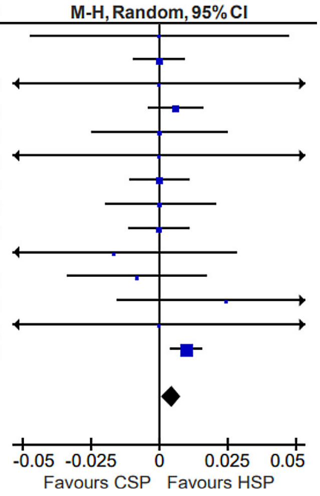


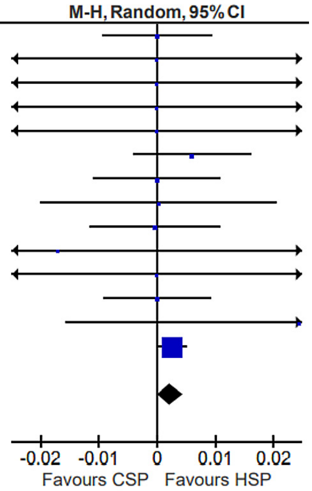
FIGURE 6. Immediate bleeding.



Study or Subgroup	HSP Events	HSP Total	CSP Events	CSP Total	Weight	Risk Difference M-H, Random, 95% CI	Year
Paspatis GA, 2011	0	40	0	40	0.6%	0.00 [-0.05, 0.05]	2011
Ichise Y, 2011	0	206	0	208	15.1%	0.00 [-0.01, 0.01]	2011
Gomez V, 2015	0	18	0	21	0.1%	0.00 [-0.10, 0.10]	2015
Kawamura T, 2018	2	334	0	328	13.1%	0.01 [-0.00, 0.02]	2018
Papastergiou V , 2018	0	78	0	77	2.2%	0.00 [-0.02, 0.02]	2018
Suzuki S, 2018	0	27	0	25	0.3%	0.00 [-0.07, 0.07]	2018
Zhang Q, 2018	0	179	0	179	11.3%	0.00 [-0.01, 0.01]	2018
Aizawa M , 2019	1	134	1	139	3.3%	0.00 [-0.02, 0.02]	2019
de Benito Sanz M, 2020	1	259	1	237	10.7%	-0.00 [-0.01, 0.01]	2020
Ito T 2021	0	60	1	59	0.6%	-0.02 [-0.06, 0.03]	2021
Pedersen IB , 2022	3	207	5	218	2.0%	-0.01 [-0.03, 0.02]	2022
Fatima H , 2022	2	82	0	87	0.8%	0.02 [-0.02, 0.06]	2022
Koyanagi R 2022	0	22	0	27	0.2%	0.00 [-0.08, 0.08]	2022
Chang 2023	26	1922	7	1925	39.6%	0.01 [0.00, 0.02]	2023
Total (95% CI)		**3568**		**3570**	**100.0%**	**0.00 [0.00, 0.01]**	
Total events	35		15				

Heterogeneity: Tau² = 0.00; Chi² = 9.11, df = 13 (P = 0.76); I² = 0%
Test for overall effect: Z = 2.46 (P = 0.01)

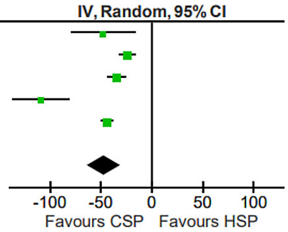
FIGURE 7.1. Delayed bleeding (per patient).



Study or Subgroup	HSP Events	HSP Total	CSP Events	CSP Total	Weight	Risk Difference M-H, Random, 95% CI	Year
Paspatis GA, 2011	0	206	0	208	5.2%	0.00 [-0.01, 0.01]	2011
Ichise Y, 2011	0	40	0	40	0.2%	0.00 [-0.05, 0.05]	2011
Gomez V, 2015	0	18	0	21	0.1%	0.00 [-0.10, 0.10]	2015
Suzuki S, 2018	0	27	0	25	0.1%	0.00 [-0.07, 0.07]	2018
Papastergiou V , 2018	0	78	0	77	0.7%	0.00 [-0.02, 0.02]	2018
Kawamura T, 2018	2	334	0	328	4.5%	0.01 [-0.00, 0.02]	2018
Zhang Q, 2018	0	179	0	179	3.9%	0.00 [-0.01, 0.01]	2018
Aizawa M , 2019	1	134	1	139	1.1%	0.00 [-0.02, 0.02]	2019
de Benito Sanz M, 2020	1	259	1	237	3.7%	-0.00 [-0.01, 0.01]	2020
Ito T 2021	0	60	1	59	0.2%	-0.02 [-0.06, 0.03]	2021
Koyanagi R 2022	0	22	0	27	0.1%	0.00 [-0.08, 0.08]	2022
Pedersen IB , 2022	0	207	0	218	5.5%	0.00 [-0.01, 0.01]	2022
Fatima H , 2022	2	82	0	87	0.3%	0.02 [-0.02, 0.06]	2022
Chang 2023	5	1922	0	1925	74.4%	0.00 [0.00, 0.01]	2023
Total (95% CI)		**3568**		**3570**	**100.0%**	**0.00 [0.00, 0.00]**	
Total events	11		3				

Heterogeneity: Tau² = 0.00; Chi² = 3.37, df = 13 (P = 1.00); I² = 0%
Test for overall effect: Z = 2.03 (P = 0.04)

FIGURE 7.2. Severe delayed bleeding (per patient).



Study or Subgroup	CSP Mean	CSP SD	CSP Total	HSP Mean	HSP SD	HSP Total	Weight	Mean Difference IV, Random, 95% CI	Year
Zhang Q, 2018	282	204	267	330	162	258	13.0%	-48.00 [-79.46, -16.54]	2018
Kawamura T, 2018	73.6	49.4	341	97.3	60.6	346	24.0%	-23.70 [-31.96, -15.44]	2018
Takeuchi Y 2019	59.6	51.51	325	94.4	62.99	286	23.7%	-34.80 [-44.00, -25.60]	2019
Ito T 2021	66	96	59	175	84	157	14.5%	-109.00 [-136.80, -81.20]	2021
Chang 2023	119	147	4995	162.9	156.3	5045	24.8%	-43.90 [-49.83, -37.97]	2023
Total (95% CI)			**5987**			**6092**	**100.0%**	**-46.89 [-62.99, -30.79]**	

Heterogeneity: Tau² = 262.95; Chi² = 41.19, df = 4 (P < 0.00001); I² = 90%
Test for overall effect: Z = 5.71 (P < 0.00001)

FIGURE 8.1. Polypectomy time.

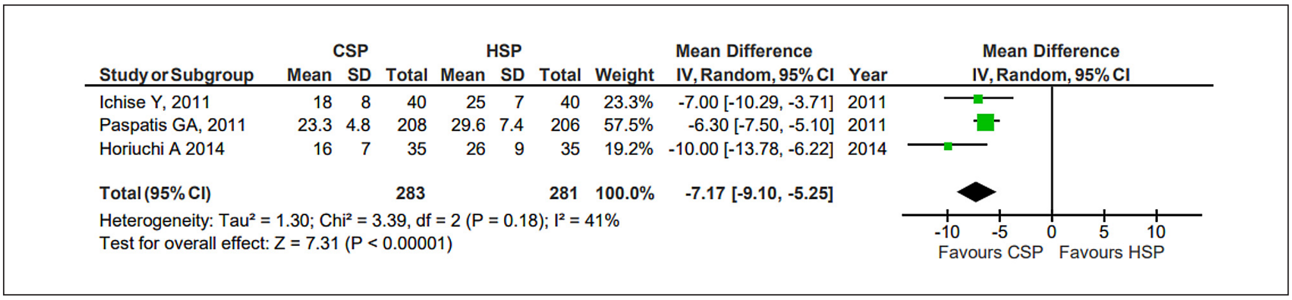


FIGURE 8.2. Total procedure time.

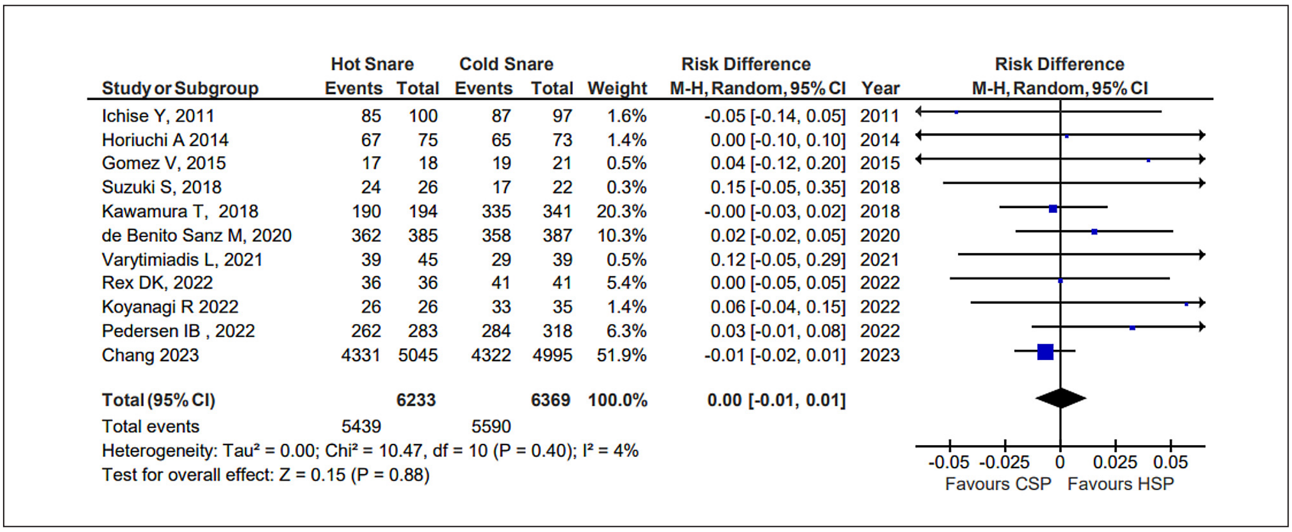


FIGURE 9. Complete resection rate HSP x CSP.

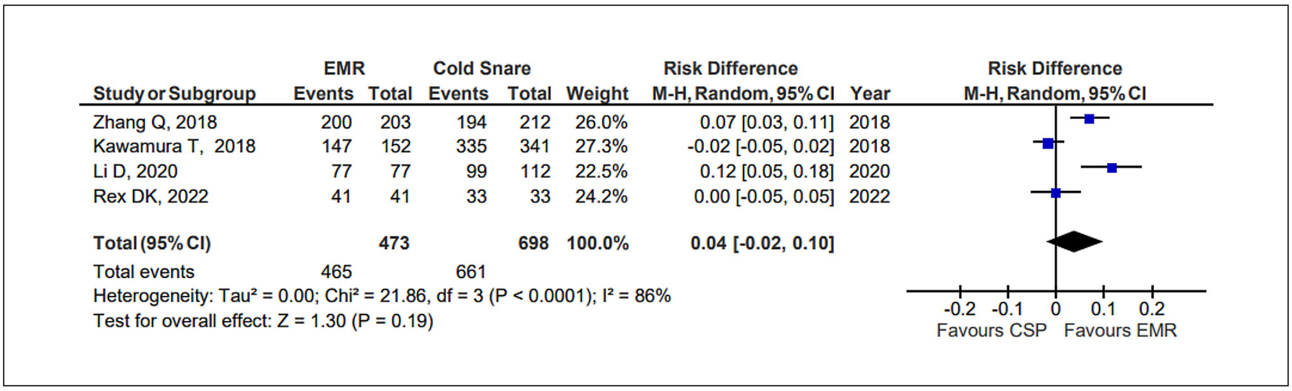


FIGURE 10. Complete resection rate Hot EMR x CSP.

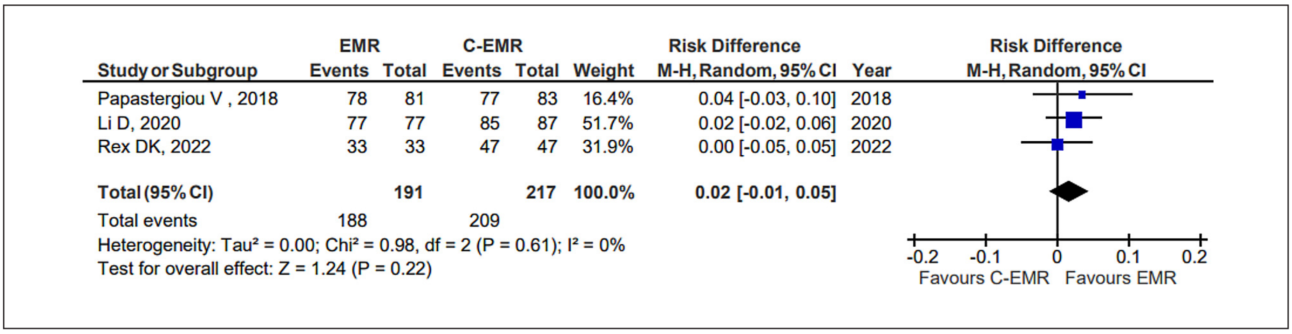


FIGURE 11. Complete resection rate Hot EMR x C-EMR.

DISCUSSION

Endoscopic management of colorectal polyps is key to preventing colorectal cancer, and high-quality resection is mandatory. For polyps up to 3 mm, the use of forceps can achieve a similar complete resection rate compared to snare[17]. When bigger than 3 mm and up to 10 mm, the use of a snare is considered the gold standard in the latest guidelines[8,18]. Many new randomized trials were published recently, with a large number of polyps being evaluated. Hence, considering the new evidence, we conducted this systematic review and meta-analysis to reevaluate this issue.

The main finding was that when comparing all hot snare versus cold snare methods, the first is associated with a higher complete resection rate but with no difference in the en bloc resection rate. One possible explanation for the superiority of electrical current is a higher resection depth, although it does not produce a wider resection margin[19]. This also could impact the recurrence rate, although not evaluated in this study.

The ideal method to evaluate the complete resection rate is hard to achieve, and different approaches have been used in the studies, using either a negative biopsy of margins or a negative specimen margin. These methods are probably not ideal, but the gold standard (colonoscopy with re-evaluation of the site of the resected polyp) is an outcome very hard to achieve, especially because of high dropout rates during follow-up[20]. In our meta-analysis, we conducted a subgroup analysis, to evaluate if there was any difference between these two methods of assessment, but no difference was found.

Besides these limitations, when we compared all hot methods versus all cold snare methods, there were some differences in the technique used to perform the polyp resection, especially the use, or not, of submucosal injection. The EMR technique may increase the complete resection rate, as shown in Zhang et al.[21], and in a recently published network meta-analysis[10], which evaluated the different techniques of polypectomies and the complete resection rate. It showed that EMR is associated with a higher complete resection rate, when compared to other polypectomy methods, for polyps from 6 to 9 mm. In this meta-analysis, we conducted direct subgroup analyses with different methods of polypectomy, but none of the techniques, including EMR, had superiority regarding complete resection rate. Network meta-analyses, which use both direct and indirect evidence, are subject to a higher level of bias than direct comparative meta-analyses[22].

The use of different types of snares may also be important in the complete resection rate outcome. Previous meta-analyses evidenced that the use of a dedicated cold snare can be associated with a higher complete resection rate than CSP[9,23], probably due to its thinner wire and its shield shape, which can provide a better cutting performance and a more precise polypectomy[23]. Most studies included in our meta-analysis allowed traditional snares and the use of dedicated snares for CSP. Two studies used exclusively dedicated snares for all CSP[24,25], but none showed a statistically significant difference in the resection rate compared to HSP.

The use of electrocautery and its settings also could influence the adverse event rate. There are mainly two types of electrical current – Coagulation and Cut modes, and a third, which is a combination of both - the blended current. The coagulation mode induces a low increase in temperature within cells, with the dissipation of heat causing dehydration and shrinkage, while the cutting current causes a rapid increase in temperature, causing the cells to rupture[26,27]. In the included studies, forced and blended coagulation modes were used. A recent RCT comparing forced coagulation vs blended coagulation evidenced similar outcomes in polyps ≥20 mm, such as serious adverse events, complete resection rate, and polyp recurrence[28]. The higher rate of adverse events may be related to the electrical current effect, and, with the data available, is not possible to recommend a better setting to improve outcomes and reduce the risk of adverse events.

Regarding bleeding, we could analyze immediate, delayed bleeding, and severe delayed bleeding. The immediate bleeding rate was similar between groups, and all bleeding cases were successfully controlled through endoscopic therapy. One of the studies allowed prophylactic clipping in the EMR groupv[29] but without difference in the results of the study.

In the analysis of the delayed bleeding, we demonstrated that cold snare methods are associated with a lower rate of delayed bleeding as previously speculated and shown in a propensity score-matching study[6]. We could analyze delayed bleeding and severe delayed bleeding, both being statistically significant toward fewer bleeding episodes in the cold snare group. This is probably explained due to the lack of thermal injury, and a lower rate of submucosal vessel injury[30]. In a study by Horiuchi et al.[31], there was a higher rate of arterial injury in the submucosa layer with HSP vs CSP (39% vs 22%, *P*=.023), and that probably is responsible for a higher incidence of delayed bleeding in the hot snare group.

When evaluating perforation, no cases were described in either group, probably because of its low incidence in polypectomies up to 10 mm, using either hot or cold snare polypectomy. Cold snare perforation in small polyps is rare, being described in a few case reports[32,33].

The cold snare methods are also associated with a shorter procedure time, including total colonoscopy and polypectomy time. The probable explanation is due to the necessity of preparing the electrocautery device. It also may be more cost-effective as it is less time-consuming due to the absence of electrosurgical units and related equipment.

To the best of our knowledge, this is the largest meta-analysis, that used only RCTs to evaluate colorectal polypectomies sized up to 10 mm. Overall, the present study has several strengths. First, many recently published studies were included, with a high number of patients, thus leading to more credible cumulative effects according to different outcome measures compared to previous meta-analyses. Secondly, we could analyze the different resection methods, the complete resection rate, colonoscopy time, and their adverse events, especially the bleeding outcome, evidencing the benefit of cold snare polypectomy in reducing the delayed bleeding rate.

However, our study has some limitations. Different hot and cold snare methods could be used for our main outcome. Despite using all techniques separating only the use of hot or cold snare, when completing a subgroup analysis, none of the polypectomy methods showed superiority in the analysis of the complete resection rate. Second, the method of assessment of the complete resection rate was different between studies, which could impact directly on the results. Although different, we conducted an analysis that showed that both methods had similar resection rates. Third, the polypectomies were conducted by different endoscopists, some more experienced than others, which may explain some discrepancy in the complete resection rate or the adverse events rate between studies, as some of them might have more expertise in some of the techniques and that could influence the result of the study.

CONCLUSION

In summary, hot snare methods achieved a higher complete resection rate than cold methods. The use of EMR or any of the other methods still cannot be defined as the gold standard, as it has a similar resection rate in the present study. The use of cold snare has some benefits, being associated with a lower delayed bleeding rate and a shorter procedure time. This is the best evidence up to this date from direct comparative studies for polyps up to 10 mm, however, the management of each polyp needs to be individualized, and suited according to the clinical scenario, patient characteristics, and personal experience.

Authors' contribution

Cavassola PRP wrote the main manuscript text. Cavassola PRP and Landim DL extracted the data. Cavassola PRP, Moura DTH, Hirsch BS, Landim DL, Bernardo WM and Moura EGH reviewed the manuscript.

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Cavassola PRP, Moura DTH, Hirsch BS, Landim DL, Bernardo WM, Moura EGH. Alça quente versus alça fria para polipectomias colorretais de até 10 mm: uma revisão sistemática e meta-análise de ensaios clínicos randomizados. Arq gastroenterol. 2024;61:e23143.

RESUMO – Contexto – O câncer colorretal é o terceiro câncer mais comum na população, e a prevenção é principalmente baseada em programas de screening, com a ressecção completa de lesões neoplásicas. Múltiplas técnicas de ressecção estão disponíveis, mas ainda há controvérsias sobre a melhor abordagem, especialmente em relação à taxa de ressecção completa e à taxa de sangramento tardio. **Objetivo** – Nosso objetivo foi avaliar a melhor técnica de polipectomia com alça para lesões colorretais de até 10 mm. **Métodos –** Foi realizada uma busca abrangente em bancos de dados eletrônicos (MEDLINE e EMBASE) para identificar ensaios clínicos randomizados que comparassem a ressecção com alça quente versus alça fria para pólipos de até 10 mm, seguindo as diretrizes PRISMA. Os desfechos incluíram taxa de ressecção completa, taxa de ressecção em bloco, tempo de polipectomia, tempo total do procedimento, sangramento imediato, sangramento tardio e perfuração. **Resultados –** Dezenove ensaios clínicos randomizados foram incluídos, totalizando 8.720 pacientes e 17.588 pólipos. A polipectomia com alça quente foi associada a uma maior taxa de ressecção completa (RD, 0,02; IC95% [+0,00, 0,04]; P=0,03; I^2=63%), embora também tenha sido associada a uma taxa mais alta de sangramento tardio (RD 0,00; IC95% [0,00, 0,01]; P=0,01; I^2=0%) e de sangramento tardio grave (RD 0,00; IC95% [0,00, 0,00]; P=0,04; I^2=0%). A polipectomia com alça fria foi associada a um menor tempo de polipectomia (MD -46,89 segundos; IC95% [-62,99, -30,79]; P<0,00001 I^2=90%) e a um menor tempo total de colonoscopia (DM -7,17 minutos; IC95% [-9,10, -5,25]; P<0,00001 I^2=41%). Não houve diferença significativa na taxa de ressecção em bloco (RD, 0,00; IC95% [-0,01, 0,01]; P=0,20; I^2=30%) ou na taxa de sangramento imediato (RD -0,00; IC95% [-0,01, 0,00]; P=0,34; I^2=11%). Não foram relatados casos de perfuração em nenhum dos grupos. **Conclusão –** A polipectomia com alça quente apresenta uma taxa ligeiramente mais alta de ressecção completa, mas, como está associada a um tempo de procedimento mais longo e a uma taxa mais alta de sangramento tardio em comparação com a polipectomia com alça fria, não pode ser recomendada como a abordagem padrão. A análise individualizada e a experiência pessoal devem ser consideradas ao escolher a melhor abordagem.

Palavras-chave – Câncer; Colorretal; pólipos; polipectomia; colonoscopia; cólon.

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