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Cold snare polypectomy: a safe procedure for removing small non-pedunculated colorectal lesions

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HIGHLIGHTS

- Cold snare polipectomy showed complete polyp resection rate of 90.8% by an inexperienced endoscopist. A short learning curve was observed. Specimen retrieval failed in 3.6% of cases and adverse event occurred in only 1 case (0.2%).

ABSTRACT – Background – Polypectomy is an important treatment option for preventing colorectal cancer. Incomplete polyp resection (IPR) is recognized as a risk factor for interval cancer. **Objective –** The primary objective was to evaluate the complete polyp resection (CPR) rate for cold snare polypectomy (CSP) in small non-pedunculated polyps and, secondarily, specimen retrieval and complication rates. **Methods –** We prospectively evaluated 479 polyps <10 mm removed by CSP in 276 patients by an inexperienced endoscopist. **Results –** A total of 476 polyps (99.4%) were resected en bloc. A negative margin (classified as CPR) was observed in 435 polyps (90.8%). An unclear or positive margin (classified as IPR) was observed in 43 cases (9.0%) and 1 case (0.2%), respectively, for an overall IPR rate of 9.2% (44/479). The IPR rate was 12.2% in the first half of cases and 5.9% in the second half (*P*=0.02). Dividing into tertiles, the IPR rate was 15.0% in the first tertile, 6.9% in the second tertile, and 5.7% in the third tertile (*P*=0.01). Dividing into quartiles, the IPR rate was 15.8% in the first quartile and 5.9% in the fourth quartile (*P*=0.03). The IPR rate was 6.3% for type 0-IIa lesions and 14.1% for type 0-Is lesions (*P*=0.01). For serrated and adenomatous lesions, the IPR rate was 9.2%. Specimen retrieval failed in 3.6% of cases. Immediate bleeding (>30 s) occurred in 1 case (0.2%), treated with argon plasma coagulation. No delayed bleeding or perforation occurred. **Conclusion –** CSP is a safe technique that provides good results for the resection of small non-pedunculated polyps, with a short learning curve.

Keywords – Colorectal polyps; cold snare polypectomy; incomplete polyp resection.

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INTRODUCTION

Colorectal cancer (CRC) has a high incidence among men and women, and colonoscopic removal of precursor lesions (adenomas) is the main strategy for CRC incidence reduction and secondary prevention[1].

The technique of choice for the removal of small and diminutive colorectal polyps varies, including the use of snares and forceps with or without diathermy. Less frequently, such as in the case of depressed lesions, the use of endoscopic mucosal resection (EMR) is suggested due to the greater potential for aggressiveness of these lesions[2,3]. When choosing a technique, one of the main goals is to achieve complete polyp resection (CPR), as incomplete polyp resection (IPR) has been associated with interval cancer[4-6]. Cold forceps polypectomy (CFP) has been adopted by many endoscopists as the technique of choice for removing diminutive polyps due to the ease of polyp resection, but this method has a CPR rate of only 39%[7].

Cold snare polypectomy (CSP) was first reported as a new endoscopic technique for treating small colorectal polyps in 1992[8]. Currently, CSP is considered a safe and effective technique for removing polyps <10 mm, recommended by the European Society of Gastrointestinal Endoscopy (ESGE) and the US Multi-Society Task Force as the first-line management of these lesions[9,10]. It also allows the removal of 1–2 mm of surrounding normal mucosa with subsequent CPR and prevents deep tissue injury, with reduced risk of bleeding or perforation[9,10]. However, failure to retrieve specimens after the procedure has been reported, precluding histologic examination of the specimens and subsequent assessment of completeness of resection[11].

Although some recommendations suggest that the histology of diminutive polyps is unnecessary, globally, histopathology determines whether a polyp is neoplastic, assesses the grade of dysplasia, and indicates the surveillance interval[12]. ESGE recommends that >90% of polyps removed be retrieved for histology, which is recognized as an important quality assurance criterion in screening colonoscopy[9]. Studies have demonstrated a higher CPR rate for CSP than CFP, along with a very low rate of complications and recurrence[13,14]. Differences in results between dedicated and traditional cold snares are still surrounded by controversy. Dedicated snares have thinner monofilament wires that would supposedly facilitate polypectomy compared with traditional snares with thicker wires[15-17].

The primary objective of this study was to evaluate the CPR rate for CSP using a dedicated cold snare in ssmall non-pedunculated polyps and, secondarily, specimen retrieval and complication rates.

METHODS

This prospective study was conducted in the Department of Endoscopy at Hospital *Santa Casa de Caridade de Bagé*, Southern Brazil, between April and August 2022. The study was approved by the local ethics committee and conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from each study participant, who received information about the risks of the procedure. Eligible participants were all patients undergoing screening, follow-up, and symptom-based colonoscopy. The inclusion criterion was having at least 1 polyp <10 mm in diameter morphologically classified as type 0-IIa or 0-Is. Exclusion criteria were polyps ≥10 mm in diameter, morphological classification 0-IIc, 0-Isp, or 0-Ip, suspected carcinomas, inadequate preparation, inflammatory bowel disease, and use of anticoagulants.

Endoscopic procedure

Colorectal endoscopic examination was performed using magnification and blue laser imaging (BLI) in all polyps (EC-L590ZW/L, Fujifilm Co, Japan) and the LASEREO system with laser light source LL-4450. Patients ingested 1L of 10% mannitol solution on the day of the examination, preceded by a fiber-free, clear-liquid diet for 1 day for bowel cleansing. All colonoscopies were performed with the patient under conscious sedation, achieved with intravenous administration of midazolam and meperidine or fentanyl. All resections were performed by the same endoscopist, with little experience in the CSP method (<20 cases). The CSP technique recommends positioning the polyp at 5–7 o'clock, with the snare around the entire lesion including at least 1 mm of surrounding normal mucosa, followed by gentle forward

pressure on the snare catheter, closure of the snare wire, and transection of the polyp without tenting, which is immediately suctioned through the working channel of the endoscope into a polyp trap (FIGURE 1). Hewett[18], however, recommends resecting a 2- to 4-mm margin of normal tissue around the polyp to ensure histologic eradication of neoplastic tissue.

Lesion characteristics such as size, morphology, location, and histology were evaluated, as well as resection margin, en bloc resection or not, specimen retrieval, and adverse events. Lesion size was estimated by using the snare diameter as a reference. The Paris classification was used to describe the morphology[19]. Location was divided into the right colon segment (from the transverse colon to the cecum) and the left colon segment (from the rectum to the descending colon). The World Health Organization classification of tumors was used for histology[20]. Similar to Arimoto et al.[11], the polyp resection margin after CSP was classified as negative, unclear, or positive. Margins were considered negative if no dysplastic cells were identified at both the lateral and deep margins. Margins were considered positive if dysplastic cells were present at the lateral and/or deep margin. Margins were considered unclear if they were ill defined, whether compromised or not. CPR was defined as resection with a negative margin[16], and IPR as resection with an unclear or positive margin.

All polyps included in this study were removed by using a dedicated cold snare (Captivator COLD 10 mm, Boston Scientific). After removal, excised specimens were mounted on cardboard plates, subjected to gentle pressure with the finger, allowed to dry for a few minutes, and fixed in 10% formalin.

The post-CSP mucosal defect was washed and inspected by magnification and image-enhanced endoscopy (IEE) BLI, and further snare resection was performed for any residual lesion. Therefore, snare resection was divided into en bloc and piecemeal. Immediate persistent bleeding requiring endoscopic hemostasis was defined as spurting or oozing that continued for >30 s immediately after CSP[11,21], and delayed bleeding was defined as hemorrhage occurring after the end of colonoscopy requiring endoscopic reintervention.

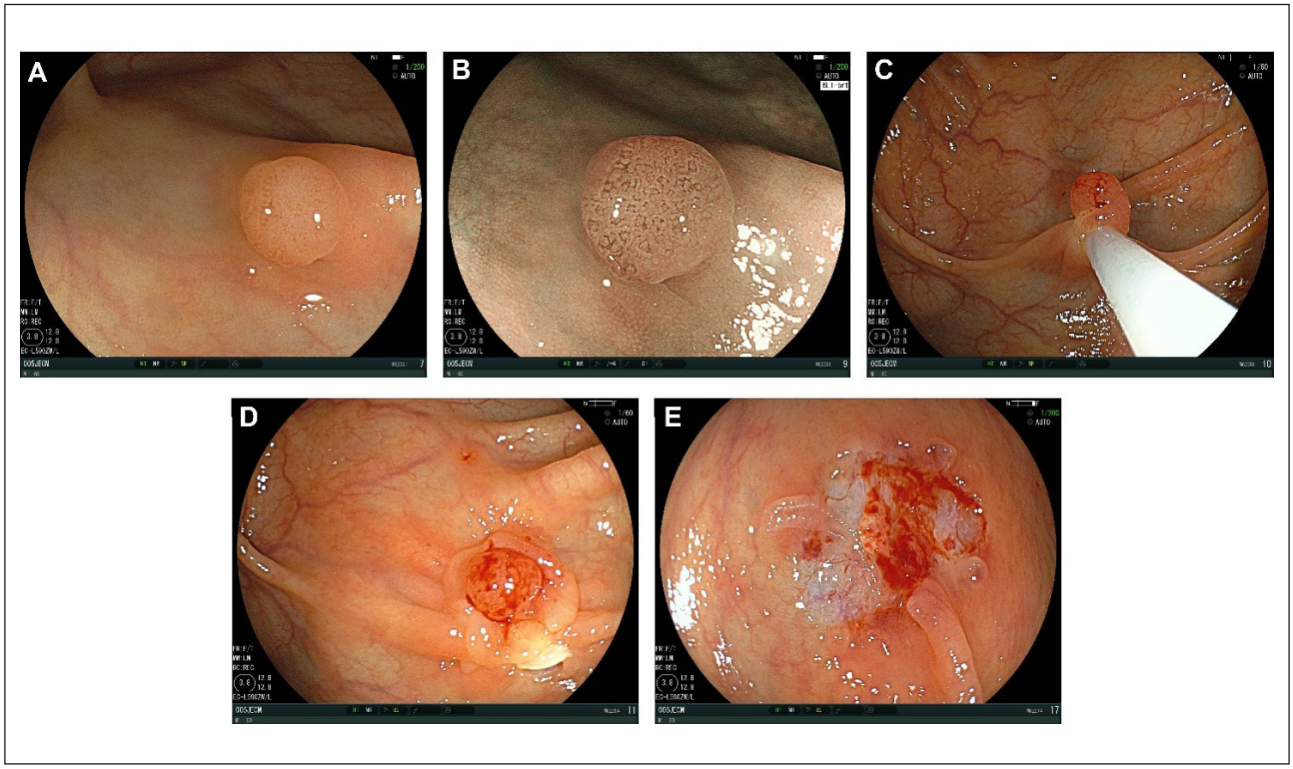

FIGURE 1. Cold snare resection. A) Type 0-Is lesion measuring 4 mm; B) BLI magnification: microvasculature suggests low-grade neoplasia; C) Firm grasp of the ensnared lesion including normal mucosa; D) Cold snare polypectomy completed showing the captured lesion with free margins; E) Defect after resection.

Statistical analysis

Data were entered into an Excel spreadsheet and subsequently exported to Stata, version 15.1, for data cleaning and analysis. Categorical variables are presented as absolute and relative frequencies. Numerical variables are presented as mean, standard deviation (SD), and range. To create separatrix measures (median, tertiles, and quartiles), the lesions were ordered by date of examination. Fisher's exact test was used for comparison of proportions of positive margins according to the other variables. Crude prevalence ratios and 95% confidence intervals were obtained by Poisson regression. The level of significance was set at 5% for 2-tailed tests.

RESULTS

A total of 276 patients were included in the study; 168 (60.9%) female and 230 (83.3%) aged ≥50 years, with a mean age of 62.5 years (SD 12 years, range 27–91 years). A total of 497 polyps were removed by CSP, but 18 (3.6%) were excluded because they were not retrieved after CSP. Therefore, 479 polyps were included in the final analysis, with a mean size of 3.5 mm (SD 1.5 mm, range 1–9 mm). The characteristics of patients and polyps are shown in TABLE 1.

Four hundred and thirty-three polyps (90.4%) were ≤5 mm and 46 (9.6%) were 6 to 9 mm in diameter. Regarding morphology, 301 (62.8%) were non-polypoid lesions (0-IIa). Of the total, 280 (58.5%) were located in the right colon segment. Four hundred and 76 polyps (99.4%) were resected en bloc, most of which were neoplastic lesions (n=402, 83.9%). A negative margin was observed in 435 polyps (90.8%), an unclear margin in 43 (9.0%), and a positive margin in 1 (0.2%). All 435 polyps with a negative margin were classified as CPR, whereas the remaining 44 polyps (43 with an unclear margin and 1 with a positive margin) were classified as IPR. Our CPR rate was 90.8% (435/479), and the IPR rate was therefore 9.2% (44/479).

The analysis of IPR cases according to the order in which the procedures were performed showed an IPR rate of 12.2% in the first half of cases and 5.9% in the second half (P=0.02). Dividing into tertiles, the IPR rate was 15.0% in the first tertile, 6.9% in the second tertile, and 5.7% in the third tertile (P=0.01).

TABLE 1. Characteristics of patients (n=276) and polyps (n=479).

Characteristic	N	%
Sex		
Female	168	60.9
Male	108	39.1
Age (years)		
<50	46	16.7
≥50	230	83.3
Polyp size (mm)		
1 to 5	433	90.4
6 to 9	46	9.6
Morphology		
Non-polypoid (0-IIa)	301	62.8
Polypoid (0-Is)	178	37.2
Histology		
Non-neoplastic	77	16.1
Neoplastic	402	83.9
Margins		
Negative	435	90.8
Positive or unclear	44	9.2
Location		
Right	280	58.5
Left	199	41.5
En bloc resection		
No	3	0.6
Yes	476	99.4

Dividing into quartiles, the IPR rate was 15.8% in the first quartile and 5.9% in the fourth quartile (P=0.03) (TABLE 2).

Regarding polyp size, the IPR rate was 6.7% for polyps ≤5 mm and 32.6% for polyps sized 6 to 9 mm (P<0.001). The IPR rate was 6.3% for non-polypoid lesions (0-IIa) and 14.1% for polypoid lesions (0-Is) (P=0.01), and 10.7% in the right colon and 7.0% in the left colon (P=0.2). For serrated and adenomatous lesions, the IPR rate was 9.2%. Immediate bleeding (>30 s) occurred in one case (0.2%), successfully treated with argon plasma coagulation. There were no cases of delayed bleeding or perforation. Patients were not followed up, so recurrence was not assessed.

DISCUSSION

This study defined CPR as resection with a negative margin, that is, a clearly evident free margin, and IPR as resection with an unclear or compromised

TABLE 2. Analysis of incomplete polyp resection* rates according to the order in which the procedures were performed.

Time sequence	Alllesions <10 mm (N=479)	
	IPR (%)	*P*-value
Median		0.02
First half	12.2	2.1 times higher
Second half	5.9	
Tertiles		0.01
First tertile	15.0	2.6 times higher
Second tertile	6.9	
Third tertile	5.7	
Quartiles		0.03
First quartile	15.8	2.7 times higher
Second quartile	9.2	
Third quartile	5.8	
Fourth quartile	5.9	
Total	9.2	n=44

IPR, incomplete polyp resection. *Defined as resection with an unclear or positive margin.

margin. Previous studies have used biopsies taken from the base or lateral margins of the polypectomy site for this evaluation[15,21,22]. We achieved an overall CPR rate of 90.8% and, therefore, an IPR rate of 9.2%.

Retrieval of the specimen through the suction channel can damage the tissue and compromise histologic examination, which may influence the outcome of subsequent assessment of completeness of resection[23]. EMR is the best method for determining whether or not the resection is complete, but it is associated with an increased risk of complications, such as bleeding and perforation[24].

The ESGE and US Multi-Society Task Force guidelines recommend CSP as the first-line method for removing diminutive (≤5 mm) and small (6–9 mm) polyps, and they recommend against the use of CFP for these lesions due to the high rates of IPR, accepting its use for polyps ≤2–3 mm where CSP is technically difficult[9,10]. For these lesions, the US Multi-Society Task Force guidelines recommend the use of jumbo or large-capacity forceps[10].A meta-analysis comparing the use of jumbo forceps vs CSP for removing diminutive polyps showed an IPR rate of 10.2% vs 7.2%, respectively, without statistically significant difference between them[25].

CSP has been recognized as the first-line treatment option for colorectal polyps up to 10 mm in diameter because, in addition to high CPR rates, the risk of bleeding is very low as it acts superficially, reaching capillaries rather than larger submucosal vessels, which may be reached by the thermal electrocautery. Perforation is an extremely rare complication of this technique. There are reports that CSP is more effective than CFP for diminutive polyps. Lee et al.[13] reported a significantly higher rate of histologic eradication with CSP than CFP (93.2% vs 75.9%, *P*=0.009). CFP and polyp size (≥4 mm) were independent predictors of incomplete histologic eradication (*P*<0.05 for both). Kim et al.[14] analyzed adenomas ≤7 mm and showed a higher rate of CPR with CSP than CFP (96.6% vs 82.6%, *P*=0.011), as well as for adenomas sized 5 to 7 mm (93.8% vs 70.3%, *P*=0.013). No significant difference was observed for adenomas ≤4 mm (100% vs 96.9%, *P*=1.000). A recent randomized trial analyzing 279 polyps ≤3 mm showed a CPR rate of 98.3% for both CSP and CFP, considering CFP an acceptable alternative to CSP for removal of polyps ≤3 mm[26]. The CARE study demonstrated that 10.1% of 346 polyps (5–20 mm) were incompletely resected, and that the IPR rate was higher for polyps 10–20 mm than for polyps 5-9 mm (17.3% vs 6.8%, relative risk = 2.1), as well as for sessile serrated lesions than for conventional adenomas (31.0% vs 7.2%, relative risk = 3.7)[6]. In the present study, the IPR rate was 6.7% for polyps ≤5 mm and significantly higher (*P*<0.001) for polyps sized 6 to 9 mm, reaching 9.2% for serrated lesions and adenomas.

CPR rates achieved with dedicated and traditional cold snares are still a matter of controversy. Dwyer et al.[15] found no significant difference in CPR rates for lesions ≤10 mm removed by dedicated CSP and traditional CSP (98.4% vs 95.4%, *P*=0.16). Serrated or hyperplastic polyps had a higher IPR rate compared with adenomas (7% vs 2%, *P*=0.03). Piecemeal resection was used more frequently in the traditional CSP group than in the dedicated CSP group (13% vs 5%, *P*=0.03). In the present study, there were only three cases (0.6%) of piecemeal resection. Horiuchi et al.[16] showed that dedicated CSP was superior to traditional CSP for complete resection of polyps ≤10 mm (91% vs 79%, *P*=0.015), especially for polyps sized 8 to 10 mm (83.3% vs 45.5%, *P*=0.014). A difference was observed between polyps that were flat (*P*=0.037) and pedunculated (*P*=0.017) in morphology, but not for sessile polyps (*P*=0.32). In the present study, the IPR

rate was higher for polypoid lesions (0-Is) than for non-polypoid lesions (0-IIa) (14.1% vs 6.3%, *P*=0.01). Another series showed a higher CPR rate with a thin wire snare (wire diameter 0.30 mm) than with a thick wire snare (wire diameter 0.47 mm) (90.2% vs 73.3%, p<0.05) (17). In a meta-analysis, Jung et al.[27] showed that both dedicated CSP (odds ratio [OR] 4.31) and traditional CSP (OR 2.45) were superior to CFP in terms of complete histologic eradication of diminutive polyps. Dedicated CSP was superior to traditional CSP (OR 1.76), with no difference in tissue retrieval rate. The present study used only dedicated CSP.

A meta-analysis conducted by Shinozaki et al.[28] showed similar results for hot snare polypectomy (HSP) and CSP in the removal of small colorectal polyps, with similar rates of CPR (*P*=0.31) and specimen retrieval (*P*=0.60). Delayed bleeding after HSP was higher than after CSP, but without statistical significance (*P*=0.06); no perforation occurred. Another meta-analysis of HSP vs CSP for removal of polyps sized 4 to 10 mm also showed no difference between the techniques in the rates of IPR (2.4% vs 4.7%, respectively, *P*=0.33) or specimen retrieval (99% vs 98.1%, respectively), but the immediate bleeding rate was lower in the HSP group than in the CSP group (3.3% vs 6.6%, *P*=0.01)[29].

Similar CPR rates were achieved with cold EMR (91.9%) and CSP (89.8%) for removal of polyps sized 6 to 10 mm (*P*=0.24)[30]. Kudo et al.[31] evaluated non-pedunculated polyps ≤10 mm resected using dedicated CSP and concluded that a mucosal defect ≥7 mm allows us to predict complete resection of the mucosal layer containing the muscularis mucosa. The complete resection rate in which the lateral and vertical margins were free of neoplastic tissue was 92% (417/454). In the remaining 8%, the lateral margins could not be properly evaluated due to fragmentation of specimens, whereas the deep margins were free of neoplasia, supporting that suction may hinder tissue analysis.

Shichijo et al.[32] evaluated the rate of incomplete mucosal layer resection with CSP, defined as the presence of muscularis mucosa or residual polyp in post-CSP biopsies, and cold snare defect protrusions (CSDPs), which were present in 36% of cases. The overall incidence of incomplete mucosal layer resection was 63%, 76% with CSDPs and 57% without CSDPs (*P*<0.01). Lesion size ≥6 mm, resection time ≥5 s and serrated lesions were recognized as risk factors for CSDPs. Tutticci et al.[33] removed 257 polyps ≤10 mm by CSP and found CSDPs in 14% of cases, which were associated with lesion size ≥6 mm OR 3.7, *P*<0.001). A significant association of polyp fragmentation with CSDP was described (OR 3.74, *P*<0.001), and CSDPs were associated with large polyp size (OR 1.32, *P*=0.007) and large specimen size (OR 1.24, *P*<0.001)[34].

A criticism of CSP is specimen retrieval failure, but this rate is low in most studies, although a rate of 6.8% has already been reported[13]. This rate was 3.6% in the present study. Some factors have been significantly associated with specimen retrieval failure, such as previous colorectal surgery, CSP, location in the right colon, inadequate bowel preparation, and lesion size up to 5 mm[35].

There are reports that the experience of the endoscopist interferes with the CPR rate, with resections performed by trainees being a risk factor for IPR[11]. Choi et al.[36] showed that the cumulative number of procedures was directly associated with the success of CPR, and after 300 polypectomies, the results of the fellows were comparable to those of the experts. The present findings are consistent with these observations, since the IPR rate of an inexperienced CSP endoscopist decreased with the increasing number of procedures performed using the technique: from 12.2% in the first half to 5.9% in the second half (*P*=0.02); from 15.0% in the first tertile to 5.7% in the last tertile (*P*=0.01); and from 15.8% in the first quartile to 5.9% in the last quartile (*P*=0.03).

Recurrence is infrequent. Murakami et al.[37] reported a recurrence rate of 5.4% for polyps ≥10 mm and 1.4% for polyps <10 mm (*P*=0.069). For polyps sized 5–9 mm and <5 mm, the recurrence rates were 1.8% and 1.1%, respectively (*P*=0.708). Multivariate analysis showed that a positive margin was the only risk factor for local recurrence. Because the resected polyps were not followed up, recurrence analysis was not performed in our cases.

Schettet al.[38] reported immediate bleeding after CSP requiring endoscopic hemostasis with clip application in only 0.49% of cases. However, one series showed 6.6% of immediate bleeding with this technique[29]. Delayed bleeding and perforation are rare

adverse events[15,30,39]. We had only one case (0.2%) of immediate bleeding, successfully treated with argon plasma coagulation, and no cases of delayed bleeding or perforation.

Our study has some limitations. First, all procedures were performed by a single endoscopist. Second, the endoscopist was not experienced in the CSP method. Third, difficulty in the histologic examination of specimens retrieved by suction has been described due to potential tissue damage, which may render the analysis of the resection margins ineffective, thus increasing the IPR. Fourth, our patients were not followed up for assessment of recurrence.

CONCLUSION

In conclusion, this study shows that CSP is an excellent technique for removal of small (<10 mm) non-pedunculated polyps, with a short learning curve and significant progressive improvement in the results. Although slightly associated with failure of specimen retrieval after resection, CSP is a very safe procedure owing to the very low rate of adverse events, which are amenable to endoscopic treatment.

Authors' contribuition

Santos CEO and Malaman D: project management. Bombassaro IZ: formal analysis. Leão ABHS: conceptualization. Santos CEO and Sanmartin IDA: draft and definitive writing. Pereira-Lima JC: revision.

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RESUMO – Contexto – A polipectomia é uma importante opção terapêutica na prevenção do câncer colorretal (CCR). A ressecção incompleta do pólipo (RIP) é reconhecida como fator de risco para o câncer de intervalo. **Objetivo –** O principal objetivo foi avaliar o índice de ressecção completa da polipectomia a frio (PF) em pequenos pólipos não pediculados e, secundariamente, a recuperação do espécime e índice de complicações. **Métodos –** Avaliamos prospectivamente 479 pólipos <10 mm removidos por PF em 276 pacientes, por um endoscopista sem experiência com este método. **Resultados –** Foram ressecados em bloco 476 pólipos (99,4%). Tivemos margem negativa, considerada ressecção completa do pólipo (RCP), em 435 (90,8%) casos. Margem indefinida ou positiva (classificada como RIP) foi observada em 43 (9,0%) casos e em 1 (0,2%) caso, respectivamente, com um índice global de RIP de 9,2% (44/479). O índice de RIP foi de 12,5% na primeira metade dos casos e 5,9% na última metade (P=0,02). Dividindo em tercis, o índice de RIP foi de 15,0% no primeiro terço, 6,9% no segundo terço e 5,7% no terceiro quarto, P=0,01. Dividindo em quartis, o índice de RIP foi de 15,8% no primeiro quarto, enquanto o último quarto foi de 5,9%, P=0,03. O índice de RIP foi de 6,3% para lesões tipo 0-IIa e de 14,1% para lesões tipo 0-Is, P=0,01. O índice de RIP foi de 9,2% para lesões serrilhadas e adenomatosas. Houve falha na recuperação dos espécimes em 3,6% dos casos. Sangramento imediato (>30 s) ocorreu em um caso (0,2%), controlado com plasma de argônio. Sem sangramento tardio e perfuração. **Conclusão –** PF é uma técnica segura que apresenta bons resultados para a ressecção de pequenas lesões não pediculadas, com uma curta curva aprendizado.

Palavras-chave – Pólipos colorretais; polipectomia a frio; polipectomia incompleta.

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