

Histological outcomes between hot and cold snare polypectomy for small colorectal polyps

Toshiki Yamamoto¹, Sho Suzuki^{1,2}, Chika Kusano^{1,2}, Kyoko Yakabe¹, Maho Iwamoto¹, Hisatomo Ikehara¹, Takuji Gotoda¹, Mitsuhiko Moriyama¹

¹Division of Gastroenterology and Hepatology, Department of Medicine, Nihon University School of Medicine, Tokyo, ²Department of Gastroenterology, Yuri-Kumiai General Hospital, Akita, Japan

Abstract

Background/Aim: To compare the complete resection rate of hot and cold snare polypectomy for small colorectal polyps.

Patients and Methods: We retrospectively reviewed the medical records of 233 consecutive patients with 461 colorectal polyps up to 10 mm in diameter that were treated by hot or cold snare polypectomy between April 2014 and August 2016. Lesions treated by hot snare polypectomy ($n = 137$) and cold snare polypectomy ($n = 324$) were compared. The histological complete resection rates were evaluated between the two groups. We analyzed the relationship between factors for complete resection and clinical factors using multivariate analysis.

Results: There was a significantly higher complete resection rate in hot snare polypectomy than in cold snare polypectomy (70.5% vs. 47.3%; $P < 0.001$). In the analysis of subgroups categorized according to polyp size, the complete resection rate for hot snare polypectomy was significantly higher than that for cold snare polypectomy among polyps ≥ 6 mm (69.0% vs. 43.5%; $P < 0.001$). Among polyps ≤ 5 mm, no significant difference regarding the complete resection rate was observed between the methods (81.3% vs. 53.4%; $P = 0.057$). There was no significant difference in the incidence of adverse events between the two groups. Multivariate analysis revealed that using hot snare polypectomy (odds ratio 3.03; $P < 0.001$), small lesion size (odds ratio 1.57; $P = 0.049$), and lesion location in the left colon (odds ratio 1.73; $P = 0.007$) were independent factors for complete resection.

Conclusion: Hot snare polypectomy provides a higher complete resection rate than does cold snare polypectomy for larger (6–10 mm) subcentimeter colorectal polyps.

Keywords: Cold polypectomy, complete resection, colorectal polyps, polypectomy

Address for correspondence: Dr. Sho Suzuki, Division of Gastroenterology and Hepatology, Department of Medicine, Nihon University School of Medicine, 1-6 Kanda-Surugadai, Chiyoda-ku, Tokyo 101-8309, Japan.
E-mail: s.sho.salubriter.mail@gmail.com

INTRODUCTION

Colorectal cancer is a common cause of cancer-related deaths worldwide.^[1] Colonoscopy has become the primary screening test for colorectal cancer, and polypectomy at

the time of colonoscopy reduces the risk of colon cancer development and mortality.^[2-4] Over 90% of colorectal polyps found during colonoscopy are diminutive or small colorectal polyps that are less than 10 mm in size.^[5,6]

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Yamamoto T, Suzuki S, Kusano C, Yakabe K, Iwamoto M, Ikehara H, *et al.* Histological outcomes between hot and cold snare polypectomy for small colorectal polyps. Saudi J Gastroenterol 2017;23:246-52.

Access this article online	
Quick Response Code:	Website: www.saudijgastro.com
	DOI: 10.4103/sjg.SJG_598_16

Therefore, endoscopic removal of diminutive and small colorectal polyps has become a daily routine for all practicing endoscopists.

The polypectomy technique for diminutive and small polyps is highly variable among endoscopists, and the choice is usually based on polyp size and physician preference.^[7] For example, for resection of polyps 4–6 mm, hot snare polypectomy (HSP) was used by 59%, cold snare polypectomy (CSP) by 15%, cold biopsy forceps by 19%, and hot biopsy forceps by 21% of physicians. These polypectomy techniques have potential risks of adverse events, including hemorrhage and perforation. Specifically, the use of electrocautery increases the risk of transmural colonic injury, delayed post-polypectomy bleeding, and perforation. CSP is the primary technique for the resection of polyps up to 10 mm in size using a snare without electrocautery.^[8] The safety of this technique is well-established.^[9] CSP has been more effective than forceps techniques to achieve complete polyp resection.^[10] However, the effectiveness of CSP for complete polyp resection compared with that of HSP remains unknown.

The aim of this study was to compare the complete histologic resection rate of small polyps using HSP versus CSP, and to investigate clinical factors that were associated with histological complete resection.

PATIENTS AND METHODS

Ethics

This study was conducted in accordance with the Declaration of Helsinki. The Institutional Review Board of Yuri-Kumiai General Hospital approved the study protocol.

Patients and study design

This was a retrospective, single-institution study. Data were obtained from the patients' medical records at Yuri-Kumiai General Hospital (Akita, Japan). The flow chart for patients enrolled in this study is shown in Figure 1. Patients with colorectal polyps who were diagnosed as adenomatous lesions by endoscopy were included in this study. Between April 2014 and August 2016, a total of 484 patients with 1160 colorectal polyps underwent endoscopic treatment at Yuri-Kumiai General Hospital. Six hundred and eleven lesions treated with endoscopic mucosal resection (EMR) were excluded from this study. Nine lesions treated using endoscopic submucosal dissection were also excluded from this study. Seventy-nine lesions that were pedunculated and/or larger than 10 mm in size were excluded from this study. Thus, a total of 233 patients with 461 colorectal polyps up to 10 mm in size who underwent snare

polypectomy, including HSP or CSP, were retrospectively studied.

Outcomes

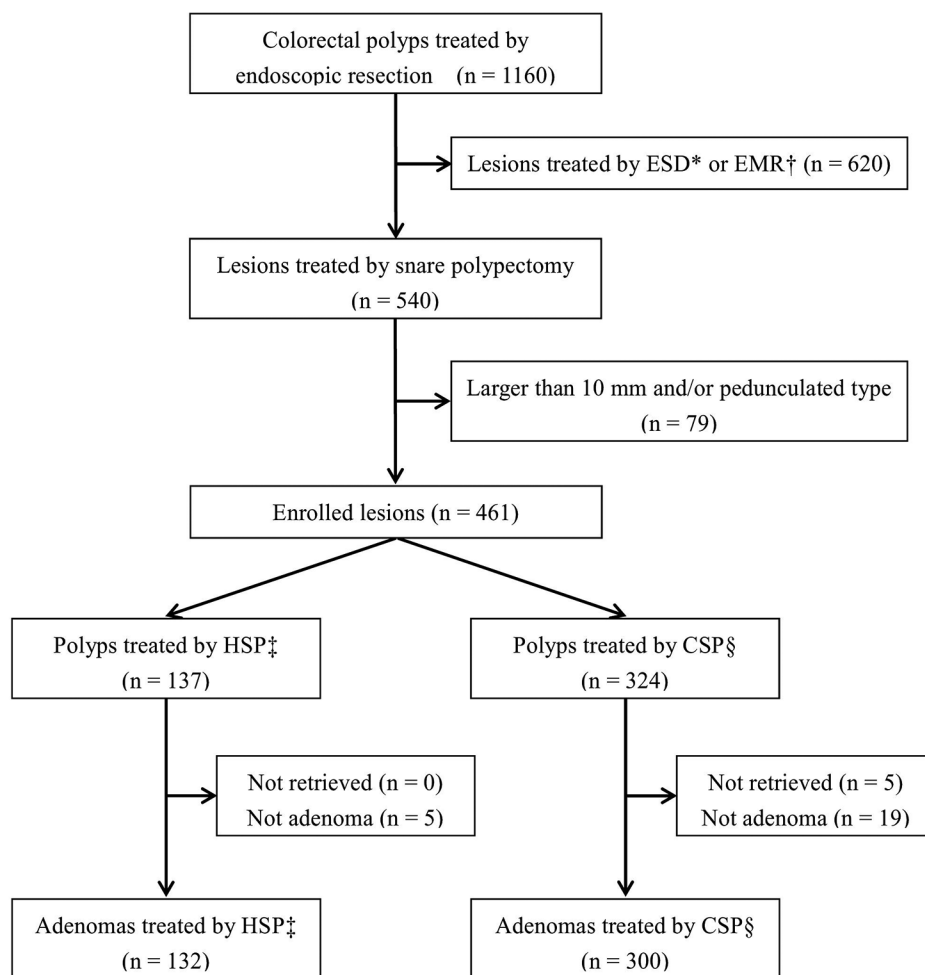
The primary outcome of interest in this study was the rates of complete resection of the HSP and CSP groups. Complete resection was defined as removal of the whole tumor in one piece, and normal tissue at the resection margins was clearly present on histologic examination. Lesions that were positive or uncertain for tumor at the resected margin were defined as incomplete resection. Furthermore, the factors associated with complete resection were analyzed in a multivariate analysis.

The secondary outcome was the rate of adverse events, including perforation and postprocedural bleeding. A diagnosis of perforation was considered if the extramural organ or fat outside the muscle layer was visualized by endoscopy or if free air was observed on abdominal radiography or computed tomography. Postprocedural bleeding was diagnosed on the onset of hematochezia and the observation of bleeding spots as confirmed by repeat colonoscopy or the requirement of a blood transfusion.

Hot and cold snare polypectomy procedures

Twelve physicians performed polypectomy for the patients who were enrolled in this study. The patients were prepared with 2 l of polyethylene glycol solution until clear rectal fluid was evacuated. A high-definition colonoscope (CF-H260AI or CF-H260AZI; Olympus Optical Co. Ltd, Tokyo, Japan) or standard colonoscope (CF-Q260AI or PCF-Q260AI; Olympus) was used for all patients. After colonoscope insertion, the characteristics of polyps, including size, location, and macroscopic type according to the Paris classification, were recorded. The polyp size was measured by visually comparing it with the snare sheath or snare diameter.

The HSP and CSP techniques are described briefly. When the polyp margin was not clearly apparent, the site was sprayed with indigocarmine prior to polypectomy. An electrosurgical snare (Snare Master; Olympus or Captivator; Boston Scientific, Natick, MA, United States) was used. The snare sheath was advanced through the accessory channel of the colonoscope. The snare was opened and encircled the polyp. The snare was slowly and progressively closed until complete closure was achieved, with the aim of capturing 1–2 mm of normal tissue around the polyp. In CSP, the snare guillotined the polyp. In HSP, the snare guillotined the polyp with an electrosurgical unit (ERBE-ICC200; Erbe Elektromedizin, Tübingen, Germany) in an endo-cut mode of 80 W. Normal saline or another solution was not injected into the submucosal



*ESD: endoscopic submucosal dissection, †EMR: endoscopic mucosal resection, ‡HSP: hot snare polypectomy, §CSP: cold snare polypectomy.

Figure 1: Flow chart for lesions enrolled in this study

tissue in both HSP and CSP. The polyp was suctioned and retrieved for histologic assessment. The polypectomy site was then visually assessed for any evidence of residual tissue and bleeding by washing the site with water.

Patients were informed to contact our hospital and visit an emergency department immediately if they experienced hematochezia. All patients visited the outpatient department of our institution to confirm their final pathological results within 1 month after polypectomy.

Statistical analyses

Fisher's exact test or Chi-square test was used to compare categorical variables, and Mann–Whitney U-test was used

to compare continuous variables for univariate analysis. Multivariate logistic regression analysis was used for multivariate analysis of the factors associated with complete resection. A *P* value of <0.05 was considered significant for all tests. All analyses were performed using JMP 12.1 software (SAS Institute, Cary, NC).

RESULTS

Baseline characteristics of patients and lesions

The baseline characteristics of patients and lesions are shown in Table 1. A total of 461 lesions were detected, and 137 were resected using HSP whereas 324 were resected using CSP. There were no significant differences in age and

sex between the methods. In the CSP group, 3 patients with 6 lesions were treated using antithrombotic agents. In those 3 patients, 1 patient used an antiplatelet agent and 2 patients used anticoagulant agents. There were significant differences in the endoscopic lesion size and morphology between the HSP and CSP groups.

Treatment outcomes

The treatment outcomes are shown in Table 2. A total of 456 lesions (98.9%) were retrieved for histological assessment. The rate of high-grade tubular adenoma in HSP was significantly higher than that in CSP. On histology, no cancers had invaded the submucosa.

The complete resection rate was significantly higher for HSP compared with that for CSP (70.5% vs. 47.3%; $P < 0.001$). In the analysis of subgroups that were categorized by polyp size, the complete resection rate for the HSP group was significantly higher than that for the CSP group among polyps ≥ 6 mm (69.0% vs. 43.5%; $P < 0.001$). In polyps ≤ 5 mm, no significant difference regarding the complete resection rate was observed between the methods (81.3% vs. 53.4%; $P = 0.057$).

There were no significant differences in adverse events between HSP and CSP. Post-procedure bleeding was observed in 3 patients who did not use antithrombotic agents or intravenous heparin (0.7% of all specimens, 1.3% patients). All bleeding episodes were successfully treated using endoscopic procedures, and no cases required surgical treatment or blood transfusion.

Factors associated with complete resection

The results of the logistic regression analysis for complete resection are shown in Table 3. The use of HSP [odds ratio (OR) 3.03; 95% confidence interval (CI), 1.90–4.84; $P < 0.001$], small lesion size (OR 1.57; 95% CI, 1.00–2.45; $P = 0.049$), and lesion location in the left colon (distal to the splenic flexure) (OR 1.73; 95% CI, 1.16–2.58; $P = 0.007$) were strongly associated with complete resection.

DISCUSSION

The rate of complete resection for small colorectal polyps with HSP was 70.5%, which was significantly higher than that with CSP. The use of HSP, lesion size ≤ 5 mm, and lesion in the left colon were found to be significantly associated with complete resection. Furthermore, high safety was also achieved in both HSP and CSP, with a perforation rate of 0% and post-procedural bleeding rate of 0.7%.

Three studies have compared CSP with HSP for small colorectal polyp resections.^[11-13] No significant

Table 1: Baseline characteristics of the 461 colorectal polyps

Characteristic	HSP [†] (n=137)	CSP [‡] (n=324)	P
Age (years)			0.250
Mean±SD [§]	67.9±9.5	69.0±9.5	
Median (range)	68 (28–86)	69 (28–90)	
Sex			*0.045
Male	112 (81.8%)	236 (72.8%)	
Female	25 (18.2%)	88 (27.2%)	
Use of antithrombotic drugs			
Antiplatelet drugs	0 (0%)	2 (0.6%)	1.000
Anticoagulant drugs	0 (0%)	4 (1.2%)	0.323
Intravenous heparin	5 (3.6%)	16 (4.9%)	0.633
Lesion size, mm			*<0.001
Mean±SD [§]	7.2±1.6	5.9±1.0	
Median (range)	7 (3–10)	6 (3–9)	
Location			0.244
Cecum	7 (5.1%)	20 (6.2%)	
Ascending colon	25 (18.2%)	76 (23.5%)	
Transverse colon	38 (27.7%)	70 (21.6%)	
Descending colon	8 (5.8%)	13 (4.0%)	
Sigmoid colon	34 (24.8%)	102 (31.5%)	
Rectum	25 (18.2%)	43 (13.3%)	
Morphology			*0.048
Protruded	130 (94.9%)	319 (98.5%)	
Flat	7 (5.1%)	5 (1.5%)	

* $P < 0.05$ †HSP: Hot snare polypectomy; ‡CSP: Cold snare polypectomy; §SD: Standard deviation

Table 2: Treatment and histological outcomes

Characteristic	HSP [†] n=137	CSP [‡] n=319	P
Retrieved			
Histology			*0.023
Low grade tubular adenoma	102 (74.5%)	265 (83.1%)	
High grade tubular adenoma	29 (21.2%)	35 (11.0%)	
Serrated adenoma	1 (0.7%)	0 (0%)	
Hyperplastic	4 (2.9%)	16 (5.0%)	
Normal colonic mucosa	1 (0.7%)	3 (0.9%)	
Histological resection for adenoma	n=132	n=300	
Complete	93 (70.5%)	142 (47.3%)	*<0.001
Incomplete	39 (29.5%)	158 (52.7%)	
Procedure-related adverse events	n=137	n=324	
Delayed bleeding	1 (0.7%)	2 (0.6%)	1.000
Perforation	0 (0%)	0 (0%)	-

* $P < 0.05$ †HSP: Hot snare polypectomy; ‡CSP: Cold snare polypectomy

Table 3: Multivariate analysis of factors for histological complete resection

Variable	Odds ratio	95% CI [†]	P
Age (≤ 65 years or >65 years)	0.83	0.55–1.26	0.384
Sex (male or female)	1.13	0.72–1.78	0.605
Use of HSP [‡] (HSP [‡] or CSP [§])	3.03	1.90–4.84	*<0.001
Lesion size (≤ 5 mm or >5 mm)	1.57	1.00–2.45	*0.049
Lesion location (left side or \geq right side**)	1.73	1.16–2.58	*0.007
Lesion morphology (protruded or flat)	0.95	0.28–3.26	0.939

* $P < 0.05$ †CI: confidence interval, ‡HSP: hot snare polypectomy; §CSP: cold snare polypectomy; ||left colon: distal to the splenic flexure; **right colon, oral to the splenic flexure

difference regarding polyp removal rates and retrieval was observed between the two methods in these studies. However, the rates of complete resection in CSP vary

widely (44–96%).^[14–16] Thus, the optimal technique for treatment of diminutive and small polyps is still unknown. In this study, the complete resection rate for the HSP group was significantly higher than that for CSP group among polyps ≥ 6 mm. This result supports previous reports of the variation and frequency of the techniques that were used for the removal of subcentimeter polyps, which revealed that HSP was the most frequently used method for the removal of larger (7–9 mm), non-pedunculated, subcentimeter polyps.^[17] In contrast, among polyps ≤ 5 mm, no significant difference regarding the complete resection rate was observed between the methods. Several studies have reported that complete resection with CSP is associated with polyp size. Lee *et al.* and Kim *et al.* reported that CSP was effective for complete resection of polyps ≤ 5 mm.^[10,18] Polyp size ≤ 5 mm was also an independent factor for complete resection in this study. Therefore, CSP should be chosen for treatment of diminutive polyps up to 5 mm, and HSP should be chosen for treatment of small (6–10 mm) polyps.

Electrocautery provides extra power in cutting, rather than tearing through the mucosa and muscularis mucosa.^[19] Thus, that power might lead to the higher complete resection rate seen with HSP in this study. Furthermore, electrocautery could contribute to the pathological diagnosis. The thermal fulguration provided by electrocautery is a major characteristic of the resection margins for the pathologist. Pathologists found it easier to assess completeness of excision following HSP than CSP.^[20] In addition, although the electrosurgical current that is used for polypectomy considerably varies, its use for endoscopic resection may affect the quality of the histological specimen.^[21] Polypectomy using electrosurgical generators with automated controlled cutting and coagulation (Endocut) is reported to cause less tissue damage and allows better histological interpretation of the specimen than when using a blended current. The ability to evaluate the histological margin was significantly higher (75.7%) for polyps that were resected using the Endocut mode than in those that were resected using a blended current (60.2%).^[22] Using the Endocut mode could contribute to the high complete resection rate and low adverse events rate for HSP in the current study. In CSP, lack of thermal fulguration may lead to difficulties with confirming the resection margin, leading to a low complete resection rate. Furthermore, it cannot be expected that a thermal burn effect will eradicate neoplastic tissue around the snare. Thus, careful observation of the surrounding mucosa after CSP using magnifying endoscopy or chromoendoscopy is recommended.

In a recent meta-analysis comparing the treatment outcomes of HSP and CSP, the complete resection rate of HSP was reported to be between 92.6% and 98.7%,^[23] which was higher than that in the present study. This difference may be due to the differences in the definition of complete resection between this study and other reports. In the present study, complete resection was defined as removal of the whole tumor in one piece, with clear presence of normal tissue at the resected margins on histologic examination. This is the strictest definition. However, in that meta-analysis, incomplete resection was defined as the clear presence of tumor cells in the margin of the removed specimen on histologic examination; consequently, the definition of complete resection included negative or uncertain tumor tissue at the resected margin. In another report, adequate resection was defined as one in which adenoma or hyperplastic tissue was not seen in the base tissue on histology after HSP and CSP.^[24]

On the other hand, because of the snare type we used in this study, the rate of complete resection in CSP might be relatively lower than that of other previous studies. Several reports have indicated that snare choice affects the ease and efficiency of CSP. The diameter (thickness) of the wire is also relevant because it affects the ease of cold transection. The CSP with a thin (0.3 mm) wire snare and/or shield shape is more effective than a thick-wired snare because the diameter (thickness) of the wire affects the ease of cold snare transection.^[15,25] In this study, a snare with a thick wire > 0.4 mm in diameter was used for all procedures, which might cause a low rate of complete resection in CSP. Complete resection with CSP is also influenced by the technique that is used. Two studies have reported the efficacy of using a suction pseudopolyp technique, which more readily permitted the endoscopist to resect the lesion and a rim of surrounding normal tissue without any complications.^[26,27]

There were no significant differences in the incidence of adverse events, including perforation, bleeding, and abdominal pain and discomfort, between HSP and CSP in a meta-analysis comparing these methods.^[23] On the other hand, Horiuchi *et al.* reported a higher bleeding rate with HSP than with CSP among patients who were given anticoagulant agents.^[12] In the current study, no significant difference in the incidence of adverse events, including perforation and delayed postprocedure bleeding, was observed between HSP and CSP, although only the CSP group contained patients who continued to receive antithrombotic agents.

This study has some limitations because it is a retrospective, single-institution study with a small sample. The baseline clinicopathological characteristics significantly differed between HSP and CSP, whereas lesions treated with HSP tended to be larger and were histologically proven to be high-grade dysplasia. Thus, this comparison is potentially biased, because when deciding to perform HSP, the physician may select lesions with a high potential of malignancy and may carefully perform the procedure to obtain complete resection. On the other hand, EMR with submucosal injection is the gold standard method for the treatment of lesions that are suspected of being malignant because EMR can resect the lesion with a greater resection margin. To reduce the above selection biases and compare the use or nonuse of an electrical current in snare polypectomy, we did not use EMR in this study. In addition, we conducted a multivariate analysis to determine the factors that were associated with complete resection of polyps to reduce confounding clinical factors that were associated with complete resection. Finally, a multicenter, randomized controlled trial is needed in the near future to determine the optimal technique to treat small colorectal polyps.

CONCLUSION

This study revealed that HSP could provide high curability for subcentimeter colorectal polyps without compromising safety, compared with CSP. In particular, HSP should be suitable for treatment of larger (6–10 mm) subcentimeter polyps.

Acknowledgements

We sincerely thank the staff of the gastroenterological unit at Yuri-Kumiai General Hospital for their valuable assistance in conducting this study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Siegel R, Naishadham D, Jemal A. Cancer statistics for Hispanics/Latinos, 2012. *CA Cancer J Clin* 2012;62:283-98.
- Shaukat A, Mongin SJ, Geisser MS, Lederle FA, Bond JH, Mandel JS, *et al.* Long-term mortality after screening for colorectal cancer. *N Engl J Med* 2013;369:1106-14.
- Winawer SJ, Zauber AG, Ho MN, O'Brien MJ, Gottlieb LS, Sternberg SS, *et al.* Prevention of colorectal cancer by colonoscopic polypectomy. The National Polyp Study Workgroup. *N Engl J Med* 1993;329:1977-81.
- Zauber AG, Winawer SJ, O'Brien MJ, Lansdorp-Vogelaar I, van Ballegoijen M, Hankey BF, *et al.* Colonoscopic polypectomy and long-term prevention of colorectal-cancer deaths. *N Engl J Med* 2012;366:687-96.
- Lieberman D, Moravec M, Holub J, Michaels L, Eisen G. Polyp size and advanced histology in patients undergoing colonoscopy screening: Implications for CT colonography. *Gastroenterology* 2008;135:1100-5.
- Regula J, Rupinski M, Kraszewska E, Polkowski M, Pachlewski J, Orłowska J, *et al.* Colonoscopy in colorectal-cancer screening for detection of advanced neoplasia. *N Engl J Med* 2006;355:1863-72.
- Singh N, Harrison M, Rex DK. A survey of colonoscopic polypectomy practices among clinical gastroenterologists. *Gastrointest Endosc* 2004;60:414-8.
- Hewett DG. Cold snare polypectomy: Optimizing technique and technology (with videos). *Gastrointest Endosc* 2015;82:693-6.
- Repici A, Hassan C, Vitetta E, Ferrara E, Manes G, Gullotti G, *et al.* Safety of cold polypectomy for <10mm polyps at colonoscopy: A prospective multicenter study. *Endoscopy* 2012;44:27-31.
- Lee CK, Shim JJ, Jang JY. Cold snare polypectomy vs. Cold forceps polypectomy using double-biopsy technique for removal of diminutive colorectal polyps: A prospective randomized study. *Am J Gastroenterol* 2013;108:1593-600.
- Ichise Y, Horiuchi A, Nakayama Y, Tanaka N. Prospective randomized comparison of cold snare polypectomy and conventional polypectomy for small colorectal polyps. *Digestion* 2011;84:78-81.
- Horiuchi A, Nakayama Y, Kajiyama M, Tanaka N, Sano K, Graham DY. Removal of small colorectal polyps in anticoagulated patients: A prospective randomized comparison of cold snare and conventional polypectomy. *Gastrointest Endosc* 2014;79:417-23.
- Aslan F, Camci M, Alper E, Akpınar Z, Arabul M, Celik M, *et al.* Cold snare polypectomy versus hot snare polypectomy in endoscopic treatment of small polyps. *Turk J Gastroenterol* 2014;25:279-83.
- Paspatis GA, Tribonias G, Konstantinidis K, Theodoropoulou A, Vardas E, Voudoukis E, *et al.* A prospective randomized comparison of cold vs hot snare polypectomy in the occurrence of postpolypectomy bleeding in small colonic polyps. *Colorectal Dis* 2011;13:e345-8.
- Din S, Ball AJ, Riley SA, Kitsanta P, Johal S. Cold snare polypectomy: Does snare type influence outcomes? *Dig Endosc* 2015;27:603-8.
- Takeuchi Y, Yamashina T, Matsuura N, Ito T, Fujii M, Nagai K, *et al.* Feasibility of cold snare polypectomy in Japan: A pilot study. *World J Gastrointest Endosc* 2015;7:1250-6.
- Carter D, Beer-Gabel M, Zbar A, Avidan B, Bardan E. A survey of colonoscopic polypectomy practice amongst Israeli gastroenterologists. *Ann Gastroenterol* 2013;26:135-40.
- Kim JS, Lee BI, Choi H, Jun SY, Park ES, Park JM, *et al.* Cold snare polypectomy versus cold forceps polypectomy for diminutive and small colorectal polyps: A randomized controlled trial. *Gastrointest Endosc* 2015;81:741-7.
- Fyock CJ, Draganov PV. Colonoscopic polypectomy and associated techniques. *World Journal of Gastroenterology World J Gastroenterol* 2010;16:3630-7.
- Din S, Ball AJ, Taylor E, Rutter M, Riley SA, Johal S. Polypectomy practices of sub-centimeter polyps in the English Bowel Cancer Screening Programme. *Surg Endosc* 2015;29:3224-30.
- Ngamruengphong S, Pohl H, Haito-Chavez Y, Khashab MA. Update on Difficult Polypectomy Techniques. *Curr Gastroenterol Rep* 2016;18:3.
- Fry LC, Lazenby AJ, Mikolaenko I, Barranco B, Rickes S, Monkemuller K. Diagnostic quality of: Polyps resected by snare polypectomy: Does the type of electro-surgical current used matter? *Am J Gastroenterol* 2006;101:2123-7.
- Fujiya M, Sato H, Ueno N, Sakatani A, Tanaka K, Dokoshi T, *et al.* Efficacy and adverse events of cold vs hot polypectomy: A meta-analysis. *World J Gastroenterol* 2016;22:5436-44.
- Gomez V, Badillo RJ, Crook JE, Krishna M, Diehl NN, Wallace MB. Diminutive colorectal polyp resection comparing hot and cold

- snare and cold biopsy forceps polypectomy. Results of a pilot randomized, single-center study (with videos). *Endosc Int Open* 2015;3:E76-80.
25. Horiuchi A, Hosoi K, Kajiyama M, Tanaka N, Sano K, Graham DY. Prospective, randomized comparison of 2 methods of cold snare polypectomy for small colorectal polyps. *Gastrointest Endosc* 2015;82:686-92.
 26. Pattullo V, Bourke MJ, Tran KL, McLeod D, Williams SJ, Bailey AA, *et al.* The suction pseudopolyp technique: A novel method for the removal of small flat nonpolypoid lesions of the colon and rectum. *Endoscopy* 2009;41:1032-7.
 27. Din S, Ball AJ, Riley SA, Kitsanta P, Johal S. A randomized comparison of cold snare polypectomy versus a suction pseudopolyp technique. *Endoscopy* 2015;47:1005-10.