

The quality of colorectal polypectomy. Is it enough to have just a visual assessment of the site?

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Abstract

Introduction: Performing a colonoscopy allows the examination of the entire colon and the assessment of polyps. **Patients, Materials and Methods:** We performed a retrospective analysis of prospectively collected data from January 2018 until February 2020 (two years), in which we enrolled a number of 210 patients performing colonoscopy in the Research Center of Gastroenterology and Hepatology, University of Medicine and Pharmacy of Craiova, Romania. We performed 326 polypectomies. **Results:** We classified the polyps into diminutive ($n=169$), small ($n=103$) and large polyps ($n=54$). Regarding the polypectomy technique, our results indicated that 40 out of 48 (83.3%) polypectomies with the biopsy forceps were complete, as well as 27 out of 31 (87.1%) cold snare polypectomies and 12 out of 14 (85.7%) hot snare polypectomies. The differences were not statistically significant ($p=0.116$). Regarding the number of incomplete polypectomies, our data suggests that the high expertise endoscopist had two incomplete resections (5.1% of total), the medium expertise endoscopist 1 had also two incomplete resections (11.1% of total), the medium expertise endoscopist 2 had three incomplete resections (15% of total), the limited expertise endoscopist 1 had three incomplete resections (27.27% of total) and the limited expertise endoscopist 2 had four incomplete resections (30.76% of total). Analyzing the data, the differences were statistically significant ($p=0.006$). **Conclusions:** Our study is able to suggest that high-definition white-light endoscopy (HD-WLE) macroscopic visualization of the polyp resection site is not enough to assess complete polyp resection and follow-up colonoscopy should be performed for cases with incomplete margins of resection.

Keywords: polypectomy, quality colonoscopy, long-term assessment, incomplete resection margins.

Introduction

Colonoscopy is the most efficient screening method for colorectal cancer (CRC). Performing a colonoscopy allows the examination of the entire colon and the assessment of various lesions, including polyps. A diagnostic of colorectal polyps implies the performance of polypectomy in order to reduce the incidence of CRC [1].

In most cases, colorectal polyps are asymptomatic and are diagnosed during a routine colonoscopy, but in some cases, due to their increasing size, or location, or even malignant transformation, patients can develop colonic bleeding, abdominal pain, change in bowel habits with periods or constipation, followed by diarrhea [2].

There are various known classifications of colonic polyps. Regarding size, the polyps are described as diminutive (for colonic polyps less than 5 mm), small (with a size ranging from 6 to 9 mm) and large (with a size over 10 mm) [3, 4]. Several studies have suggested that the increasing size of the polyps is associated with advanced adenomas, but on the other hand small and diminutive polyps should not be neglected as well. Recent

data shows that up to 10% of the colorectal resection specimens indicate the presence of advanced adenomas [5, 6].

Based on experience, endoscopic equipment, and accessories, as well as current guidelines, the physician can choose from a variety of procedures in order to remove colonic polyps, such as biopsy forceps or snare resections. Some cases require endoscopic mucosal resection (EMR) or endoscopic submucosal dissection (ESD), especially for large polyps, or with *in situ* adenocarcinoma (early-stage cancer) [7].

Colonoscopic quality index is crucial for CRC prevention. Some of the most important aspects include high polyp and adenoma detection rate (ADR), as well as complete polyp resection. Several recent studies suggest that incomplete polyp resection (IPR) and low ADR are associated with high rate of interval cancers [8].

Aim

In our study, we assessed polypectomy quality in our Research Center of Gastroenterology and Hepatology

within the University of Medicine and Pharmacy of Craiova, Romania, by analyzing the techniques used for polypectomy, polyp localization and size, as well as expert proficiency for complete resection. We are not trying to highlight a specific need of a polypectomy technique in order to achieve complete resection.

☐ Patients, Materials and Methods

Patients

At the start of the study, we obtained ethical approval from the Ethics Committee of the University of Medicine and Pharmacy of Craiova, in order to conduct this study. Each patient also signed an informed consent of enrolling in our study. Besides the consent of admittance in the study, the patients also signed an informed consent regarding the procedure and sedation. The procedures performed were daily routine procedures, without any intervening factors in the decision-making process of individual doctors concerning the type of polypectomy.

We performed a retrospective analysis of prospectively collected data from January 2018 until February 2020 (two years), in which we enrolled a number of 210 patients performing colonoscopy with polypectomy in the Research Center of Gastroenterology and Hepatology, University of Medicine and Pharmacy of Craiova. The admission criteria were age over 18, colorectal polyps diagnosed during colonoscopy, signed informed consent for colonoscopy, and polypectomy.

Materials and Methods

Our Research Center benefits from high performance endoscopic equipment. Colonoscopies were performed with an Olympus Exera III Endoscopy System with two flexible colonoscopes CF-HQ190L. For polypectomies, we used Olympus accessories: standard single use biopsy forceps (FB-230U), single-use oval electro-surgical snares (SD-210U-15). For complications such as local bleeding, we used hemostasis equipment such as: EZClip – Rotatable clip fixing device, single-use injection 25G, 26G needles (for injection of 1:10 000 or 1:100 000 adrenaline solution), Coagrasper – Single-use electro-surgical hemostatic forceps or Gold Probe Single-Use electro-hemostasis catheters.

The colonoscopies and polypectomies were performed by a consistent endoscopic team because both our personal experience and data from the literature indicates that

polyp and ADR is higher with more observers. Therefore, the endoscopy team consisted of two endoscopy nurses, one resident physician and one endoscopist with different levels of polypectomy expertise. Our Research Center includes five gastroenterology physicians with competence in diagnostic and therapeutic endoscopy: one endoscopist with high expertise (more than 500 polypectomies), two endoscopists with medium expertise (100–200 polypectomies) and two young endoscopists with limited expertise (less than 50 polypectomies).

During the colonoscopy, whenever a polyp was identified, the size was estimated and the polyps were classified as diminutive (smaller than 5 mm), small (size 6–9 mm) and large (over 10 mm). Polypectomy was performed using single use biopsy forceps, or looped snares for cold or hot snare polypectomy. The retrieval of the resected polyp was with either the biopsy forceps, for biopsy forceps polypectomy and with a polyp trap for cold or hot snare polypectomies, or directly with the snare through the anus for larger polyps located in the rectum. The resection piece was introduced in a specimen with formaldehyde for subsequent histopathological examination in the Department of Pathology. Since our study assessed quality of polypectomy, we decided to randomly select cases where we also performed biopsies from the polypectomy edges even though macroscopically, in both high-definition white-light endoscopy (HD-WLE) or narrow band imaging (NBI), the polypectomies seemed complete. The samples were introduced in a different specimen with formaldehyde, with a label on which we specified to the pathologist the origin of the biopsy. Also, we noted which type of polypectomy procedure was elected before the biopsy. The final data was statistically processed by using Microsoft Excel package (Microsoft Corporation) with predefined functions and a module for the Data Analysis (Student's *t*-test).

☐ Results

Our study included 210 patients with colonic polyps. We performed a number of 326 polypectomies, hence several patients had more than two polyps. We classified the polyps into diminutive ($n=169$), small ($n=103$) and large polyps ($n=54$). Regarding the classification of polypectomies and expertise of the endoscopist, we enhanced the numbers of each polypectomy based on the polyp size and endoscopist expertise (Table 1).

Table 1 – Characteristics of polyp sizes, endoscopic expertise, and procedure types

Expertise of the endoscopist	Polyp size			Total procedures	Procedure type		
	Diminutive polyps	Small polyps	Large polyps		Biopsy forceps	Cold snare	Hot snare
High expertise endoscopist	74	37	21	132	43	57	32
Medium expertise endoscopist 1	31	18	9	58	20	25	13
Medium expertise endoscopist 2	28	21	10	59	19	24	16
Limited expertise endoscopist 1	17	15	6	38	21	10	7
Limited expertise endoscopist 2	19	12	8	39	22	11	6
<i>Totals</i>	<i>169</i>	<i>103</i>	<i>54</i>	<i>326</i>	<i>125</i>	<i>127</i>	<i>74</i>

Regarding the number of procedures, 125 were resections with biopsy forceps, 127 were resections with cold snare and 74 with hot snare.

High expertise endoscopist performed 132 procedures including 43 (32.57%) biopsy forceps, 57 (43.18%) cold snare polypectomies, 32 (24.25%) hot snare polypectomies.

Medium expertise endoscopist 1 performed 58 procedures including 20 (34.48%) biopsy forceps, 25 (43.10%) cold snare polypectomies, 13 (22.42%) hot snare polypectomies.

Medium expertise endoscopist 2 performed 59 procedures including 19 (32.20%) biopsy forceps, 24 (40.68%) cold snare polypectomies, 16 (27.12%) hot snare polypectomies.

Limited expertise endoscopist 1 performed 38 procedures including 21 (55.26%) biopsy forceps, 10 (26.31%) cold snare polypectomies, seven (18.43%) hot snare polypectomies.

Limited expertise endoscopist 2 performed 39 procedures including 22 (56.41%) biopsy forceps, 11 (28.20%) cold snare polypectomies, six (15.39%) hot snare polypectomies.

We classified the histopathological reports into adenocarcinoma, tubular adenoma, tubulovillous adenoma, hyperplastic and other benign reports, such as lymphoid hyperplasia or inflammatory polyps (Figure 1). On 13 polypectomies with diminutive or small polyps, we could not retrieve the resection pieces, mainly due to high fragmentation. The retrieval rate of the resected polyps was 96.01%. The histopathological reports included 12 adenocarcinomas, 143 tubular adenomas, 51 tubulovillous adenomas, 86 hyperplastic polyps and 21 with other benign diagnosis.

We also encounter 10 serrated adenomas. We used the

Paris Classification for the evaluation of each polyp as described: type 0 – Ip for polypoid/pedunculated (89 polyps); type 0 – Is polypoid/sessile, broad based (187 polyps); type 0 – Ila flat and elevated (20 polyps); type 0 – IIb completely flat (17 polyps); type 0 – IIc superficially depressed (nine polyps) and type 0 – III excavated/ulcerated neoplastic lesion (four polyps). Cases of the polyps diagnosed during our study are highlighted in Figures 2–4.

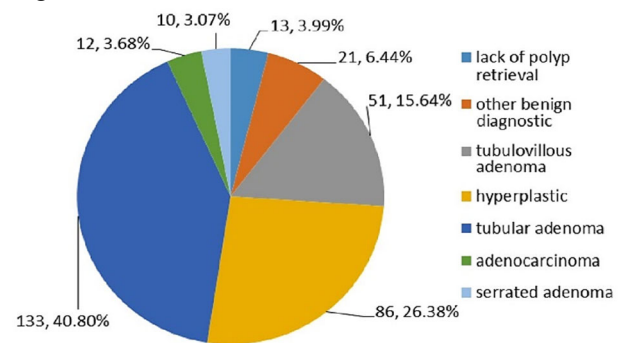


Figure 1 – Enhancement of cases based on histopathological report.

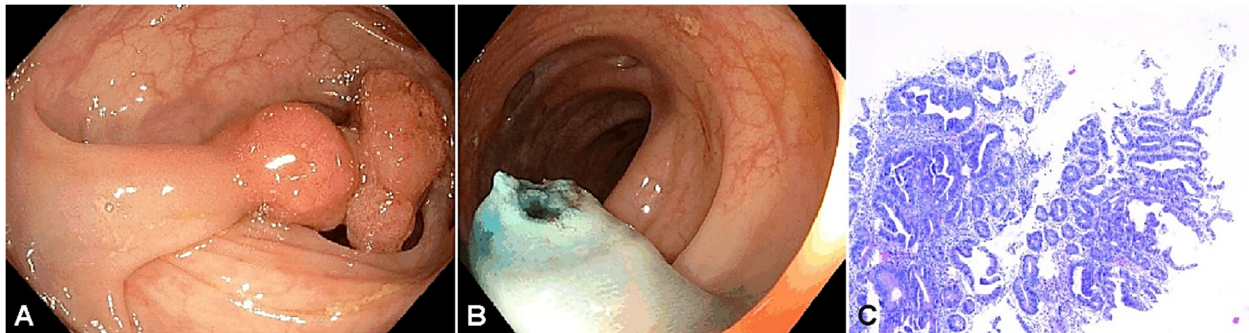


Figure 2 – (A) Large pedunculated polyp in HD-WLE; (B) Resection site; (C) Tubular adenoma with high-grade dysplasia (HE staining, 50x). HD-WLE: High-definition white-light endoscopy; HE: Hematoxylin-Eosin.

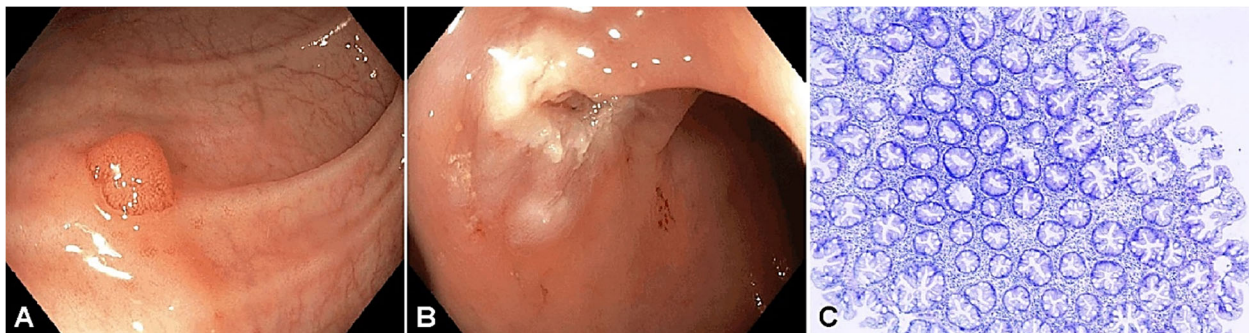


Figure 3 – (A) Small sessile polyp in HD-WLE; (B) Resection site after hot snare polypectomy; (C) Microvesicular hyperplastic polyp (HE staining, 50x). HD-WLE: High-definition white-light endoscopy; HE: Hematoxylin-Eosin.

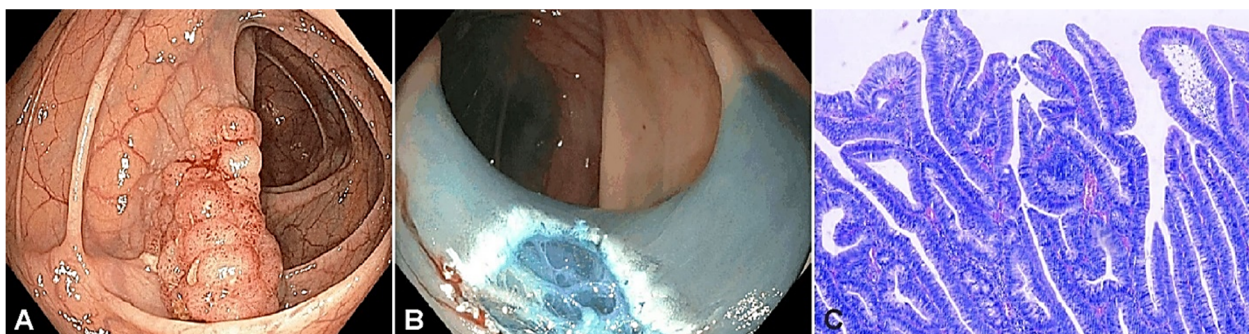


Figure 4 – (A) Large sessile polyp in HD-WLE; (B) Resection site; (C) Tubulovillous adenoma with high-grade dysplasia (HE staining, 50x). HD-WLE: High-definition white-light endoscopy; HE: Hematoxylin-Eosin.

We made an assessment regarding the localization of the 326 polyps and the data suggested that 58 were localized in the rectum, 82 in the sigmoid colon, 45 in the descending colon, 62 in the transverse colon, 42 in the ascending colon and 37 in the cecum (Table 2).

Table 2 – Number and colonic localization of the polyps

Localization	No. of polyps
Rectum	58
Sigmoid colon	82
Descending colon	45
Transverse colon	62
Ascending colon	42
Cecum	37

In 93 randomly selected cases of polypectomy, a biopsy within the edges of the polypectomy was also performed, after concluding that the visual aspect after the polypectomy did not indicate the fact that residual polypoid tissue was still present. Out of the 93 selected polypectomies, 48 were performed with biopsy forceps, 31 with cold snare and 14 with hot snare polypectomy. The histopathological reports of the extra biopsies from the edge of the polypectomy site indicated that 14 out of the 93 (15.05%) cases presented residual polyp tissue therefore the polypectomy was not complete. We also performed thermal ablation of the resection edges for polyps >20 mm with the polypectomy loop. The 14 incomplete polypectomies were performed with biopsy forceps (eight), cold snare (four) and hot snare (two). Regarding the polypectomy technique, our results indicated that 40 out of 48 (83.3%) polypectomies with the biopsy forceps were complete, as well as 27 out of 31 (87.1%) cold snare polypectomies and 12 out of 14 (85.7%) hot snare polypectomies (Table 3). The differences were not statistically significant ($p=0.116$).

Table 3 – Complete/incomplete polypectomies based on the polypectomy technique

	Polypectomy technique		
	Biopsy forceps	Cold snare	Hot snare
Complete polypectomy	40	27	12
Incomplete polypectomy	8	4	2
Total cases of postpolypectomy edge samples	48	31	14

Table 4 – Assessment of incomplete polyp resections based on endoscopy expertise, size, localization, histopathological date of the polyps and type of procedure

Expertise of the endoscopist	Incomplete resections	No. of polyp resections assessed	Size of the polyp	Histopathological data	Type of procedure	Localization of the polyp
High expertise endoscopist	2/39 (5.1%)	39	LP – 30 mm	TVA	Hot snare	Rectum
			SP – 8 mm	TA	Cold snare	Sigmoid colon
Medium expertise endoscopist 1	2/18 (11.1%)	18	LP – 13 mm	TA	Cold snare	Rectum
			SP – 7 mm	HP	BF	Transverse colon
			SP – 9 mm	HP	Cold snare	Rectum
Medium expertise endoscopist 2	3/20 (15%)	20	LP – 12 mm	TA	Hot snare	Cecum
			SP – 6 mm	TA	BF	Sigmoid colon
			SP – 7 mm	HP	BF	Descending colon
Limited expertise endoscopist 1	3/11 (27.27%)	11	SP – 8 mm	TA	BF	Rectum
			LP – 18 mm	TVA	Hot snare	Sigmoid colon

For each polypectomy randomly selected for biopsies of the edges' polypectomy site, we also recorded data regarding which endoscopist performed the procedure, which technique was used, the size of the polyp, histopathological data, as well as the localization of the polyp. The analysis of the data showed us that out of the 93 selected polypectomies, 39 were performed by the endoscopist with high expertise, 18 were performed by endoscopist with medium expertise number 1, 20 were performed by endoscopist with medium expertise number 2, 11 were performed by endoscopist with limited expertise number 1, 13 were performed by endoscopist with limited expertise number 2. The pathologist was able to assess the resection margins in 65 of the 93 (69.89%) selected polypectomies.

The analysis of the 14 cases with IPR revealed us that high expertise endoscopist had two cases of IPRs (one large polyp of 30 mm, tubulovillous adenoma located in the rectum, hot snare piecemeal resection and one small polyp 8 mm in the sigmoid colon, tubular adenoma, cold snare resection).

The medium expertise endoscopist 1 had also two cases of IPRs (one large polyp of 13 mm in the rectum, tubular adenoma, cold snare resection and one small polyp of 7 mm in the transverse colon, hyperplastic polyp, biopsy forceps resection).

The medium expertise endoscopist 2 had three cases of IPRs (one small polyp of 9 mm in the rectum, hyperplastic polyp, cold snare resection, one large polyp of 12 mm in the cecum, tubular adenoma, hot snare resection, one small polyp of 6 mm in the sigmoid colon, tubular adenoma, biopsy forceps resection).

The limited expertise endoscopist 1 had also three cases of IPRs (one small polyp of 7 mm in the descending colon, hyperplastic polyp, biopsy forceps resection, one small polyp of 8 mm in the rectum, tubular adenoma, biopsy forceps resection, one large polyp of 18 mm in the sigmoid colon, tubulovillous adenoma, hot snare resection).

The limited expertise endoscopist 1 had four cases of IPRs (one small polyp of 6 mm in the sigmoid colon, tubular adenoma, biopsy forceps resection, one small polyp of 7 mm, tubular adenoma in the rectum, biopsy forceps resection, one large polyp of 11 mm, tubular adenoma in the rectum, cold snare resection and a small polyp of 8 mm, in the transverse colon hyperplastic polyp, biopsy forceps resection) (Table 4).

Expertise of the endoscopist	Incomplete resections	No. of polyp resections assessed	Size of the polyp	Histopathological data	Type of procedure	Localization of the polyp
Limited expertise endoscopist 2	4/13 (30.76%)	13	SP – 6 mm	TA	BF	Sigmoid colon
			SP – 7 mm	TA	BF	Rectum
			LP – 11 mm	TA	Cold snare	Rectum
			SP – 8 mm	HP	BF	Transverse colon

BF: Biopsy forceps; HP: Hyperplastic polyp; LP: Large polyp; SP: Small polyp; TA: Tubular adenoma; TVA: Tubulovillous adenoma.

Regarding the number of incomplete polypectomies our data suggests that the high expertise endoscopist had two incomplete resections (5.1% of total), the medium expertise endoscopist 1 had also two incomplete resections (11.1% of total), the medium expertise endoscopist 2 had three incomplete resections (15% of total), the limited expertise endoscopist 1 had three incomplete resections (27.27% of total) and the limited expertise endoscopist 2 had four incomplete resections (30.76% of total). Analyzing the data, the differences were statistically significant ($p=0.006$).

☒ Discussions

Our data suggests that endoscopic expertise is associated with higher percentage of complete polyp resections, although the endoscopic resection technique is not associated with the completeness of polyp resections. The idea and aim of our study were built because there are various studies claiming that follow-up colonoscopies indicate the presence of residual polypoid tissue after apparent complete resection.

IPR is not associated with endoscopist experience, but rather with assistant experience and histopathological type and advanced dysplasia according to Lee *et al.* Also, regarding the pathologist report and the resection margins, there are several instances when the pathologist was not able to assess the resection margin. The reasons can be important fragmentation of the pathology specimen, as well as crush or cautery artifacts depending on the resection technique [9].

Another study performed by Pohl *et al.* included 1427 patients in colonoscopic screening for neoplastic polyps of whom 269 had 346 neoplastic polyps. For each case, it was performed endoscopic resection of the polyp. After macroscopic assessment of the polypectomy, a biopsy was taken from the margins of the resection. The results suggested that 10.1% of polypectomies were incomplete, whilst the results suggested that interval cancers could be associated with IPRs [10].

Regarding polypectomy technique, in 2004, Singh *et al.* performed a survey that included up to 189 gastroenterologists who worked both in academic and private practice. The results showed that for diminutive polyps the forceps techniques were most often used, whether for small polyps (7–9 mm) electro-surgical snare resection was more often used. For polyps ranging from 4 to 6 mm, there was no preferred method. For large polyps, 69% of the gastroenterologists surveyed did not use any methods to prevent bleeding, and from the physicians who used a technique to prevent bleeding, up to 76% used adrenaline injection [11].

Liu *et al.* assessed complete polyp resection in a study with 47 patients and 65 polyps and had data suggesting IPR occurred in 15% of the resections. The authors also suggested that performing resection of the small polyps

with standard biopsy forceps was more prone to IPR and that an endoscopist can misinterpret the resection site as indicating complete resection [12].

Likewise, our study suggests that endoscopic expertise is associated with less IPR and although endoscopic resection technique is not essentially associated with IPR, we noticed that endoscopists with limited experience tend to use more often the biopsy forceps especially for small and diminutive polyps which according to some authors can lead more often to IPR. Efthymiou *et al.* assessed the resection of diminutive polyps with cold biopsy forceps and their data suggested that only 39% (21 out of 54) of diminutive polyps were completely resected using this technique. Although the study was rather limited, the data is concerning regarding complete polyp resection by simply using biopsy forceps [13]. On the other hand, in a more recent study from 2019, Hasegawa *et al.* assessed the resection of diminutive polyps using jumbo cup forceps in a larger study with 361 patients and 573 adenomas and concluded that this technique was safe for complete one-bite resections [14].

There are various risk factors for IPR that include age of the patients, size of the polyp, endoscopic appearance, histological aspect, depth of invasion, relationship with colonic flexures, visibility of a lesion and experience of the endoscopist. A polyp which is located on a colonic fold poses a higher risk of IPR compared to a polyp that is located between folds [15].

Quality of colonoscopy and proper endoscopic polypectomy depends on endoscopist experience, multiple observers, bowel preparation, upgraded endoscopic equipment with HD-WLE and optical zoom functions with spectral imaging color enhancement, which improve the ADR and detection of preneoplastic lesions [2, 16–18].

Our data suggests similar complete polyp resection rates between the snare and biopsy forceps technique. Similar data is suggested by Lee *et al.* who found no significant difference for diminutive polyps between resections with cold snare or biopsy forceps but concluded that cold snare was superior for removal of polyps larger than 4 mm, although with higher costs and maybe lower retrieval rates as compared with biopsy forceps [19]. Comparing cold snare and hot snare techniques, various studies did not find any statistical differences for both retrieval and complete polyp resection, although the authors conclude that cold snare should be the election method for diminutive and small polyp resection [20, 21]. The *European Society of Gastrointestinal Endoscopy (ESGE)* recommends cold snare polypectomy for diminutive and small sessile polyps (6–9 mm) and hot snare polypectomy for large polyps or pedunculated polyps [22].

The *American Gastroenterological Association (AGA)* has several important recommendations regarding polypectomy, such as: for diminutive and small polyps, the advised technique is cold snare, with the exception for

polyps smaller than 3 mm, when the authors recommend using biopsy jumbo forceps. The *Association* recommends against the use of biopsy forceps for diminutive polyps bigger than 3 mm because high rates of incomplete resections [23, 24].

Our study did not include data concerning bowel preparation for each incomplete polypectomy, and recent data suggests that improper bowel preparation can lead to lower ADR, even in the presence of multiple observers, as well as an increased number of unretrieved polyps [25]. Therefore, these patients should have follow-up colonoscopies with proper bowel preparation in order to diminish the risk of interval cancers. Concerning the retrieval rate of the resected polyps, which is another indicator for quality polypectomy, our data shows a 96.01% retrieval rate, similar to other studies which estimate up to 98% or even 100% retrieval rates [26].

Complete polyp resection also requires the evaluation of the resection margins by the pathologist, which is a key for quality polypectomy. Several markers were introduced in order to help with the diagnosis of colorectal polyps, especially in situations that may reduce the quality of biopsies [27, 28]. Recent studies show that in some cases, the pathologist was able to detect the resection margins in only 67% of the cases. This matter is particularly important for malignant polyps since incomplete or underdetermined margins of resections can suggest the need for radical surgery approach [29].

☒ Conclusions

Our study is able to suggest that HD–WLE macroscopic visualization of the polyp resection site is not enough to assess complete polyp resection and follow-up colonoscopy should be performed for cases with incomplete margins of resection. Experience in polypectomy plays an important role in achieving complete polyp resection. Thus, quality colonoscopic polypectomy also includes proper bowel preparation, adequate polypectomy technique according to the guidelines and personal proficiency, adequate polyp retrieval and advanced endoscopic equipment, as well as continuous training of the endoscopy assistant and the pathologist.

☒ Conflict of interests

The authors declare that they have no conflict of interests.

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