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TOPIC HIGHLIGHT

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Improving quality measures in colonoscopy and its therapeutic intervention

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Abstract

Colonoscopy with polypectomy has been shown to reduce the risk of colon cancer. The critical element in the quality of colonoscopy in terms of polyp detection and removal continues to be the performance of the endoscopist, independent of patient-related factors. Improved results in terms of polyp detection and complete removal have implications regarding the development of screening and surveillance intervals and the reduction of interval cancers after negative colonoscopy. Advances in colonoscopy techniques such as high-definition colonoscopy, hood-assisted colonoscopy and dye-based chromoendoscopy have improved the detection of small and flat-type colorectal polyps. Virtual chromoendoscopy has not proven to improve polyp detection but may be useful to predict polyp pathology. The majority of polyps can be removed endoscopically. Available polypectomy techniques include cold forceps polypectomy, cold snare polypectomy, conventional polypectomy, endoscopic mucosal resection and endoscopic submucosal dissection. The preferred choice depends on the polyp size and characteristics. Other useful techniques include colonoscopic hemostasis for acute colonic diverticular bleeding, endoscopic decompression using colonoscopic stenting, and transanal tube placement for colorectal obstruction. Here we review the current knowledge concerning the improvement of quality measures in colonoscopy and colonoscopy-related therapeutic interventions.

Key words: Colonoscopy; Polypectomy; Hemostasis; Endoscopic decompression; Colorectal polyp; Colonic diverticular bleeding; Colorectal obstruction; Gastrointestinal endoscopy

Core tip: Achieving appropriate bowel preparation and proper luminal distention for endoscopic mucosal imaging remains the key step enabling the endoscopist to detect colorectal neoplasia and predict polyp pathology. Success improves with experience and feedback. In this review we discuss the impact of high-definition colonoscopy, hood-assisted colonoscopy, and dye-based and virtual chromoendoscopy on colorectal polyp detection and prediction. Colonoscopic polypectomy is a continuously evolving therapy and has the potential to further reduce the risk of colorectal cancer. We propose that optimal polypectomy techniques for nonpedunculated polyps should be primarily based on polyp size, and these include cold forceps polypectomy (1-3 mm), cold snare polypectomy (4-10 mm), conventional polypectomy (7-14 mm), and endoscopic mucosal resection (EMR) (15-20 mm). For polyps larger than 21 mm, piecemeal EMR or endoscopic submucosal dissection is preferred.

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INTRODUCTION

Colonoscopy is widely used for colorectal cancer detection and prevention. Colon cancer prevention is predicated on the detection and removal of polyps with neoplastic potential[1-4]. Despite the proven effectiveness of colonoscopy, it is not perfect, as some polyps and even cancers may be missed because they lie outside the visual field, behind folds or are simply not recognized[5-8]. Right-sided lesions, flat polyps, and variability in endoscopists' adenoma detection rate are all potential reasons why polyps are missed and why some "interval" cancers are discovered after a negative screening colonoscopy.

Polypectomy is the most commonly performed therapeutic intervention, and all endoscopists should be able to perform this procedure safely and effectively. The decision to perform polypectomy is based on a general belief that all polyps with neoplastic potential should be removed. After a polyp is discovered, the endoscopic must make a decision regarding the best strategy for dealing with it. The technique chosen for polypectomy is generally based on the morphology and size of the polyp and can range from cold or hot forceps polypectomy, cold snare polypectomy, conventional (hot snare) polypectomy, endoscopic mucosal resection (EMR) and endoscopic submucosal dissection (ESD). In addition to the removal of polyps, colonoscopy is used in the management of hemostasis and obstructive colorectal lesions. Based on the premise that good results require appropriate bowel preparation and proper luminal distention, the aim of this review is to provide the reader with an overview of the current knowledge regarding the improvement of quality measures in colonoscopy and its therapeutic intervention.

QUALITY INDICATORS FOR COLONOSCOPY

An endoscopist's adenoma detection rate has proven predictive value in relation to a patient's colorectal cancer risk after a negative screening colonoscopy[9]. One study used a national colorectal screening program database of over 50000 Polish individuals undergoing screening colonoscopy, and it established the adenoma detection rate as an independent predictor of interval colorectal cancer after screening colonoscopy. Considerable variability exists among endoscopists in this important measure. The study showed that who performed the procedure was more important than the patients' age or gender in predicting adenomas at colonoscopy[10]. Among patients aged 50 or older, the adenoma detection rates by nine endoscopists ranged from 15.5% to 41.1% (P < 0.001). A study in a large community-based practice first demonstrated that the time taken to withdraw the colonoscope (*e.g.*, withdrawal time) was also important. When endoscopists with mean withdrawal times of less than 6 min were compared to those with mean withdrawal times of 6 min or more, those with the longer withdrawal time had higher rates of detection of any neoplasia (28.3% *vs* 11.8%, P < 0.001) as well as of advanced neoplasia (6.4% *vs* 2.6%, P = 0.005)[11].

Using the same withdrawal technique scale, those authors evaluated the quality of withdrawal during video-recorded colonoscopies by 11 endoscopists[12]. The endoscopists were grouped by their detection rates, *i.e.*, low (adenoma detection rate < 21%), moderate (21%-42%) or high adenoma detection rates (> 42%) in relation to their adenoma detection rates determined during the prior 12 mo. The endoscopists with a low adenoma detection rate had significantly shorter withdrawal technique scores (40.8 ± 3) compared to the endoscopists with a moderate (62.2 ± 2.5) or high (59.5 ± 3) adenoma detection rate. The high-rate detectors exhibited better performance including better fold examination, adequate distension, cleansing, and time spent viewing the mucosa. That study found that the withdrawal technique (rather than the withdrawal time) was the important indicator that differentiated between endoscopists with varying adenoma detection rates.

A number of attempts to influence endoscopist behavior to improve detection rates have proven unsuccessful. For example, enforcing more time for withdrawal/inspection has not increased adenoma detection rates[13]. However, routine feedback and monitoring has resulted in a decrease in incomplete colonoscopies, shortened intubation times, and increased withdrawal times, but these were without clear improvement in the adenoma detection rate (*e.g.*, from 19.6% to 22.7%, P = 0.17)[14]. These data suggest that although performance measures in colonoscopy are influenced by feedback, effective methods to improve adenoma detection remain elusive.

HIGH-DEFINITION WHITE LIGHT COLONOSCOPY

According to a 2011 meta-analysis with pooled data of five studies of 4422 patients, the absolute increase in the adenoma detection rate is small (estimated to be approximately 3.5%) with no evidence of increased detection of advanced adenomas[15]. The use of high-definition white light colonoscopy leads to high-quality images and a marginal increase in the adenoma detection rate compared to standard definition colonoscopy.

HOOD-ASSISTED COLONOSCOPY

The transparent hood attached to the distal tip of a colonoscope has been suggested to be of help in depressing colonic folds to improve the visualization of their proximal aspects[16-18]. Theoretically, the use of a clear hood attachment should improve polyp detection, but the results of randomized trials so far have been mixed. However, a meta-analysis of hood-assisted colonoscopy in 6185 patients reported that the use of this technique detected significantly more patients with polyps (OR = 1.13, P = 0.030) and had a lower average polyp miss rate

(12.2% *vs* 28.6%) than standard colonoscopy[19]. Hood-assisted colonoscopy also had a significantly higher cecal intubation rate than standard colonoscopy (OR = 1.36, P = 0.020), whereas the time to cecal intubation (standard mean difference, 0.04 min, P = 0.280) was similar for the two groups. Overall, we believe that the data support the notion that hood-assisted colonoscopy is associated with improved detection of colorectal neoplasia and with higher cecal intubation rates compared to standard adult colonoscopy.

CHROMOCOLONOSCOPY

Chromocolonoscopy with indigo carmine spraying is used to improve the yield of colonoscopy for neoplasias. The sprayed dye increases the visual contrast between normal and pathologic mucosa. A four-center randomized study comparing high-definition white light chromocolonoscopy with high-definition white light colonoscopy for average-risk colorectal cancer screening found only a trend toward better detection of diminutive adenomas with the use of chromocolonoscopy. The increased time required for dye spraying (30.6 min *vs* 21.9 min) has led to the suggestion that chromocolonoscopy is best limited to high-risk cases for neoplasia[20].

A large randomized two-center study using a simplified dye application technique showed that the difference in procedure times between the pancolonic chromocolonoscopy group and the standard colonoscopy group could be reduced (*e.g.*, 11.6 min *vs* 10.1 min) ($P < 0.01$)[21]. In that study, indigo carmine dye was applied during continuous withdrawal using a low-volume one-step method through a catheter that remained in the working channel. Chromocolonoscopy increased the overall detection rate for adenomas (0.95 *vs* 0.66 per patient), flat adenomas (0.56 *vs* 0.28 per patient) and serrated lesions (1.19 *vs* 0.49 per patient) ($P < 0.001$). That study not only found a significant increase in adenoma detection with pancolonic chromocolonoscopy but also offered a simplified application method making its routine use less cumbersome. Although the application of dye throughout the entire colon is not widely practiced at present, the use of continuous low-volume dye spraying through the working channel via a water jet during withdrawal has the potential to greatly reduce the increased procedure times reported in previous studies.

VIRTUAL CHROMOENDOSCOPY

In order to minimize the perceived obstacles of chromocolonoscopy, such as the use of vital dyes and catheters, newer endoscopes has been developed that allow for "virtual chromoendoscopy" using optical and/or electronic methods, such as narrow-band imaging (NBI), I-Scan, and flexible spectral imaging color enhancement (FICE). Virtual chromoendoscopy is based on the principle that light penetrates tissues to variable depths based on wavelengths, with blue light (shorter wavelengths) penetrating less deeply than red light (longer wavelengths). In NBI, narrow-band filters placed behind the light source eliminate red light and increase the contribution of blue (415 nm) and green (540 nm) wavelengths. The 415-nm light enhances the visualization of superficial mucosal capillaries, and the 540-nm light increases the visibility of submucosal and deeper mucosal vessels[22]. The related but competing technologies of I-Scan and FICE use the same concept and achieve similar results through the use of digital filters following image acquisition with white light.

Despite this advanced technology, the use of virtual chromoendoscopy for visualization during withdrawal has thus far failed to improve adenoma detection. Based on the results of eight randomized trials with 3673 participants, there was no significant difference between white light colonoscopy (standard definition and high-definition pooled) and NBI for the detection of patients with colorectal polyps (six trials, n = 2832, RR = 0.97, 95%CI: 0.91-1.04), patients with colorectal adenomas (eight trials, n = 3673, RR = 0.94, 95%CI: 0.87-1.02), or patients with colorectal hyperplastic polyps (two trials, n = 645, RR = 0.87, 95%CI: 0.76-1.00)[23].

VIRTUAL CHROMOENDOSCOPY FOR POLYP CHARACTERIZATION

Using magnifying endoscopes, investigators in Japan described capillary patterns that proved highly accurate in distinguishing neoplasia from non-neoplasia[24]. Unfortunately, in the United States high magnification is available only on Fujinon colonoscopes. Virtual chromoendoscopy relies primarily not only on surface blood vessel patterns but also on structural changes that may correspond to pits. Use of the meshed capillary pattern on NBI colonoscopy with optical magnification effectively distinguishes neoplastic from non-neoplastic colorectal polyps. NBI colonoscopy without optical magnification for neoplastic polyp diagnosis appears to be comparable with NBI with optical magnification when the meshed capillary pattern is used[25].

Using high-definition white light colonoscopy and NBI, the Discard trial assessed 363 polyps from 130 patients undergoing surveillance colonoscopy and found that both experienced and nonexperienced endoscopists had high levels of accuracy in predicting adenomas and assigning correct surveillance intervals based on their predictions[26]. Another interesting feature of the assessment of NBI with high-definition colonoscopy was added by the integration of a "confidence level" into the clinical interpretation of polyps[27]. Using prespecified criteria, the endoscopists made the diagnosis (*i.e.*, either hyperplastic or adenomatous) with "high confidence" in about 80% of polyps, and in these instances 92% of the polyps were diagnosed accurately when compared with histology[27]. In determining the impact of diminutive polyps on the surveillance interval assignment, Denis *et al*[28] concluded that pathologic interpretation would not be necessary in up to 44.1% of diminutive polyps, which could therefore be "diagnosed then discarded". Of the remaining polyps, Denis *et al*[28] found that the surveillance interval assigned optically would have been correct for 98.3% of the polyps, which led the authors to propose an algorithm for polyp management based on size, clinical history, and endoscopic findings.

The American Society for Gastrointestinal Endoscopy Taskforce consensus statement recommended two different virtual chromoendoscopy-based policies, namely a predict-resect-and-discard strategy for nonrectosigmoid ≤ 5-mm lesions characterized at virtual chromoendoscopy with high confidence, and a predict-and-do-not-resect policy for rectosigmoid diminutive polyps predicted to be hyperplastic at virtual chromoendoscopy with high confidence[29]. The achievement of these goals will require that endoscopists have the tools and the training to make accurate *in vivo* pathology predictions.

COLD OR HOT FORCEPS POLYPECTOMY

Polypectomy with cold biopsy forceps is a frequently used technique for the removal of small, sessile, colorectal polyps. A survey of colonoscopic polypectomy practices among clinical gastroenterologists found that the polypectomy technique is highly variable and that cold forceps polypectomy dominated other polypectomy methods for small polyps 1 to 3 mm in size[30]. A randomized, controlled study of standard, large-capacity *vs* jumbo biopsy forceps for the polypectomy of small, sessile, colorectal polyps showed that complete visual eradication of the polyp with one forceps bite was achieved in 78.8% of the jumbo forceps group and in 50.7% of the standard forceps group ($P < 0.0001$)[31]. Biopsies from the polypectomy sites of adenomatous polyps thought to be visually completely eradicated with one bite showed a trend toward a higher complete histologic eradication rate with the jumbo forceps (82.4%) compared to the standard forceps (77.4%), but the difference did not reach significance ($P = 0.62$) and neither approached 100%.

Jumbo forceps may lead to more effective polypectomies because of the larger size of the forceps cup. One challenge associated with cold forceps polypectomies is that after the initial bite, minor bleeding can obscure the polypectomy field, increasing the risk of leaving residual polyp behind. A retrospective study was done to determine the incidence of an incomplete polyp resection despite a perceived complete polypectomy, and post-polypectomy sites of ten polyps (15%) were found to have residual polypoid tissue[32]. Six were removed by standard biopsy forceps, two by jumbo forceps, one by hot snare, and one by cold snare. Compared to other polypectomy devices, standard biopsy forceps were more likely to result in an incomplete resection (27% *vs* 9%, $P = 0.076$).

Hot forceps polypectomy is another option for small polyps; it is similar to cold forceps polypectomy except that it uses electrocautery to try to destroy any residual polyp tissue[33]. However, a retrospectively study of hot forceps polypectomy for 3-6-mm polyps revealed that when a follow-up endoscopic examination was performed 1 to 2 wk later, 11 of 62 sites (17%) contained viable polyp remnants, indicating incomplete treatment[34].

COLD SNARE POLYPECTOMY

The snare resection technique without electrocautery should be considered the primary method for diminutive polyps in the 4-10-mm range. It was reported that the removal of small polyps by cold snaring is associated with a low rate of complications such as bleeding and perforation[30,35,36]. We directly compared cold snare polypectomy with conventional polypectomy for colorectal polyps up to 8 mm[37]. We found that the procedure time was significantly shorter with cold polypectomy *vs* conventional polypectomy (18 min *vs* 25 min, $P < 0.0001$). The complete polyp retrieval rates were identical [96% (97/101) *vs* 96% (100/104)]. No bleeding requiring hemostasis occurred in either group. Abdominal symptoms shortly after polypectomy were significantly more common with conventional polypectomy (20%; 8/40) than with cold polypectomy (2.5%; 1/40; $P = 0.029$).

It was also reported that the rate of histologic eradication for polyps whose mean size was 3.66 mm was significantly higher in the cold snare polypectomy group compared to the cold forceps polypectomy group (93.2% *vs* 75.9%, $P = 0.009$), and the time required for polypectomy was significantly shorter in the cold snare polypectomy group (14.3 s *vs* 22.0 s, $P < 0.001$)[38]. A multivariate analysis revealed that the method of cold forceps polypectomy and the polyp size (≥ 4 mm) were independent predictors associated with incomplete histologic eradication [OR = 4.750 (95%CI: 1.459-15.466), OR = 4.375 (95%CI: 1.345-14.235), all $P < 0.05$, respectively].

We prospectively compared the bleeding risk after cold snare polypectomy with that of conventional polypectomy for colorectal polyps up to 10 mm in anticoagulated patients[39]. No delayed bleeding occurred in the cold snare polypectomy group despite the continuation of anticoagulants, whereas five patients (14%) in the conventional polypectomy group required endoscopic hemostasis ($P = 0.027$). This difference may be based on the phenomenon that the presence of histologically demonstrated injured arteries in the submucosal layer with the cold snare was significantly less frequent than with the conventional snare (22% *vs* 39%, $P = 0.023$).

CONVENTIONAL POLYPECTOMY AND ENDOSCOPIC MUCOSAL RESECTION

A survey of common gastroenterology practices found that conventional polypectomy (hot snare polypectomy) with electrocautery was the preferred method for the removal of polyps 1 cm or greater[40]. The technique of conventional polypectomy is similar to that of cold snare polypectomy up to the point of snare closure. The purpose of electrocautery in polypectomy is to provide

Table 1 Optimal polypectomy techniques for nonpedunculated polyps

Size of nonpedunculated polyp (mm)	Optimal polypectomy technique
1–3	Cold forceps polypectomy
4–10	Cold snare polypectomy
7–14	Conventional polypectomy (hot snare polypectomy)
15–20	Endoscopic mucosal resection (EMR)[1]
≥21	Piecemeal EMR or endoscopic submucosal dissection

[1]Submucosal injection of saline creates a polypoid lesion.

extra power in cutting tissue and/or to prevent bleeding by the coagulation of tissue. The basic principle in electrocautery is that if enough electrical current is delivered, heat will be generated to cause cellular bursting leading to tissue cutting. An Endocut mode has been used in the electrocautery setting for conventional polypectomy. It is suspected that the choice of electrocautery setting would influence the rate of immediate and/or delayed bleeding, but it remains unknown whether the Endocut mode will affect the frequency of postpolypectomy bleeding.

It was recently shown that neoplastic polyps are often incompletely resected and that the rate of incomplete resection varied widely among endoscopists[41]. In that study, after polyp removal by conventional polypectomy was considered to be complete macroscopically, biopsies were obtained from the resection margin. Of 346 neoplastic nonpedunculated polyps (5-20 mm) removed by 11 gastroenterologists, 10.1% were incompletely resected. The incomplete resection rate increased with polyp size and was significantly higher for large (10-20 mm) than small (5-9 mm) neoplastic polyps (17.3% *vs* 6.8%, RR = 2.1), and for sessile serrated adenomas/polyps than for conventional adenomas (31.0% *vs* 7.2%, RR = 3.7). The incomplete resection rate for endoscopists with at least 20 polypectomies ranged from 6.5% to 22.7%. We must take into account the difficulty of the complete resection of nonpedunculated polyps, even if their size ranges from 5 to 20 mm.

EMR is commonly used for the resection of sessile polyps or early adenocarcinoma of the colon. By injecting a cushion of fluid into the submucosal space, the epithelium is separated from the underlying tissues, lifting the lesion up. This makes it safer to remove the lesion using a snare and perform electrocautery[42-44]. There is no official distinction between saline-assisted piecemeal polypectomy and EMR, but the term polypectomy is typically reserved for the removal of flat lesions measuring less than 2 cm, and EMR is used for larger lesions[40]. Iishi *et al*[45] removed 56 sessile colorectal polyps 2 cm or greater in diameter in 56 patients by using an EMR technique; 23 (55%) of the 42 patients treated with piecemeal resection required additional endoscopic or surgical interventions. In their patients followed 1 year or longer after the initial treatment, the cure rate by *en bloc* resection was 100% (14 of 14) and that by piecemeal resection was 83% (35 of 42). The first piece of tissue snared can leave divots or ledges in the remaining polyp that can make it more easily grabbed in subsequent snares. If residual polyp tissue is left after a piecemeal polypectomy, argon plasma coagulation can be used to try to destroy any residual tissue[46]. After piecemeal polypectomy, the site should be reexamined in 3 to 6 mo to identify any residual polyp tissue[47].

ENDOSCOPIC SUBMUCOSAL DISSECTION

ESD is a new technique developed in Japan for the resection of early gastric cancers. ESD for colorectal lesions is associated with lower recurrence rates and better pathological specimens compared to traditional piecemeal polypectomy. However, ESD is associated with high perforation rates, and it is often time-consuming[48]. However, ESD is not widely used with large colorectal lesions because of technical difficulties and possible complications. Japanese investigators have reported on the efficacy and safety of ESD for large colorectal neoplasms in studies including 608 cases of colorectal neoplasm (≥ 20 mm) treated by ESD. Cases were divided by size into 20-49 mm lesion (511 cases) and larger lesions (≥ 50 mm; 97 cases). The average age, lesion size, and procedure time were 67.4 years, 30 mm, and 60 min for the smaller lesions *vs* 67.1 years, 64.2 mm, and 119.6 min for the large lesions. The *en bloc* resection rates were 99.2% and 99.0% (P = 0.80), and the complication rates were 4.1% and 9.9% (P = 0.03). Complications with the smaller lesions consisted of perforations (2.7%), bleeding (1.2%), and ischemic colitis (0.2%). In the larger lesions the complications were perforations (8.2%) and bleeding (1.0%). Two cases with smaller polyps required emergency surgery for perforation, compared to no such cases among the larger lesions. There was no difference in efficacy between the groups; complications were more frequent with the larger polyps but all perforations were successfully managed conservatively. ESD can be effective and safe for large colorectal tumors, though it may be still challenging[49].

OPITIMAL POLYPECTOMY TECHNIQUES

We propose that optimal polypectomy techniques for nonpedunculated polyps should be based primarily on polyp size, including cold forceps polypectomy (1-3 mm), cold snare polypectomy (4-10 mm), conventional polypectomy (7-14 mm), and EMR (15-20 mm) (Table 1). For polyps larger than 21 mm, piecemeal EMR or ESD is preferred. A recent study confirmed that cold forceps polypectomy appeared to be adequate for the resection of diminutive polyps (≤ 3 mm) if no residual tissue is visible by chromoendoscopy[50]. A 10-mm size cutoff for cold snare polypectomy is commonly used based on previous cold-snare studies[51]. However, when it is technically difficult to remove the polyps (≥ 7 mm) using cold snaring, this technique should be switched to conventional polypectomy. There is little data in the literature that demonstrates the advantage of saline injection for polyps > 10 mm. According to our experiences, EMR seems preferable for the removal of larger polyps (⩾ 15 mm).

HEMOSTASIS

Diverticular bleeding is the most common cause of significant lower gastrointestinal bleeding. Although bleeding in approximately 80% of patients with colonic diverticular bleeding stops spontaneously[52], some patients continue to bleed or experience massive bleeding. Endoscopic treatment is effective when the stigma of a recent hemorrhage can be identified[53]. A retrospective study collected data from two tertiary hospitals including 64 patients (61 men, age 76 ± 11 years) with acute severe diverticular bleeding. The goal was primary hemostasis using colonoscopic clipping for diverticular bleeding. Twenty-four of the patients (38%) had diverticular stigmata of recent hemorrhage, and 21 of these patients (88%) were treated successfully using endoscopic clips without complications or early rebleeding. Endoscopic clipping provided primary hemostasis in 9 of 12 patients (75%) with active diverticular bleeding.

ENDOSCOPIC COLONIC DECOMPRESSION

Acute malignant colonic obstruction can be treated endoscopically with self-expanding metal stents which both provide palliation and serve as a bridge to surgery. However, the use of a colonic stent in a malignant colorectal obstruction seems to have no advantage over emergency surgery, as the clinical success rate was significantly higher in the emergency surgery group[54]. Self-expanding metal stents have also been used for the preoperative decompression of acute benign colonic obstruction. Colorectal stents are associated with acceptably low rates of stent perforation, migration and obstruction. The advantages of colorectal stenting includes shorter hospital stays and procedure times and less blood loss. Endoscopic decompression using a transanal drainage tube for the management of acute colorectal obstruction has also been used as a bridge to elective surgery and palliation, regardless of whether the lesion was malignant or benign[55,56]. It has also been suggested that the use of endoscopic transanal drainage tubes may be safer and more cost-effective than the use of self-expanding metal stents.

CONCLUSION

Achieving appropriate bowel preparation and proper luminal distention for endoscopic mucosal imaging remains the key steps enabling an endoscopist to detect colorectal neoplasia as well as predict polyp pathology. Success improves with experience and feedback. In this review we discussed the impact of high-definition colonoscopy, hood-assisted colonoscopy, and dye-based and virtual chromoendoscopy on colorectal polyp detection and prediction. Colonoscopic polypectomy is a continuously evolving therapy and has the potential to further reduce the risk of colorectal cancer. Methods to improve polyp detection rates are needed, and research in this area is active. New instruments and ideas are continually being introduced and tested. The majority of polyps today can be removed endoscopically. Here we discussed techniques of polyp removal with cold forceps polypectomy, cold snare polypectomy, conventional polypectomy, EMR, and EMD, including situations where each is preferred. Colonoscopic hemostasis for acute colonic diverticular bleeding and endoscopic decompression using colonoscopic stenting and transanal tube placement for colorectal obstruction are useful in the appropriate situations.

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