



Complications of colonoscopy

This is one of a series of statements discussing the utilization of gastrointestinal endoscopy in common clinical situations. The Standards of Practice Committee of the American Society for Gastrointestinal Endoscopy prepared this text. In preparing this guideline, a MEDLINE literature search was performed, and additional references were obtained from the bibliographies of the identified articles and from recommendations of expert consultants. When little or no data exist from well-designed prospective trials, emphasis is given to results from large series and reports from recognized experts.

Guidelines for appropriate utilization of endoscopy are based on a critical review of the available data and expert consensus. Further controlled clinical studies are needed to clarify aspects of this statement, and revision may be necessary as new data appear. Clinical consideration may justify a course of action at variance to these recommendations.

Complications of colonoscopy are rare but can be serious and life threatening. In a study involving over 25,000 diagnostic colonoscopies, the overall complication rate (primarily bleeding and perforation) was reported to be 0.35%,¹ which is similar to the 0.3% rate reported in a recent prospective study in 3196 patients.² Colonoscopy with polypectomy carries a higher rate of up to 2.3%.¹ However, this compares favorably with surgical open transabdominal colotomy and polypectomy that carry an overall complication rate of 14% to 20%^{3,4} and a 5% mortality rate.³ True rates of complications in the community setting are difficult to determine because reports of complication rates tend to come from centers with extensive experience. In addition, the latest risk of colonoscopy and polypectomy may be lower because the equipment, electrosurgical techniques, and experience have improved.⁵ Studies of screening colonoscopy in asymptomatic individuals reported major complication rates of 0.2% to 0.3% consisting of bleeding, perforation, myocardial infarction, and cerebrovascular accidents.^{6,7} With the introduction of large multicenter databases, such as the CORI (Clinical Outcomes Research Initiative) project, better estimates of complications should be available in the future. However, although more accurate data may be obtained for immediate postprocedure complications, late complications may still be underestimated because of under-

reporting. There are several methods of colonoscopic polypectomy, including cold biopsy, hot biopsy (i.e., biopsy with cautery), and snare (with and without electrocautery). Argon plasma coagulation has also been used to supplement piecemeal snare polypectomy of large sessile polyps.^{8,9} Complications of colonoscopic polypectomy include the same complications of diagnostic colonoscopy. In addition, complications directly related to the polypectomy include acute or delayed hemorrhage, perforation at the site of polypectomy, and postpolypectomy coagulation syndrome. Sedation-related complications are discussed in the guideline on upper GI endoscopy.¹⁰

RISK FACTORS FOR COMPLICATIONS

A preprocedure history and physical examination may show an increased risk of hemorrhage either because of medication use or underlying coagulopathy. The risk of hemorrhage may be increased with use of pure cut current,¹¹ though in one study of 4735 polypectomies,¹² bleeding occurred at a comparable rate with coagulation or blended current. The rate of postpolypectomy hemorrhage appears to decrease as the endoscopist gains experience.¹³ It is not clear that polyp size is related to the risk of perforation.¹⁴ However, right-sided sessile polyps are thought to present the highest risk of perforation because the colonic wall is thinnest in this area.¹⁵

PREVENTION OF COMPLICATIONS

There is always risk of complications occurring after colonoscopy with or without polypectomy despite the best efforts to prevent them. However, some approaches may minimize the risk of complication occurrence. Proper technique for closing a polypectomy snare requires experience. Undue delay in closure of the snare can result in desiccation of the polyp stalk, making it difficult to fully close the snare. Conversely, failure to allow adequate cautery effect to occur before closing the snare can increase the risk of hemorrhage. In addition, careful attention is required to avoid entrapment of normal bowel mucosa when the snare is closed.¹⁶ Use of saline solution or epinephrine injected at the base of the polyp or under the polyp in order to raise the polyp and increase the degree of separation from the underlying submucosa has been described as a technique to reduce the risk of postpolypectomy

hemorrhage, particularly for large, right-sided sessile polyps, and decrease depth of thermal injury.¹⁷⁻²⁰ Mechanical methods with metallic clips or detachable snares have been used to prevent polypectomy-associated hemorrhage.^{21,22} For patients with coagulopathy, consideration should be given to delaying the procedure or correcting the coagulopathy, as appropriate. Because of the infrequent nature of these complications, there are no controlled trials to demonstrate any benefit of these approaches. Consideration should be given to using mini-snare resection without electrocautery instead of hot-biopsy forceps for the treatment of diminutive polyps to potentially reduce bleeding.²³

PREPARATION-RELATED COMPLICATIONS

Cleansing of the bowel before colonoscopy is performed to allow for visualization of the colonic mucosa. In addition, this preparation decreases the concentration of potentially explosive gases in the lumen. Reports of explosive complications are rare.^{5,24} Although combustible levels of hydrogen and methane gas have been found in up to 10% of patients receiving only standard phosphosoda enema preparation for sigmoidoscopy in one study, none of the patients receiving a polyethylene glycol solution preparation had combustible gas.²⁵ Other studies have found potentially explosive levels of colonic gases in patients receiving a mannitol preparation.^{26,27}

There are two general classifications of bowel preparations: the balanced salt solutions containing polyethylene glycol (PEG) and non-PEG solutions including magnesium citrate and sodium phosphate (oral phosphasoda). In elderly patients or in those with renal impairment or with congestive heart failure, severe life-threatening electrolyte abnormalities or fluid volume abnormalities may occur that can occur with either preparation.²⁸⁻³⁰ Other uncommon complications from oral preparations include vomiting-induced Mallory-Weiss tears,³¹⁻³³ esophageal perforation,³⁴ and pulmonary aspiration.³⁵ Finally, sodium phosphate preparations may cause endoscopic and histologic inflammatory changes in the colonic mucosa that may be confused with inflammatory bowel disease.³⁶ The type of bowel preparation should be individualized to the particular patient.

COLONOSCOPIC PERFORATION

Colonic perforation during colonoscopy may result from mechanical forces against the bowel wall, barotrauma, or as a direct result of therapeutic procedures. Early symptoms of perforation include persistent abdominal pain and abdominal distention. Later symptoms are the result of peritonitis and include fever and leukocytosis. Plain

radiographs of the chest and abdomen may demonstrate free air, though CT scans have been shown to be superior to the upright chest film.³⁷ Therefore, an abdominal CT scan should be considered for patients with an unrevealing plain film in whom there is a high suspicion of a perforation. Rates of perforation may or may not differ with diagnostic versus therapeutic (e.g., polypectomy) colonoscopy. In a survey of over 25,000 diagnostic colonoscopies, the rate of perforation from diagnostic colonoscopy was estimated at 0.2%.¹ In the same survey, polypectomy was performed in over 6000 patients and was associated with a 0.32% rate of perforation. In a report of 5000 colonoscopies, including 1795 snare polypectomies, there were 4 perforations during diagnostic colonoscopies (0.12%) and 2 perforations after attempted polypectomy (0.11%).³⁸ In a retrospective analysis of 1555 polypectomies among 1172 patients, a single silent perforation occurred in one patient who had a 1-cm pedunculated polyp removed with a snare (0.06%).¹⁶ In a series of 1000 colonoscopic polypectomies in 591 patients, there were no perforations,³⁹ whereas perforation was reported in 2 of 777 patients undergoing polypectomy (0.3%) in a series of 2019 polypectomies.⁴⁰ No perforations occurred in 3196 patients undergoing screening colonoscopy in a prospective study.²

HEMORRHAGE

Clinically important postprocedural hemorrhage is defined as lower GI bleeding requiring transfusion, hospitalization, reintervention (such as a repeat colonoscopy) or surgery.² Hemorrhage may occur immediately after polypectomy or can be delayed for as many as 29 days after the procedure.⁴¹ The site of bleeding can be identified endoscopically or through red blood cell nuclear scintigraphy with subsequent arteriography.⁴² Various studies have reported hemorrhage in 0.3% to 6.1% of polypectomies.^{2,11} In an ASGE survey, the rate of bleeding was 0.09% among over 25,000 diagnostic colonoscopies and 1.7% among over 6000 patients undergoing colonoscopic polypectomy.¹ Hemorrhage occurred after snare removal of 48 polyps in a series of 1795 polypectomies (2.7%).³⁸ In one report, bleeding occurred in 0.64% of polypectomies (0.85% of patients) and required transfusions in 3 of 10 patients.¹² Another series reported 8 minor bleeding episodes occurring in 591 patients (1.4%) undergoing 1000 polypectomies.³⁹ Other investigators reported immediate postpolypectomy hemorrhage in 1.5% of patients and delayed bleeding in 1.9% of patients.⁴⁰ Although there may be differences in the bleeding rates after hot biopsy, cold snare, and snare with electrocautery, there are no studies to confirm this.

POSTPOLYPECTOMY COAGULATION SYNDROME

Electrocoagulation injury to the bowel wall has been reported to induce a transmural burn in approximately 0.51% to 1.2% of patients undergoing polypectomy, which may result in the postpolypectomy coagulation syndrome.^{16,40} Typically, patients with this syndrome present 1 to 5 days after colonoscopy with symptoms of fever, localized abdominal pain, peritoneal signs, and leukocytosis. Free air is absent from radiographic studies. Five of the 6 reported cases in one series had polyps in the right side of the colon and all were sessile lesions.¹⁶ It is important to recognize this entity because it does not require surgical treatment.

MISCELLANEOUS COMPLICATIONS

Miscellaneous rare complications of colonoscopy include splenic rupture,⁴³ acute appendicitis,⁴⁴ and tearing of mesenteric vessels with intraabdominal hemorrhage. Chemical colitis may occur if glutaraldehyde, used during disinfection, has not been adequately rinsed from the endoscope.⁴⁵ Complications of colonoscopic polypectomy also include bacteremia,⁴⁶ retroperitoneal abscess,⁴⁷ subcutaneous emphysema,^{48,49} snare entrapment, and ensnarement of adjacent, normal bowel.¹⁶ Death has also been rarely reported in relation to colonoscopy, with or without polypectomy. In a review of colonoscopy and sigmoidoscopy, 5 deaths were reported in 83,725 procedures (0.006%).⁵⁰

TREATMENT OF COMPLICATIONS

Surgical consultation should be obtained in all cases of free perforation. Although perforation often requires surgical repair, nonsurgical management may be appropriate in selected individuals.⁵¹ Patients with silent perforation or those with localized peritonitis without signs of sepsis that continue to improve with conservative management may avoid surgery.^{52,53} Laparoscopic repair of these perforations may be feasible.⁵⁴ The so-called "mini-perforation" is characterized by early presentation (within 6-24 hours after polypectomy), local pain, and tenderness, without signs of diffuse or spreading peritoneal irritation.⁵⁵ These patients are treated with bowel rest, intravenous antibiotics, and frequent serial examinations for clinical deterioration. Although there are reports of closing perforations with clipping devices,⁵⁶ this cannot be recommended at the present.

Acute postpolypectomy hemorrhage is often immediately apparent and amenable to endoscopic therapy. In addition to standard endoscopic modalities (e.g., injection therapy, thermocoagulation, and electrocoagulation) for GI bleeding, recently band ligation,⁵⁷ EndoLoop application, and use of endoscopic

clipping devices have been described.⁵⁸ Nonendoscopic treatment modalities include angiographic embolization and surgery.⁵⁹ Management of postpolypectomy bleeding does not always require admission to the intensive care unit.⁵⁹

Postpolypectomy coagulation syndrome is usually managed with intravenous hydration, broad-spectrum parenteral antibiotics, and nothing by mouth until the symptoms subside.¹⁶ Successful outpatient management with oral antibiotics has also been reported.⁴⁰

COLONOSCOPIC TATTOOING

When a lesion is found that is not going to be removed endoscopically, or needs to be relocated for endoscopic follow-up, the use of a permanent dye (e.g., India ink) in order to "tattoo" the colon adjacent to the lesion can aid with subsequent localization during surgical resection or follow-up colonoscopy. Given the permanent nature of the ink injection, there has been concern about the safety of this procedure. In a study of 55 patients with India ink tattoos placed an average of 36 months before biopsy during re-examination, only mild chronic inflammation was found in 6 patients and hyperplastic change in one patient.⁶⁰ In a study of 7 patients undergoing surgical resection 1 day to 7 weeks after tattooing, histologic changes included necrosis, edema, and neutrophilic infiltration in the submucosa and muscularis propria.⁶¹ Colonic abscess with peritonitis has been reported after India ink tattooing.⁶² In a review of this topic, the overall risk of a clinical complication of tattooing has been estimated at 0.22%.⁶³ In animals, the use of diluted India ink ($\geq 1:100$ dilution) was visible endoscopically, laparoscopically, and at laparotomy 7 days and 1 month after injection without producing significant histologic changes.⁶⁴ Recent study of a new carbon-based permanent marker reported no complications in 188 injections in 113 patients.⁶⁵

SAFETY OF BARIUM ENEMA AFTER FAILED COLONOSCOPY

Patients who are adequately prepped but have an incomplete diagnostic colonoscopy should be considered for barium enema the same day, assuming an endoscopic perforation has not occurred.⁶⁶ It appears that this approach may be unsafe when barium enema is performed within 5 days of colonoscopic polypectomy or deep colon biopsy (other than in the rectum).^{67,68} However, there are sparse data addressing this important issue. Additionally, it is unclear whether CT colonography ("virtual colonoscopy") can be performed safely in the immediate postpolypectomy setting.

SUMMARY

Endoscopic complications are rare but inevitable, occurring in fewer than 0.35% of procedures [B]. Knowledge of potential complications and their expected frequency can lead to an improved informed consent process [C]. Complications from the procedure include perforation, hemorrhage, postpolypectomy coagulation syndrome, infection, preparation-associated complications, and death, and are more likely to occur with therapeutic procedures rather than diagnostic procedures [B]. Risk factors for polypectomy-associated complications include the location and size of the polyp, experience of the operator, polypectomy technique and possibly the type of electrocoagulation current used [B]. Use of saline solution injection under large sessile polyps decreases depth of thermal injury [A] and may decrease complications [B]. Early recognition of complications and prompt intervention may decrease patient morbidity [C]. Treatment of complications range from supportive for postpolypectomy coagulation syndrome, to repeat colonoscopy with injection or electrocoagulation for bleeding, to surgical repair for free perforation [B]. Consideration of the risks and benefits may improve clinical outcome by identifying potential complications and taking appropriate steps to minimize the risks [C].

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A, Prospective controlled trials. B, Observational studies. C, Expert opinion.

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