

Utility and techniques of intraoperative endoscopy and interventions

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ABSTRACT

Intraoperative endoscopy is an indispensable tool for gastrointestinal surgery. Advent of CO₂ endoscopy has allowed for incremental expansion of its applications. With experienced endoscopist surgeon and operating room staffs, intraoperative endoscopy can be done without added morbidity in time-efficient manner, while providing value in diagnosis and treatment. Intraoperative endoscopy has long been used to localize small tumor when palpation and preoperative endoscopic tattoo do not clarify the precise location of the tumor. It can be used to ascertain distal transection point in rectum, to assess integrity and perfusion of pelvic anastomosis, to aid in laparoscopic sleeve cecectomy or combined endo-laparoscopic surgery (CELS), and to localize small intestine bleeding. Intraoperative endoscopy is invaluable in the case of anastomotic leak and bleeding. Utility of intraoperative endoscopy is expected to grow as new device and platform become available.

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Introduction

Among common misconceptions regarding the use of colonoscopy during colon and rectal surgery had been¹: it is time-consuming,² it interferes with subsequent surgery and increases morbidity due to bowel distension, and³ it may weaken freshly constructed anastomosis. A wealth of experience has shown that it can be done safely without added morbidity and efficiently.^{1,2} Carbon dioxide is reabsorbed 150 times faster than atmospheric air, so that even in laparoscopic colon surgery, it does not compromise operative field shortly after intraoperative colonoscopy was used.² Nakajima et al.² has also shown that use of CO₂ colonoscopy concomitant with CO₂ insufflation of abdomen during laparoscopic colon surgery did not increase patients' end-tidal CO₂. To perform intraoperative colonoscopy efficiently, at least one CO₂ colonoscopy tower should be stationed in operating room corridor, not in endoscopy suite, along with routine supplies such as clips, snares, and endoscopic needle. Circulating nurse should be facile with setting up scope and with assisting. It is important that surgeon is familiar with setting up the scope and trouble-shooting, in case experienced staff is not available. Most common indication for intraoperative colonoscopy is localization of tumor when preoperative tattooing was not done or not visible.³ However, indications have grown over the past two decades and are expected to expand, as new tools and platforms are developed.

The goal of this article is to describe current indications where intraoperative colonoscopy adds value to colorectal surgery.

Equipment and setup

Whenever intraoperative colonoscopy is anticipated, a colonoscopy tower is brought into the operating room before a case starts, and proper connection is checked. It is important to check CO₂ tank to ensure there is enough gas left. When CO₂ is connected, "air" in the main control should be turned off. [Figure 1](#) shows a colonoscopy tower author's group uses at our institution. It is preferable that it is connected to endoscopy software that can be edited afterwards. If not, color printer should be available for medical documentation.

Authors routinely prepare patients with mechanical bowel prep and place all laparoscopic colectomy patients in lithotomy position for access.

Intraoperative tumor localization

When interpreting outside colonoscopy, caution is needed regarding precise location of the tumor. Cecal or ascending colon cancer, whose picture contains relevant colonoscopic landmarks, such as ileocecal valve, leaves no room for doubt. In contrast, "transverse colon" or "descending colon" tumor could be located anywhere from sigmoid colon to proximal transverse colon, depending upon tortuosity of colon and degree of looping. The location of endoscopic tattoo in the report should be noted as well.

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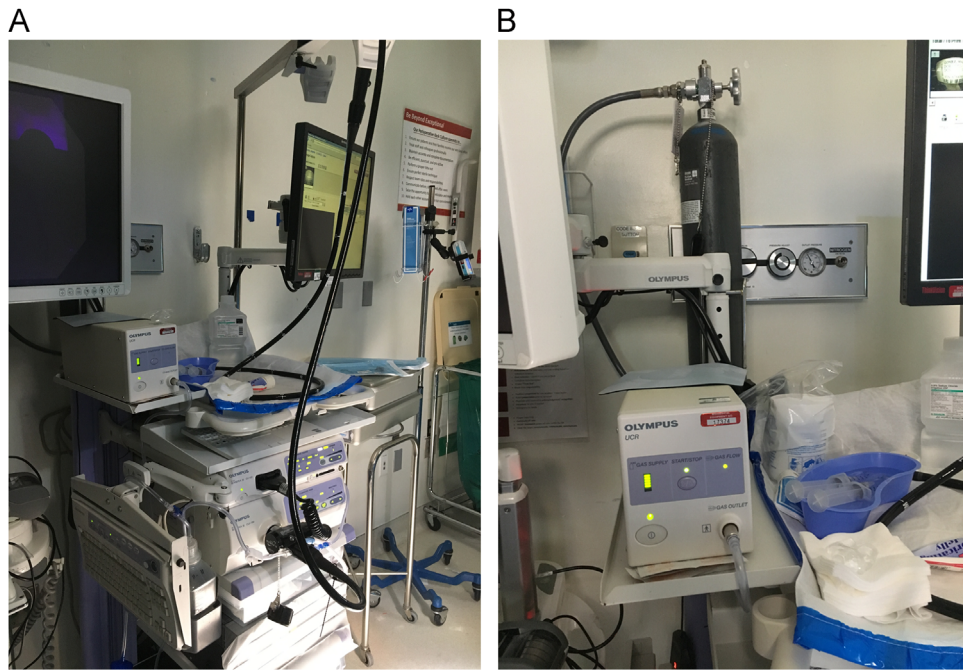


Fig. 1. Typical setup of colonoscopy tower with CO₂ insufflator.

For example, transverse colon tumor that was tattooed both proximally and distally to the tumor should raise flag. Frequently, some tattoos are not visible from operative view for various reasons. If only one of the two tattoos is visible, the precise location of the tumor is far from certain. Authors routinely perform flexible sigmoidoscopy for rectal and sigmoid cancer. Depending upon body habitus, some tumor that was measured 20 cm from anus in the report could in fact be located in upper rectum, in which case preoperative chemoradiation could be considered for locally advanced tumor. Unless tumor is located in undisputable location, such as cecum and rectum, or in case of locally advanced, bulky tumor, it is prudent not to place all trocars until precise location is confirmed. If the tumor is not localized, intraoperative colonoscopy should be performed. Blind resection based on colonoscopic impression or colonoscopy report should not be done. Reports of wrong segment resection can be found in literature⁴ and can be devastating. With intraoperative colonoscopic direct visualization of the tumor, there is no question on the location of the tumor. A laparoscopic clip, suture, or tattoo can facilitate identification, if the point of transection will be done later in the operative procedure.⁵ Occasionally, intraoperative colonoscopy with pneumoperitoneum could be difficult with excessive looping. Change in patient position to lateral decubitus or manual abdominal pressure to minimize looping, maneuvers common in endoscopy suite, cannot be done intraoperatively with pneumoperitoneum. One could try to help laparoscopically (hold down sigmoid colon with bowel grasper to minimize looping), or alternatively, remove laparoscopic instruments and pneumoperitoneum and place manual abdominal pressure.

Ascertaining distal margin in pelvic surgery

Intraoperative colonoscopy is also useful in ascertaining adequate distal margin for upper rectal cancer where the tumor is not easily palpable through rectal examination and a partial mesorectal excision is being performed. In this case, a surgeon partially clamps the planned transection point with stapler while the assistant visualizes with colonoscope. Once CO₂ is suctioned

and distal rectum is irrigated with betadine, if desired, the stapler is closed and fired.

In reoperative surgery, where distal resection point should be distal to the previous colorectal anastomosis to ensure adequate blood supply (in a case where IMA pedicle was taken at index operation and the descending colon proximal to the anastomosis depends on marginal artery for its blood supply), visualization of previous EEA staple line with intraoperative colonoscopy is crucial to prevent a devascularized segment and increased risk of anastomotic leak.⁵

Screening colonoscopy during colon resection or anorectal procedure

When preoperative colonoscopy was not done due to diverticular stricture or near-obstructing tumor in elective resection (when bowel prep is still possible), there are two options; first is to perform screening colonoscopy within 3–6 months.⁶ The rate of synchronous colon cancer is relatively low, even though likelihood of finding adenomatous polyp can be as high as 24%.^{7,8} Alternative is intraoperative colonoscopy. Colonoscopy after anastomosis is completed is preferred. In this case, anastomosis needs to be stabilized by hand during colonoscopy to prevent undue tension on the anastomosis. After colonoscopy is completed, air leak test is repeated to ensure that the integrity of newly constructed anastomosis was not compromised. It is author's preference to choose early postoperative colonoscopy, unless risk of synchronous cancer is high, or patient's compliance is in doubt. If colonoscopy is planned, hand-assisted laparoscopic surgery (HALS) is done to use the hand port for manual stabilization.

Screening colonoscopy during hemorrhoidectomy for bleeding is not only indicated but also beneficial to patients in that it saves them another sedation and procedure. The patient is being placed in left lateral decubitus position during colonoscopy then switched to lithotomy (or prone) position for hemorrhoidectomy.

Intraoperative assessment of left-sided anastomosis

Traditionally, the integrity of left-sided colonic anastomosis has been checked either by instilling saline solution or by insufflating

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