

## **Lesson S12: PreAnesthetic Assessment of the Patient for Colonoscopy**

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**TIME TO COMPLETE ACTIVITY:** 2 hours

**RELEASE DATE:** May, 2010

**TERMINATION DATE:** May 31, 2011

**TARGET AUDIENCE:** Anesthesiologists

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### **Needs statement**

Colonoscopy is commonly used for routine cancer screening and therapeutic intervention of colorectal pathologies. Many anesthesiologists work in ambulatory surgical or office based settings and it has been estimated that up to 10% of anesthetics administered in the USA are for gastrointestinal examinations. Although these ambulatory procedures are not associated with significant morbidity or mortality, complications can arise. Patients are often elderly and may be taking multiple medications. Physicians should be knowledgeable of the required patient preparation and be able to assess the risks and benefits of sedation so that patients can be appropriately selected.

### **Learning Objectives**

At the end of this activity, the participant should be able to:

1. Describe the bowel preparation performed prior to colonoscopy.
2. Understand drug dosing and techniques for relief of discomfort and/or pain related to colonoscopy.
3. List complications of bowel preparation.
4. Recognize and treat complications of iatrogenic electrolyte imbalance in this population.
5. Describe the requirements of the endoscopist performing the procedure.

6. Identify patients who are not candidates for the test on an outpatient basis.
7. Define discharge criteria for patients who have undergone colonoscopy.
8. Recognize complications of colonoscopy.
9. Outline appropriate preoperative tests.
10. Formulate a perioperative plan.

### Case History

A 73 year old woman presented to the outpatient clinic for routine colonoscopy. She gave a history of hypertension and type 2 diabetes. Medications included furosemide, simvastatin, glyburide, aspirin and amlodipine. She stated that she was anxious about the procedure and admitted that she had noticed some bleeding recently after defecation. Family history included a father who died of colon cancer at the age of 63. Blood pressure was 175/105, pulse 62. Blood glucose level by finger stick was 225mg/dl.

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### Introduction

Gastrointestinal (GI) procedures are performed in a variety of settings such as the intensive care unit, emergency room, operating room, hospital or ambulatory surgical endoscopy suites and offices. Colonoscopy is an important tool for monitoring, preventing, and diagnosing gastrointestinal diseases ranging from inflammation of the GI tract to colon cancer. A coordinated effort between the nursing staff, internist, anesthesiologist and gastroenterologist is essential to ensuring patient safety and maximizing efficiency.

### Indications for Colonoscopy

The decision to perform colonoscopy must consider cost, risk, and accuracy of diagnostic alternatives. Colonoscopy procedures can be diagnostic or therapeutic; high-risk or low-risk; and high-yield or low-yield.

Colonoscopy is a valuable diagnostic tool that allows acquisition of good quality tissue samples through optimum exposure to mucosal tissue in the anal canal and terminal ileum. Other cost-effective diagnostic methods include barium enema examination and virtual colonoscopy, but these are most appropriate when it is not necessary to directly visualize the canal or perform a biopsy. The indications for therapeutic use of colonoscopy (i.e. polypectomy) are more widely accepted since the cost, morbidity rate, and mortality rate of this procedure are lower than the alternative of surgery. Age, diet, and family history all may influence risk stratification for cancer or other pathophysiology of the GI tract.

Before performing colonoscopy, the patient's risk for perforation should be determined, and a risk-benefit analysis assessed. Examples of high risk colonoscopic procedures include decompression of acute colonic pseudoobstruction, polypectomy of large polyps, stent placement, and dilation of colonic strictures. Perforation in patients who are at high anesthetic risk (ASA 3 or more), have a significantly longer hospital stay (i.e., 23 days versus 12 days in those that are ASA 1-2) and a poor prognosis (17%

mortality versus 0.065%). Colonoscopy for screening purposes of asymptomatic average-risk persons has a risk of perforation of about 0.06% (5 perforations in 7,804 patients).<sup>2</sup>

Indications for colonoscopy can also be classified according to the expected yield for diseases such as neoplasia. Rectal and colonic bleeding is among the highest-yield indication for colorectal cancer. Conversely, many screening procedures as well as postpolypectomy and ulcerative colitis surveillance are considered to be relatively low-yield indications. [Table 1.]

Indication	Procedures to Detect Cancer
Two Consecutive positive FOBT*, neither rehydrated	2.7
Rectal bleed, non-emergency	8.9
Acute lower GI hemorrhage	11.8
Iron-deficiency anemia	13
Positive FOBT*, rehydrated	45
Screening average-risk males 60 yrs	64
Surveillance after cancer resection, anastomotic recurrence	74
Surveillance after cancer resection, metachronous cancer	82
Screening average-risk people 50 yrs	143
Screening positive family history, prospective studies only	286
Postpolypectomy surveillance	317

\* FOBT - Fecal Occult Blood Test  
 Adapted from Waye JD, Rex DK, Williams CB. Colonoscopy: Principles and Practice. Malden, MA: Blackwell Publishing Ltd.; 2003; 102

As age increases, the yield of colonoscopy increases because of an increased likelihood of polyps and an increased incidence of colorectal cancer. In a 2002 study, gender was also shown to have an affect on colorectal cancer, as the frequency of large polyps and colorectal cancer were found to be significantly lower in females than in males.<sup>3</sup>

Bleeding as an indication for colonoscopy is associated with a high prevalence of early stage cancer. In such a circumstance, early intervention can improve survival rate. A colonoscopy is generally recommended for patients aged 40 or older who present with positive fecal occult blood test. Recent studies have also demonstrated the cost-effectiveness of distal colon visualization followed by full colonoscopy for patients suffering from rectal bleeding who are aged 20-30.<sup>4</sup>

Colonoscopy is indicated for other disease processes. For patients with chronic diarrhea, a biopsy should be performed to check for collagenous or lymphocytic colitis. The yield for this type of disease is 5-15%, with an increased prevalence in older females. Abdominal pain without bleeding is usually not associated with colorectal cancer. However, abdominal pain coupled with chronic diarrhea may require a colonoscopy to exclude the presence of Crohn's disease. Colonoscopy is also indicated when there are positive findings on radiographs and sigmoidoscopy. Such findings may include filling defects detected by barium enema and virtual colonoscopy, colonic strictures seen in radiographic imaging, and colonic thickening viewed on abdominopelvic CT scans.

Colonoscopy is widely used for colorectal cancer screening. According to guidelines outlined by The American College of Gastroenterology, colonoscopy is listed as the most effective screening tool for colorectal cancer, assuming the proper resources and professional expertise are available to correctly perform the procedure. In a study published in The New England Journal of Medicine comparing the sensitivity of barium enema and colonoscopy, barium enema detected polyps in only 39% of cases that were detected by colonoscopy.<sup>5</sup>

### Contraindications

Before performing a colonoscopy, the patient should be carefully evaluated for contraindications to the procedure. Contraindications to colonoscopy can be classified as either absolute or relative. Toxic megacolon, fulminant colitis, and a perforated viscus open to the peritoneal cavity are absolute contraindications. Relative contraindications are ones in which significantly increase risk of an adverse outcome such as acute diverticulitis, recent myocardial infarction or pulmonary embolism, and pregnancy. [Table 2]

<b>ABSOLUTE</b>	<b>RELATIVE</b>
Toxic megacolon	Acute diverticulitis
Fulminant colitis	Recent MI
Perforated viscus	Pulmonary embolism
	Pregnancy

### Preparation

To improve the accuracy of diagnosis and reduce the risk of complications, the colon must be adequately cleansed before a colonoscopy is performed. A study of 400 colonoscopies showed that efficient colon cleansing is cost effective. Inadequate bowel preparation resulted in extra time spent to suction and wash the mucosa to achieve satisfactory exposure and also led to more aborted examinations and earlier repeat surveillance.<sup>6</sup> The average cost increased by 12% and 22% in university and public hospitals studied, respectively

Several bowel cleansing methods are approved for colonoscopy preparation. Polyethylene glycol (PEG) has been considered to be the "gold standard" for bowel preparation.<sup>11</sup> It is a nonabsorbable solution which passes through the bowel without net absorption or secretion. Significant fluid and electrolyte shifts are therefore avoided. However, the large volume (4 liters), the salty taste and the sulphur smell

frequently lead to poor tolerability and compliance, sometimes resulting in inadequate bowel preparation. Several other bowel cleansing preparations have been developed and include sodium phosphate (NaP), magnesium citrate, and sodium picosulphate plus magnesium oxide (PSMC)-containing preparations. NaP is a low volume hyperosmotic solution which draws plasma water into the bowel lumen to promote colonic cleansing. As a result, significant fluid and electrolyte shifts can occur. The advantage of the low volume is better patient tolerance compared to PEG. However, even in healthy individuals electrolyte disturbances may result when the 2 required doses are taken 12 hours apart. Patients with renal failure, congestive heart failure and liver failure should avoid this preparation. PSMC is a hyperosmotic saline laxative which increases intraluminal volume resulting in increased intestinal motility. Magnesium, a constituent of PSMC, stimulates the release of cholecystokinin which also stimulates intestinal motility. Since magnesium is eliminated by the kidney, patients with renal insufficiency or failure should avoid this preparation.

Dietary methods for colon cleansing include a 24 regimen of clear liquids, laxatives, and enemas. Regardless of the method used, the patient must be thoroughly instructed on the cleansing procedure and must adhere precisely to the guidelines for preparation to be effective.

None of the approved bowel preparations are fully compliant with the three essential criteria of efficacy, tolerability, and safety. This was described in a consensus document prepared by three leading American gastrointestinal societies – the American Society of Gastrointestinal Endoscopy, the American Society of Colon and Rectal Surgeons and the Society of American Gastrointestinal and Endoscopic Surgeons - as well as a position paper by the Canadian Association of Gastroenterology.<sup>7</sup> Randomized controlled trials have compared the efficacy and tolerability of various bowel cleansing regimens.<sup>8-11</sup> Studies comparing full-volume (i.e. 4 liters) PEG with low-volume (i.e. 2 liters) PEG combined with magnesium citrate or bisacodyl have demonstrated equal efficacy of colonic cleansing but with improved patient tolerance with the low-volume regimen. However, there is little data on how low volume PEG compares with sodium phosphate (NaP).<sup>10-11</sup> A meta-analysis of twenty nine trials on optimal bowel preparation concluded that NaP was more effective in bowel cleansing than 4-liter PEG or sodium picosulphate plus magnesium oxide (PSMC)-containing preparations. Three of the trials compared NaP to PSMC and met inclusion and exclusion criteria but results were conflicting. Three trials compared PEG to PSMC with inconclusive data. Moreover, the sample population of patients per trial was small ranging from 223 a maximum of 500.

The United States Food and Drug Administration has warned of increased risk of complications from bowel preparation for patients who have congestive heart failure, renal insufficiency, gastrointestinal obstruction, bowel perforation, colitis, megacolon, ileus, dehydration, ascites, gastric retention, inability to take fluid orally, or patients taking medications or diuretics that might affect electrolyte balance.<sup>1</sup> Also, Food and Drug Administration required manufacturers of two oral sodium phosphate products (Visicol<sup>®</sup> and OsmoPrep<sup>®</sup>) to add a boxed warning because of the risk of acute phosphate toxicity. Regardless of the type of preparation used, adequate hydration is essential.

There is a low incidence of bacterial infection as a complication of colonoscopy particularly if endoscopic equipment is not properly cleaned and disinfected prior to use.<sup>1</sup> Despite the large number and variety of GI endoscopic procedures performed, documented instances of infectious complications remain rare, with an estimated frequency of 1 in 1.8 million procedures.<sup>1</sup> Microorganisms may be spread from patient to patient by contaminated equipment (exogenous infections). Microorganisms may also spread from the GI tract through the bloodstream during an endoscopy to susceptible organs or prostheses, or may spread to adjacent tissues that are breached as a result of the endoscopic

procedure (endogenous infections). The American Heart Association created guidelines for antibiotic prophylaxis for prevention of bacterial endocarditis in patients at risk of this complication.<sup>1</sup>

Even in the case of infection, serious complications are seldom observed.<sup>1</sup> However, because of the risk of infection, it is essential that protocols for reprocessing endoscopic equipment be carefully followed and reviewed periodically.

### Anticoagulant considerations

Patients receiving anticoagulant and antiplatelet therapy require careful management when preparing for colonoscopy. Decisions regarding suspending therapy for the procedure must be made. The risks associated with discontinuing the therapy, such as thromboembolism, must be weighed against the risk of gastrointestinal hemorrhage related to the procedure. In 2002, the American Society of Gastrointestinal Endoscopy (ASGE) presented guidelines for the management of anticoagulation based on classifying endoscopic procedures as either high or low risk (Table 3).<sup>1</sup>

**TABLE 3: American Society of Gastroenterologists Guidelines**

	<b>Low Risk of Thromboembolism</b>	<b>High Risk of Thromboembolism</b>
<b>High Procedural Risk</b>	Discontinue warfarin 3-5 days before colonoscopy, reinstitute after procedure.	Discontinue warfarin 3-5 days before colonoscopy. Consider heparin while INR is below therapeutic level.
<b>Low Procedural Risk</b>	Delay elective procedures while INR is in supratherapeutic range, no change in anticoagulation therapy.	Delay elective procedures while INR is in supratherapeutic range, no change in anticoagulation therapy.

Adapted from Wayne JD, Rex DK, Williams CB. Colonoscopy: Principles and Practice, Malden, MA: Blackwell Publishing Ltd.; 2003; 225

A recent study examined the risk of bleeding following polypectomy in patients taking clopidogrel.<sup>18</sup> When compared to patients who were not receiving the medication, patients receiving clopidogrel demonstrated the same rate of immediate intraprocedural bleeding (i.e. 2.1% in each group). Delayed bleeding was higher in the anticoagulated group (3.5% vs 1%) as was the chance of hospitalization and transfusion (2.1% vs 0.4%). There was no mortality. Clopidogrel use combined with aspirin and a higher number of polyps removed were significant risk factors but clopidogrel alone was not. In a 2002 retrospective review of 109 colonoscopies in which patients discontinued warfarin three days prior to the procedure, only one case involving hemorrhagic complications was recorded.<sup>19</sup>

Other case studies identified patients who developed thrombosis after anticoagulation therapy was discontinued for a short period of time.<sup>20</sup>

## Preoperative Laboratory Testing

Preprocedure laboratory tests are generally not required. Laboratory studies should be requested only if indicated by abnormalities in the patient's history and physical examination especially if the finding will alter patient management (e.g., patient has been bleeding recently and may be anemic). Preoperative and perioperative blood glucose levels should be measured for diabetic patients. Unless indicated by physical examination chest X-ray is not indicated at any age.

## Sedation Plans

Although there is debate about whether sedation is obligatory for colonoscopy, studies indicate that patients usually desire sedation.<sup>21</sup> Proper sedation can contribute positively to patient comfort and satisfaction and can serve to improve study performance and patient recovery.<sup>22</sup> Studies have found the combination of propofol and demerol to be advantageous, although the latter drug is generally not used as part of an anesthetic technique in the United States.<sup>23</sup> A study comparing propofol with midazolam/fentanyl for outpatient colonoscopy showed that patient receiving propofol experienced a faster and deeper sedation, recovered sooner and were discharged earlier than those given midazolam/fentanyl.<sup>24</sup> Propofol for sedation is a popular choice due to its effectiveness and low risks under the care of appropriately trained anesthesiologists.<sup>25</sup> Other anesthesiologists have noted that small doses of ketamine provide good analgesia with rapid recovery, especially in combination with propofol. If midazolam is used, it must be remembered that pharmacodynamics are altered in the older population and recovery may be greatly delayed if more than 1 - 2mg are used.

The goal of sedation during colonoscopy is the reduction of patient movement. Studies have shown that the use of the cardiovascular index known as CARDEAN and beat by beat cardiovascular monitoring (Finapres®) were associated with a 51% reduction of clinically unpredictable movements in unparalyzed patients.<sup>26</sup>

Studies examining patient-controlled sedation (PCS) with propofol and nurse-administered propofol sedation (NAPS) reveal that both methods achieve the same level of safety. Similar results were reported for sedation controlled by endoscopists.<sup>27,28,29</sup>

Music customized to the patient's preference combined with sedation has been shown to reduce anxiety, heart rate, and blood pressure in a meta-analysis of 8 studies.<sup>30</sup> Patient education regarding the procedure may also improve outcome. Ketamine is often used for children undergoing GI endoscopy. Different combinations of sedative agents were tested in 402 pediatric procedures. The combinations were the following: 1) midazolam and meperidine, 2) midazolam, meperidine, and ketamine, 3) midazolam and ketamine. The results showed that the highest level of efficacy and safety was achieved with the combination of midazolam and ketamine.<sup>31</sup> Pediatric sedation could also be accomplished by combining mask anesthesia with an inhalational agent.

## Review of the procedure

One full day before the procedure, patients are placed on a clear liquid diet. Patients are instructed to begin drinking a mixture of 238 – 255 grams of PEG dissolved in 64 ounces of clear fluid. The patient must drink 8 ounces of the mixture every 10 – 15 minutes until the entire 64 ounces is consumed. The night before, patients undergo a fast. This regimen is used to clean and prepare the colon for a successful colonoscopy. A 1-day PEG 3350 regimen has been used successfully in children.<sup>32</sup>

Sodium phosphate tablets have been tested and are concluded to be just as effective and better tolerated with probably fewer side effects.<sup>33</sup> However, there have been rare, but serious reports of acute phosphate nephropathy in patients who received oral sodium phosphate products for colon cleansing prior to colonoscopy. Some cases have resulted in permanent impairment of renal function, and some patients required long-term dialysis. While some cases have occurred in patients without identifiable risk factors, patients at increased risk of acute phosphate nephropathy may include those with increased age, hypovolemia, increased bowel transit time (such as bowel obstruction), active colitis, or baseline kidney disease, and those using medicines that affect renal perfusion or function (such as diuretics, angiotensin-converting enzyme [ACE] inhibitors, angiotensin receptor blockers [ARBs], and possibly nonsteroidal antiinflammatory drugs [NSAIDs]).

A study examining the safety of propofol in 97 outpatients using sodium phosphate tablets for colonic cleansing showed that there were no incompatibilities.<sup>34</sup> Some patients experienced intravascular volume contraction treatable with carbohydrate-electrolyte rehydration.

Video colonoscope is the most common type of equipment used. It has an outer polymer layer that allows flexibility and elasticity to maneuver through a tortuous bowel without twisting. A variable stiffness colonoscope has been developed to adjust flexibility according to the conditions of the bowel.

The video camera lens is located at the distal end of the colonoscope and is controlled by finger controls located at the proximal end of the scope. The image is transmitted to an external video source. Fiber optics transmit light from an external source. Proper illumination of the bowel and proper exposure for video quality is regulated by the camera's automatic lens aperture. In addition, the colonoscope is equipped with solid-state image sensors called "charge-coupled devices" (CCD) that capture the light reflected back from the bowel tissue and send integrated signals to a video screen to construct the image. Special CCDs called "color chips" contain a multicolored filter to resolve the image into its component primary colors.

Finger controls are also used for regulation of air, water, and suction systems. The endoscopist can release air to insufflate the colon for better viewing. Similarly, the endoscopist can expel water from an external water source when a valve is depressed. Suction is available to remove air or water from the lumen.

A magnetic three-dimensional imaging system can assist the endoscopist in accurately determining the position of the colonoscope and locating problematic loops of bowel.<sup>35,36</sup> This is accomplished through internal sensor coils that detect low-frequency magnetic pulses emitted from a specially equipped table upon which the patient is positioned. Signals are deciphered by a computer to produce a 3-D display of the colon.

Endoscopes have a wide range of accessories for specific functions such as polypectomy, biopsy, image enhancement, and ablation. Polypectomy snares consist of a wire loop within a polymer sheath. The snare is passed through an accessory channel in the colonoscope and is manipulated using a handle connected to the end. The polyp is released into a retrieval device. Similarly, biopsy forceps can be used to sample and retrieve tissue for further examination. Other accessories that can be passed through the colonoscope's accessory channel include injection needles to inject the tissue with a desired solution, spray catheters which spray dyes onto the bowel tissue to enhance its visibility, and thermal devices which are used for tissue ablation.



## The endoscopy suite

In the admitting area, provisions are made for securing the patient's clothing and valuables. Patient identification is performed, as well as a properly executed consent, history and physical examination, and review of any indicated laboratory tests. Baseline vital signs are recorded. Details of medications, allergies, oral intake status and next of kin should also be obtained. Another adult must be present to accompany the patient on discharge. Also, it is advisable that the patient should not be alone for several hours after the procedure and arrangements should be made with a family member or friend to accompany the patient home. Frequently a vein is cannulated in the holding area and a small amount of sedation is given at that time.

Colonoscopy is performed by inserting an endoscope into the anal canal and navigating it through the bowel from the rectum to the ileocecal junction. The endoscope contains a camera lens so that the whole procedure can be visualized in detail on a television screen. Although specific techniques might vary depending on the standards of the institution or because of physician personal preference, some general principles should be followed. Basic monitoring such as pulse oximetry, heart rate and blood pressure should be applied. Once the patient is positioned either on the left side or in a supine position, the physician lubricates the anal canal and relaxes the anal sphincters. The distal 10cm of the endoscope is also lubricated and inserted obliquely into the anus while the physician supports the bending section with his forefinger. Once inside the rectum, the physician rotates and angulates the endoscope to clearly visualize the lumen of the rectum. Fluid and residue can be aspirated at this or any other stage of the procedure. Once the rectum has been clearly visualized, the physician slowly navigates the endoscope through the following sections: sigmoid colon, descending colon, transverse colon, ascending colon, and cecum. When necessary to improve vision, the physician can insufflate or aspirate the section of bowel using the controls at the end of the endoscope. Navigation should be slow and exact, and the physician may move the endoscope in a retrograde direction to review specific areas. Caution needs to be exercised when traversing the sigmoid-descending colon junction, splenic and hepatic flexures, and the ileocecal junction. After viewing the length of the colon, the endoscope is withdrawn, whereupon further inspection of the colon may be attained.

Computed tomographic colonography (CTC) has been introduced as an alternative to colonoscopy.<sup>37,38</sup> Results from the American College of Radiology Imaging Network National CT Colonography study (ACRIN) suggests that CTC may prove safer, equally effective and offer greater patient satisfaction. However, CTC also requires bowel preparation and if polyps are discovered, direct visual colonoscopy will still be required.

## Complications

Like any invasive procedure, colonoscopy may have complications. However, in the care of expert physicians in a clinical setting, complications are rare. Rates of mortality attributable to colonoscopy are extremely low and generally secondary to serious complications such as oversedation due to the absence of basic monitoring such as pulse oximetry. Local studies have put this rate at approximately 0.01%.<sup>38,39</sup> Careful selection of patients is critical to ensure good outcome.

One of the more evident complications associated with colonoscopy is bowel perforation, with the incidence of perforation typically between 0.1-0.3%.<sup>39,40</sup> Bleeding is another common problem and it occurs with about the same frequency as perforation.

Cardiopulmonary effects of sedation in patients undergoing colonoscopy have been explored.<sup>42</sup> The study showed that 2.4% of sedated patients experienced adverse cardiopulmonary side effects. Specifically, 1% experienced short bouts of oxygen desaturation and 0.9% had vasovagal reactions, including low blood pressure and heart rate deceleration. Other studies indicate that sedation impacts the autonomic nervous system leading to complications. For example, midazolam potentiates the sympathetic nervous system and may accentuate cardiovascular incidents during colonoscopy.<sup>42</sup> Although significant cognitive dysfunction may be observed after colonoscopy, the addition of midazolam or fentanyl to propofol does not increase this problem.<sup>43</sup> Also, anesthesia has not been shown to increase the rate of bowel perforation.<sup>44</sup> Complications may arise but colonoscopy with or without sedation is still considered safe.

### Discharge Criteria

Currently, no standardized discharge criteria exist for colonoscopy candidates. After the procedure, the patient should be placed in a designated recovery space, such as a postanesthetic care unit or a holding room, and closely observed for a minimum of 30-60 minutes with all standard monitoring equipment. Criteria should be established by the institution regarding the minimum length of stay for recovery and discharge.

### Management of the Case

The patient was sedated with a 1 mg dose of midazolam while in the holding area. The anesthesiologist explained the procedure in detail and assured her that she would not be uncomfortable. The patient was given sufficient time for her anxiety to decrease. Her blood pressure decreased. Also, 8 units of regular insulin was given intravenously and a repeat blood sugar was shown to be 152mg/dl. She was referred to an endocrinologist for further evaluation of her diabetic medications. A total of 5 ml propofol was administered prior to the insertion of the colonoscope. A # 4 laryngeal mask airway was used to protect the airway. An additional 4 ml of propofol was delivered in the latter stages of the procedure. The patient awoke and recovered without issues. She discharged approximately two hours after the completion of the procedure.

### Conclusion

Colonoscopy continues to be a valuable tool for investigating diseases and malignancies of the GI tracts. The use of colonoscopy requires a thorough examination of each case. Criteria such as risk factors, age, yield, potential complications, and the most effective sedation protocol must be discussed among the health care professionals. Although much research has been conducted concerning general risks, benefits, and sedatives associated with the procedure, more studies must be conducted to determine proper guidelines for discharge criteria, surveillance, and anticoagulation. With the elderly population increasing in numbers and a greater willingness of younger patients at higher risk stratifications to have the test, frequency and prevalence of colonoscopy will increase. Awareness and familiarity with the most recent developments concerning the procedure will help ensure positive patient outcomes.

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### Post-test

**1. An absolute contraindication for colonoscopy is:**

- a. Pregnancy
- b. Toxic megacolon
- c. Recurrent potentially malignant polyps
- d. Diverticulitis

**2. For pre-colonoscopy cleansing:**

- a. PEG-ELS is considered to be definitively better than sodium phosphate
- b. Sodium phosphate is considered to be definitively better than PEG-ELS
- c. Studies are conflicting
- d. Neither PEG-ELS and sodium phosphate are effective

**3. The estimated frequency of bacterial infection as a complication of colonoscopy is:**

- a. 1 in 1,800 procedures
- b. 1 in 18,000 procedures
- c. 1 in 1.8 million procedures
- d. Unknown

**4. The endoscopist cannot manually control:**

- a. Light transmitted through lens aperture
- b. Air for bowel insufflation
- c. Suction of fluid or air
- d. Angulation of lens

**5. Concerning discharge after colonoscopy:**

- a. Patients should not be alone for several hours
- b. A responsible adult should accompany the patient
- c. More data as to the appropriate time is required
- d. All of the above

**6. Cardiopulmonary side effects associated with colonoscopy include:**

- a. Lowered blood pressure
- b. Lowered heart rate
- c. Oxygen desaturation
- d. All of the above

**7. Comparing computed tomographic colonography (CTC) to optical colonoscopy (OC):**

- a. Both are effective tools to detect colonic polyps
- b. Polyps can be removed during CTC
- c. OC is significantly safer
- d. CTC does not require bowel cleansing

**8. Providing music therapy to patients during colonoscopy has been shown to:**

- a. Increase heart rate and risk of bleeding
- b. Increase patient anxiety
- c. Decrease anxiety, heart rate, and blood pressure
- d. Decrease recovery time

**9. The safest and most efficacious combination for sedating children undergoing colonoscopy is:**

- a. Midazolam and ketamine
- b. Ketamine and meperidine
- c. Nitrous oxide and meperidine
- d. Meperidine and midazolam

**10. Serious complications associated with colonoscopy include:**

- a. Oversedation due to absence of basic monitoring
- b. Bowel perforation
- c. Bleeding
- d. All of the above