ANESTHETIC CONSIDERATIONS FOR OUTPATIENT COLONOSCOPY

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Introduction

Gastrointestinal (GI) procedures are administered in multiple setting such as the intensive care unit, emergency room, hospital operating room, or in an ambulatory unit. One of these procedures, colonoscopy, is a popular tool for monitoring, preventing, and diagnosing a variety of gastrointestinal diseases ranging from inflammation of the GI tract to colon cancer. A coordinated effort between the anesthesiologist and the gastroenterologist is essential to maximize patient safety and efficiency.

Indications and Contraindications

The decision to perform colonoscopy must take into account the cost, risk, and accuracy of diagnostic alternatives. In the United States, the fulfillment of these criteria may differ from that in foreign countries, where resources and/or perceptions relating to colonoscopy are population specific. Indications for colonoscopy can be classified as diagnostic vs. therapeutic, high-risk vs. low-risk, and high-yield vs. low-yield.

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Indications for Colonoscopy Use

The diagnostic use of colonoscopy is mainly reserved for obtaining biopsied material, since the procedure gives optimum exposure to mucosal tissue from the anal canal to the terminal ileum. If a biopsy is not deemed necessary, there are more cost-effective methods of diagnosis, including barium enemas and virtual colonoscopy. 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. It is important to note that age, diet, and family history all may influence risk stratification for cancer or other pathophysiological processing of the GI tracts[1].

Before performing the colonoscopy, the patient should be identified as being at high or low risk for perforation, and a risk-benefit analysis should be assessed. Examples of indications that are high risk include decompression of acute colonic pseudoobstruction, polypectomy of large polyps, stent placement, and dilation of colonic strictures. In contrast, when physicians employ colonoscopy for screening purposes of asymptomatic average-risk persons, the risk of perforation is extremely low[2,3,4].

Furthermore, indications for colonoscopy should be classified according to their 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].

A study in 1993 evaluated seven major indications for colonoscopy including rectal bleeding, polyp follow-up, iron deficiency anemia, cancer follow-up (21%), abdominal pain (38.2%), abnormal bowel habit, and colitis to analyze the diagnostic yield of the procedure. Of significance, rectal bleeding, polyp follow-up and iron deficiency anemia produced the highest diagnostic yields of 69.1%, 53.3% and 47.7% respectively, whereas, cancer follow-up (21%), abdominal pain (38.2%) and abnormal bowel habit (46.8%) produced much lower yields[5]. It is important to note,

however, that the yield of colonoscopy increases with age. The frequency of polyps is higher and there is a higher incidence of colorectal cancer[3,6,7,8]. In a 2002 study, gender was also shown to have an affect on colorectal cancer, as the frequency rates of large polyps and colorectal cancer were found to be significantly lower in females than in males[8].

Table 1
Colonoscopy Yields

Indication	Procedures to detect 1 Cancer
Two Consecutive positive FOBT*, neither rehydrated	2.7
Rectal bleed, nonemergency	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.

Bleeding indications for colonoscopy are associated with a high prevalence of early stage cancer, and therefore early intervention can improve survival rates[9,10,11]. Generally, patients who present with positive fecal occult blood tests and are 40 years or older undergo a full colonoscopy. Recent studies have also demonstrated the cost-effectiveness of distal colon visualization followed by full colonoscopy for patients suffering from rectal bleeding who are in their twenties and thirties[12].

Additional indications for colonoscopy are associated with other diseases besides neoplasia. If a patient presents with chronic diarrhea, a

biopsy should be peformed to check for collagenous or lymphocytic colitis. The yield for this type of disease is 5-15%, with an increased prevalence in older females[13]. When bleeding does not accompany abdominal pain, illness is usually not associated with colorectal cancer. However, colonoscopy is indicated in a patient with abdominal pains coupled with chronic diarrhea to exclude the presence of Crohn's disease. Moreover, positive findings on radiographs and sigmoidoscopy could be indications for the diagnostic use of colonoscopy. Examples of these findings include filling defects seen with barium enemas and virtual colonoscopy, colonic strictures seen in radiographic imaging, and colonic thickening viewed on abdominopelvic CT scans (which could signify a tumor).

As previously mentioned, one of the major uses for colonoscopy in the United States is for colorectal cancer screening. Of importance, special guidelines exist for patients with a family history of familial adenomatous polyposis (FAP), hereditary nonpolyposis colon cancer (HNPCC), and inflammatory bowel diseases. The colon cancer alliance indicates that screening should begin during puberty, at age 21, and 8 years after the onset of pancolitis, or 12-15 years after the onset of left-sided colitis for these diseases, respectively[14]. According to the 2000 guidelines as 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[15]. In a recent study published in The New England Journal of Medicine comparing a barium enema and colonoscopy in their sensitivity to detecting early signs of colorectal cancer, it was found that the barium enema detected polyps in only 39% of cases that were detected by colonoscopy[16].

Contraindications

Before performing a colonoscopy, the health professional must verify that the patient exhibits no 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, and these should nullify any type of colonoscopy. Relative contraindications are ones in which risk to the patient is significantly increased. Examples of relative contraindications that should be considered are acute diverticulitis, recent myocardial infarction or pulmonary embolism, and pregnancy [Table 2].

Table 2
Colonoscopy Contraindications

Absolute	Relative
Toxic megacolon	Acute diverticulitis
Fulminant colitis	Recent MI
Perforated viscus	Pulmonary embolism
	Pregnancy

Preparation

The colon must be adequately cleansed before a colonoscopy can be performed to improve the accuracy of diagnosis and reduce the risk of complications[17,18,19]. Efficient colon cleansing is also cost effective according to a recent study of 400 colonoscopies by Rex et al. This report concluded that the extra time involved in suctioning and washing to satisfactorily expose the mucosa of patients with inadequate bowel preparations led to more aborted exams and earlier repeat surveillance. In monetary terms, the average cost increased by 12% and 22% in the university and public hospitals studied, respectively[20].

Early methods of colon preparation were modeled after barium enema preparations and modified for colonoscopy. Currently, three major options exist for colon preparation: diet and cathartic regimen, gut lavage, and phosphate preparations. Regardless of the method used, the patient must be thoroughly instructed on the cleansing procedure and must adhere precisely to the guidelines in order for the preparation to be effective.

Dietary methods for colon cleansing include a 48-72 hour regimen of clear liquids, laxatives, and enemas. In a 1984 study, this regimen was compared to another regimen which involved a minimum-residue diet which the patient undertook 24-72 hours before the exam[21]. The study showed that the cleansing efficacy of the minimum-residue diet was better than that of the clear liquids/laxatives/enemas regimen and has since become standard. Concerning cathartic methods of cleansing, a solution of magnesium citrate and senna X-prep was shown to have good cleansing efficacy and was acceptable to most patients[22]. The combination of magnesium citrate and bisacodyl has also been utilized and was found to be more effective in colon cleansing than castor oil[23].

The main solution used for the gut lavage method of colon preparation is a polyethylene glycol electrolyte lavage solution (PEG-ELS). The benefit of this solution is that it does not significantly alter fluid and electrolyte balance when compared to saline or electrolyte preparations[24]. Although the efficacy rate of PEG-ELS reaches a high level, there is still scientific debate concerning its benefit relative to the third type of preparation, sodium phosphate[25,26].

A recent study comparing the cleansing efficacy of two types of PEG solutions with a sodium phosphate preparation showed that the sodium phosphate solution has a slightly less cleansing efficacy than one of the PEG solutions[27]. However, other studies comparing sodium phosphate with PEG[28] and a PEG-bisacodyl solution[29] indicated opposite results, concluding that the sodium phosphate solution was superior to the PEG solutions in cleansing efficacy and patient tolerance. Furthermore, before administering a regimen of sodium phosphate for colon cleansing, certain contraindications must be taken into account. The FDA warns of increased risk to patients who have congestive heart failure, renal insufficieny, gastrointestinal obstruction, bowel perforation, colitis, megacolon, ileus, dehydration, ascites, gastric retention, inability to take fluid orally, or patients taking medications/diuretics that might affect electrolyte balance[30].

Although rare, incidences of bacterial infection caused by colonoscopy do exist. The main concerns for infection during this procedure are bacteremia caused by endogenous bacteria and infection spread to the patient by contaminated equipment. Bacterial infections transmitted by endoscopes are extremely rare if proper procedures for disinfection are performed beforehand[31]. Postprocedural bacteremia caused by endogenous bacteria or other factors is uncommon as well. In fact, only 2.2% of colonoscopies have recorded this type of infection, and even in the case of infection, complications are seldom observed[32].

While infection rates are considered uncommon, sparse data concerning the issue of infection risk and colonoscopy cause ambiguity in this area and have prompted the American Heart Association to create guidelines for antibiotic prophylaxis to be used for specific indications to help prevent against bacterial endocarditis[33]. In addition to preventative measures, a careful cost-benefit analysis should be performed for each case before deciding to use antibiotic prophylaxis.

Anticoagulant considerations

Management of anticoagulants and antiplatelet agents must be emphasized during colonoscopy. Decisions must be made about when to stop and resume anticoagulation therapy during the procedure. The risks associated with discontinuing the therapy include thromboembolic complications, and must be weighed against the risk of gastrointestinal hemorrhage related to the procedure. Before any guidelines were published, a 1996 survey of 1269 American Society of Gastrointestinal Endoscopy (ASGE) members[34] found that anticoagulation was routinely stopped before colonoscopy by 71-82% of physicians, and all restarted the therapy immediately after the procedure. In 2002 the ASGE updated guidelines for the management of anticoagulation based on classifying endoscopic procedures as either high or low risk[35] [Table 3].

Table 3
ASGE Guidelines

	Low Risk of Thromboembolism	High Risk of Thromboembolism
High procedural risk	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
Low procedure risk	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 Waye JD, Rex DK, Williams CB. Colonoscopy: Principles and Practice. Malden, MA: Blackwell Publishing Ltd: 2003, 225.

In conclusion, no controlled studies have been published concerning the risks of either continuing or discontinuing anticoagulation therapy before colonoscopy. However, there have been case studies published of patients who developed thrombosis after anticoagulation therapy was discontinued for a short period of time[36]. Furthermore, in a 2002 review of 109 previously performed colonoscopies in which patients discontinued their warfarin for three days prior to the procedure, only one case involving hemorrhagic complications was recorded[37].

Preanesthetic Testing

Frequently no tests are required. Any laboratory studies should be requested only after a history and physical examination have been completed and the anesthesiologist has reason to believe that the results will alter his management stratedgy (eg, patient has been bleeding recently, Hb level is 8 gm and the decision is made to transfuse preprocedure).

Sedation Plans

Although there is debate about whether sedation is obligatory for

colonoscopy, studies indicate that patients desire sedation even though it may not be necessary. Proper sedation can contribute positively to patient comfort, satisfaction and improve recovery[38].

Small doses of midazolam and merperidine potentiate the effects of propofol, an ultrashort-acting hypnotic agent, thereby allowing careful and efficient sedation during endoscopic examinations[39]. In a study conducted in 2003, propofol was tested against midazolam/fentanyl for outpatient colonoscopy. On average, propofol was administered to a total dose of 277 mg whereas midazolam and fentanyl were given at 7.2 mg and 117 μg, respectively. The group using propofol experienced a faster and deeper sedation. Just as importantly, the patients under propofol recovered sooner and were discharged earlier than those using midazolam/fentanyl[40]. Propofol for sedation is a popular choice due to its effectiveness and low risks under the care of appropriately trained anesthesiologists[41]. Anecdotal experience from one of the authors related to propofol sedation alone for colonoscopy showed no post procedure pain as would be expected since the colonoscope is simply maneuvered within the hollow viscus of the gut.

Patients can undergo two types of sedation procedures: patient-controlled sedation (PCS) with propofol and nurse-administered propofol sedation (NAPS). Studies reveal that both methods achieve the same levels of safety[42,43,44]. A 2003 randomized trial study compared PCS with propofol and alfentanil to a combination of physician-administered midazolam and pethidine. The study revealed that patients in the PCS group had significantly higher pain scores as well as recall than those in the midazolam and pethidine group. However, subjectively, both patient groups were satisfied with the sedation they received. On the other hand, PCS demonstrated significantly faster recovery times, an important factor in the outpatient setting[45].

Music therapy has also been linked to sedation, and has been shown to reduce anxiety, heart rate, and blood pressure. The reduction in anxiety is not significant, but there is a trend showing that state anxiety is reduced with music therapy. Hence, potential exists for music to reduce pre-

procedural anxiety and potentially the need for sedation in patients undergoing colonoscopy[46]. Recently, patient education regarding the procedure through videotape has been shown also to improve outcomes[47].

For children undergoing GI endoscopy, current literature asserts that ketamine is the sedation drug of choice. The sedative agent reduces complications while improving sedation. Different combinations of sedative agents were tested in 402 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[48]. Certainly more than adequate sedation could be accomplished by combining mask anesthesia with an inhalational agent in the pediatric population.

Preoperative Tests

To prepare for colonoscopy, patients are instructed to follow certain procedures the day before. One day before, patients take a clear liquid diet. Next, patients are required to begin drinking polyethylene glycol (PEG) 8 oz. every 10 minutes for 3 hours starting in the afternoon of the day before the exam. The night before, patients undergo a fast. This regimen is used to clean and prepare the colon for a successful colonoscopy. A study consisting of 69 patients was performed to identify a correlation between the success of the exam and the hydrogen content of the fasting breath of the patient. The results indicate that people with poor colonic preparation have a higher fasting breath hydrogen level compared to those who have a well prepared colon. Hence, testing the hydrogen level may prove to be helpful to ensure that the colon is well cleansed and prepared for a successful examination and the patient has been compliant[49].

PEG is not the only option sodium phosphate tablets have been tested and are concluded to be just as effective and better tolerated. In a study of 845 patients comparing sodium phosphate tablets and PEG,

greater patient compliance and fewer GI side effects were associated with the tablet. Hence, it can be seen that sodium phosphate tablets are just as effective, more convenient for patients and have fewer side effects than the PEG regime[50].

The increase in popularity of propofol for colonoscopies prompted a study to determine if sodium phosphate tablets were compatible with its administration. A review of 97 outpatients concluded that colonic cleansing with the use of sodium phosphate tablets was safe for patients using propofol based sedation[51]. Some patients, however, experienced intravascular volume contraction. This problem can be treated with carbohydrate-electrolyte rehydration, thereby allowing patients to cleanse the colon in a tolerable manner without hypovolemic variations caused by the tablets[52].

Equipment

Colonoscopy equipment has been revolutionized over the past two decades to make the procedure more safe, efficient, and provide easier visualization. There is no doubt that recent and future advancements in colonoscopy equipment will further modernize this useful procedure. The following summarizes the most common type of equipment used in colonoscopy today.

Colonoscopy begins with the video colonoscope[53]. It has an outer polymer layer that gives it the right combination of flexibility and elasticity to be able to maneuver through tortuous bowel without twisting. Because different levels of stiffness are required depending on the conditions of the bowel, a variable stiffness colonoscope was produced[54]. Thus the endoscopist can alter the stiffness of the colonoscope during the course of the procedure.

At the distal end of the colonoscope is a video lens the position of which is controlled by the endoscopist via simple finger controls at the proximal end of the scope. Located within the colonoscope itself is the machinery necessary for transmitting the internal image to an external

video source. The light which projects into the bowel comes from an external light source, connected to the colonoscope and projected to the lens through fiber optics. An automatically controlled lens aperture regulates the amount of light transmitted through this lens.

Implanted within the colonoscope are solid-state image sensors called "charge-coupled devices" (CCD). These photosensitive sensors capture the light reflected back from the bowel tissue and send integrated signals to a video screen on which the image is reconstructed. To produce colors images, special CCDs called "color chips" are used which contain a multicolored filter that resolves the image into its component primary colors.

In addition to finger controls that regulate the illumination system of the colonoscope, the user has access to controls that are used to operate the air, water, and suction systems. By manipulating a valve, which tonically releases air from the colonoscope, the endoscopist can insufflate the colon for better viewing. The colonoscope also contains a tube that can expel water from an external water source when a valve is depressed. Furthermore, the endoscopist can take advantage of a suction valve that is used to suction air or water from the lumen.

A recent innovation, which is used to accurately determine the position of the colonoscope during colonoscopy and to locate problematic loops of bowel, is the magnetic three-dimensional imaging system[55]. This innovation was introduced in 1993 by two groups of Britsh researchers[56,57]. The colonoscope is equipped with internal sensor coils that detect low-requency magnetic pulses from a special table upon which the patient is positioned. The pulses induce electrical signals within the coils that are transmitted to a computer. The computer is then able to decipher the signals to produce a 3-D display of the colonoscope onto a computer screen.

There are many accessories associated with the colonoscope that are used for specific functions such as polypectomy, biopsy, image enhancement, and ablation. These include polypectomy snares, which 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 relaeased into a retrieval device that can be extruded from the patient along with the snare. Similarly, biopsy forceps can be used in the same manner 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.

Basic Procedure

Colonoscopy involves 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, there are some general principles that should be followed[58].

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 10 cm 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. Furthermore, fluid and residue can be aspirated at this stage or any other stage of the procedure to clear out the lumen. 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. Furthermore, 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.

Complications

Being an invasive procedure, colonoscopy is associated with a variety of complications. However, in the care of expert physicians in a clinical setting, the frequency of any significant complications occurring is extremely low. Recent advancements in colonoscopy equipment and technique are some factors that can be attributed to such low rates. Recently it has been suggested that quality assurance programs, which highlight "core quality indicators" developed by the ASGE, can be implemented in endoscopy units to address the complications associated with colonoscopy[59].

Low mortality rates are attributed to colonoscopy and death results only when there are serious complications associated with the procedure. Local studies have put this rate at around 0.01%[60,61]. Careful selection of patients is critical to ensuring survival after the procedure. The physician must take into account the patient's physical state and any contraindications. Several studies have been done yielding the complication rates associated with colonoscopy. These have been categorized based on whether procedures were diagnostic or therapeutic, with a significant increase in therapeutic procedures. Perforation rates for diagnostic procedures were low (0.029 percent to 0.61 percent) versus a higher 0.07 percent to 0.72 percent for perforations with therapeutic procedures. The side effect of bleeding was not reported enough to generate an estimate of its frequency with diagnostic procedures and occurred 0.2 percent to 2.67 percent with therapeutic procedures. Patient death occurred with a low frequency. The reported rates were from 1 in 30.000 to 1 in 3.000 with increased mortality rates in the older patient and more symptomatic patient groups. In terms of death occurring during the screening process, rates were even lower; one cost-effectiveness analysis

estimated it to be 1 per 20.000 patients[62].

Bowel perforation caused by endoscope puncture presents as one of the more obvious complications involved in colonoscopy. This complication is not considered to be serious in an otherwise healthy individual. Data from previous procedures have consistently put the incidence of perforation at between 0.1-0.3%[61,63,64]. However, the relative safety of diagnostic vs. therapeutic colonoscopy in regard to perforation is disputed[63.64].

Bleeding, another common problem, occurs with about the same frequency as perforation[61]. It can result either because of tissue perforation or polypectomy. Medication must be taken into account when predicting the effects of bleeding on the patient. If the patient is on anticoagulant or antiplatelet therapy, decisions on whether to discontinue therapy and for how long must be made according to established guidelines before the procedure begins[35].

Complications from bacterial infection obtained during colonoscopy are not of tremendous concern. If instruments are properly disinfected before use, the occurrence of exogenous infection remains low[32]. Additionally, endogenous contamination is quite infrequent and rarely results in any serious symptoms[33].

In a recent study in Germany, the effects of sedation on the cardiopulmonary system of patients undergoing colonoscopy were explored[65]. 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 vagovagal reactions, including low blood pressure and heart rate. Other studies indicate that sedation plays a role on the autonomic nervous system and this may be a factor leading to complications. For example, midazolam potentiates the sympathetic nervous system may accentuate cardiovascular incidents during colonoscopy[66]. In another study consisting of 180 patients, midazolam lowered systolic and diastolic blood pressure resulting in hypotension (systolic blood pressure lower than 100 mmHg). Hence, sedation with midazolam can show a significant decrease in arterial

oxygen saturation and can increase the occurrence of hypotension. Although these complications may arise, colonoscopy with or without sedation is still considered safe[67]. However, close observation relating to sedation during endoscopic procedures is warranted[67]. A study of 53 patients showed that patients may still reach hazardous levels of sedation in the first 24 hours after the operation. Continued monitoring by family or friends in the out patient setting is indicated.

Similarly, anxiety is seen as a more frequent complication of colonoscopy. A patient's state-anxiety will usually go up during the procedure when assessed using the State-Trait anxiety index and compared to their score before the procedure[68]. Recent studies indicate that having the patient listen to self-selected music either before or during the procedure is successful in significantly lowering anxiety[69,70,71].

Although colonoscopy has been effective for colorectal cancer screening, there can still be instances of missed lesions. Most of the lesions that are overlooked are less than 10 mm in diameter and are missed for a variety of reasons[72,73]. Virtual colonoscopy, like fiber optic colonoscopy, has been shown to be capable of detecting lesions that are at least 10 mm in diameter[74]. However, no evidence has been published comparing the efficacy of virtual colonoscopy with the traditional fiber optic approach.

Discharge Criteria

Currently, no standardized discharge criteria exist for health professionals dealing with colonoscopy candidates. It can be assumed, however, that each institution determines a minimum length of stay for patients who have just undergone a colonoscopy or has other criteria to determine when to discharge these patients[74]. Only a 1996 study at Beth Israel Medical Center in New City[75] asked the question of whether patient risk factors, intraoperative occurrences, and medications used during endoscopy could be used to predict a minimum stay after postconscious sedation. In a study of 405 adult patients who underwent an upper endoscopy or colonoscopy, preprocedural data (demographic and risk

factor data), intraprocedural data (medications and intraoperative occurrences), and postprocedural data (time of recovery and postprocedure occurrences) were obtained. The results concluded that "Age predicted length of time in recovery, but only 2% of the variation in recovery time was predicted by study variables".

Furthermore, this study could not predict a better method for discharge than the ones already established at individual institutions.

Patient discharge can be affected by the type of anesthetics used during the colonoscopy. In a study comparing propofol versus midazolam/fentanyl, patients receiving propofol, recovered faster and were discharged about 10 minutes earlier than the patients using other sedation methods[41]. In another study comparing remifentanil/propofol with intravenous anesthesia using fentanyl/midazolam/propofol, the remifentanil/propofol combination provided sufficient sedation and allowed patients to be discharged about 15 minutes after the procedure[76].

Another study compared total intravenous anesthesia versus inhalational anesthesia. A group of 69 patients underwent tests that used an intravenous fentanyl, midazolam, propofol combination or an inhalational combination of sevoflurane/nitrous oxide anesthetic. The inhalational anesthesia showed recovery of psychomotor abilities to be 30-90 minutes faster compared to the intravenous anesthesia[77]. These types of studies show that certain types of sedation may be more suitable and should be examined to improve patient discharge times after colonoscopies.

Follow-up and Surveillance

Approximately 33% of patients initially treated by surgery with curative purpose will experience re-emergence of their cancer. Furthermore, many of these patients will die from a disseminated form of the disease. The goal of post-operative follow-up in these patients is to reduce these numbers. There is no consensus on the type of strategy to implement, however, any strategy is justifiable as long as it positively affects quality of life, the disease-free period, and overall global survival.

For non-cancer patients, the value of follow-up is controversial. Literature reveals that a more intensive and frequent follow-up leads to an increased number of reoperations and an overall more aggressive oncological approach in non-resectable cases. The benefits of this type of intensive follow-up, however, have not been determined; additionally, requiring that all patients undergo intensive surveillance is not cost-effective and is not evidence-based medicine[78].

The individual characteristics of each case must be taken into consideration before creating a follow-up plan. It has been suggested that physicians lean more toward intensive follow-up with patients at high risk of treatable recurrence and willingness to undergo reoperation. Along the same lines, low-risk cases could be followed with few tests such as referential colonoscopy, history and physical exams, carcinoembyonic antigen (CEA), and rectoscopy[79]. Recent studies have shown that new diagnostic tests such as CT colonography may reduce the number of colonoscopies used for screening. In fact, Gluecker et al (2003) have shown that patients undergoing colorectal cancer screening prefer CT colonography to both double-contrast barium enema examination and colonoscopy[79].

Recent literature has shown, via meta-analyses, that survival rates can improve with intensive follow-up; however, there are still no large controlled studies that have proven any survival benefit with this strategy[80]. Furthermore, studies are needed to examine the need and timing criteria for subsequent surveillance in order to contain costs associated with the procedure and to increase public awareness of the benefits that surveillance screening can and cannot provide[81].

Conclusion

There is no doubt that colonoscopy continues to be a valuable tool for the gastroenterologist to investigate diseases and malignancies of the GI tracts. The use of colonoscopy calls for a thorough examination of each case as an individual. Criteria such as risk factors, age, yield, potential complications, and the most effective sedation protocol must be

discussed among the anesthesiologist and gastroenterologist. 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 colonoscopy will increase. Awareness and familiarity with the most recent developments concerning the procedure will help the anesthesiologist ensure that the patient receives the most successful course of action.

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