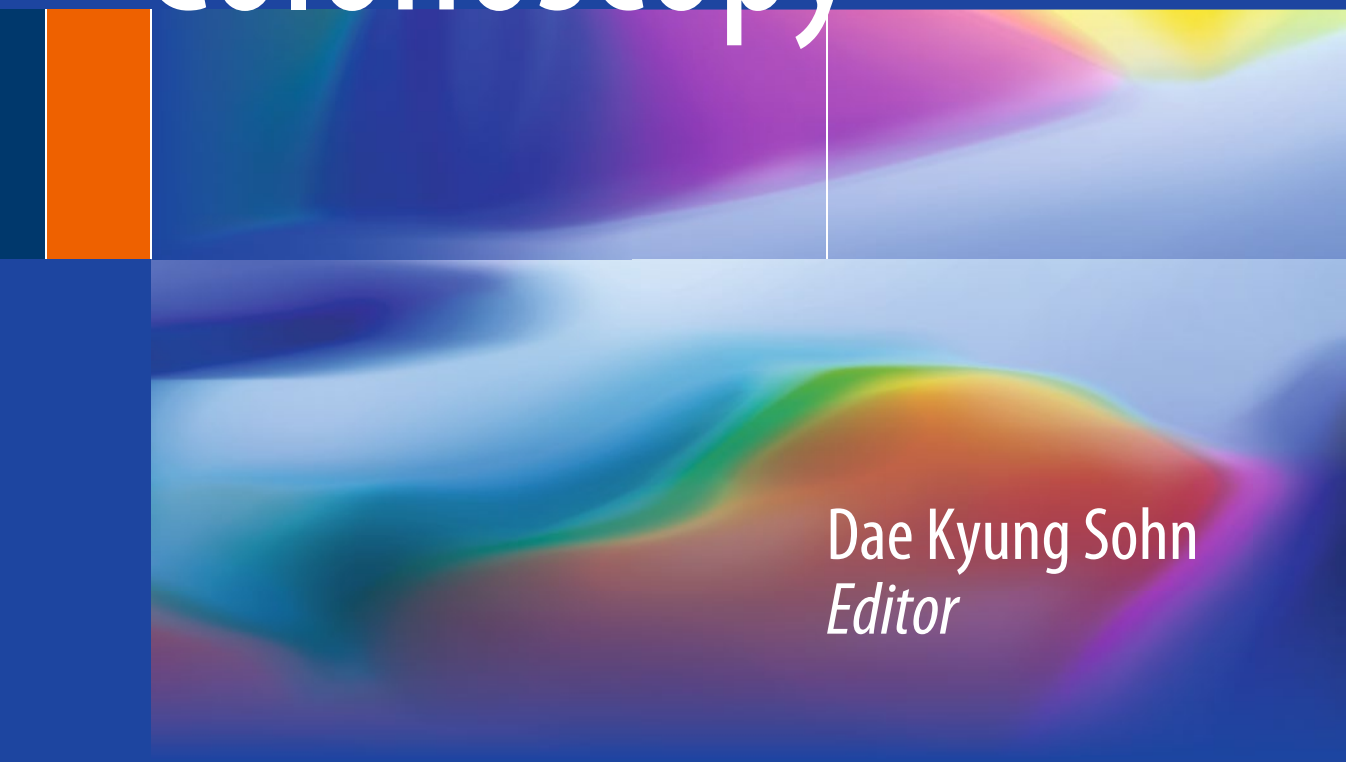
Practice and Principles in Therapeutic Colonoscopy



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Preface

The development of endoscopic technology has increased its therapeutic use over the imaging diagnosis. The common uses of therapeutic colonoscopy are resection of benign and malignant lesions, hemostasis for colorectal bleeding, decompression and recanalization of obstructed bowel, etc. All techniques of therapeutic colonoscopy have been a requirement for an expert endoscopist. This book presents a state-of-the-art knowledge and technique for therapeutic colonoscopy. All technical aspects are covered in detail including indication, instruments, and tips, and the text is complemented by many illustrations. This book will be invaluable in clinical practice for all who are involved or interested in therapeutic colonoscopy.

My deep appreciation goes to professor Jae-Gahb Park and all my colleagues for their unflinching support and encouragement. I'd like to also thank my lovely wife and two children—Jimin and Yuji, who always trust and support me.

Goyang, South Korea
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Dae Kyung Sohn

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Bun Kim

1.1 Introduction

Certain prerequisites should be met before the procedure for a successful and safe therapeutic colonoscopies [1]. First, in terms of patients, sufficient explanation and gaining informed consents in essential. In addition, the patient's concurrent medication and general health condition should be checked. Furthermore, proper sedative and bowel-cleansing agents should be carefully selected for each individual patient (Table 1.1). Second, a colonoscopist should be proficient in therapeutic colonoscopic procedures and well trained assistant including nurses are necessary. Third, the proper systems and instruments including supplies for emergencies should be prepared.

1.2 Patients

1.2.1 Informed Consent for Therapeutic Colonoscopy

Informed consent for therapeutic colonoscopy is obtained in accordance with the informed consent for general colonoscopy. Informed consent is obtained according to hospital or individual center policy.

Informed consent includes assessment of the competence of the individual to process

Table 1.1 Checklist before therapeutic colonoscopy

Current medication
Antiplatelet agent: aspirin, NSAIDs, dipyridamole, thienopyridines (clopidogrel and ticlopidine), GP II/IIIa inhibitors (tirofiban, abciximab, eptifibatide)
Anticoagulant: warfarin, UFH, LMWH
Medication affecting renal function: ACE inhibitor, angiotensin receptor blocker, diuretics, NSAIDs
Patient status
Elderly, childhood, pregnancy, lactation, severe/chronic constipation, diabetes, hypertension, renal dysfunction, congestive heart failure, stroke/dementia, inflammatory bowel disease, lower GI bleeding
Choice of sedative drug
Midazolam, fentanyl, meperidine (pethidine), ketamine, propofol
Diet
Method of diet modulation: clear liquid diet, low residue diet
Duration of diet modulation
Bowel cleansing agent
Choice of bowel cleansing agent: PEG, low volume PEG + ascorbic acid, tablet NaP [32–40], sodium picosulfate + magnesium citrate, additional use of adjunctive agent (magnesium citrate, bisacodyl, etc.)
Intake method of bowel cleansing agent: divided dose regimen, nondivided dose regimen

NSAID nonsteroidal anti-inflammatory drug, *GP* glycoprotein, *UFH* unfractionated heparin, *LMWH* low molecular weight heparin, *ACE* angiotensin converting enzyme, *GI* gastrointestinal, *PEG* polyethylene glycol

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Table 1.2 Information to disclose to the average patient

Serious and uncommon risks of colonoscopy, likely to include:
Perforation and bleeding
Could require transfusion or surgery
Serious and uncommon risks associated with colonoscopy and/or the administered anesthesia, which could include:
Cardiac or respiratory complications
Infection (arrhythmia, infarction, aspiration)
Common nonserious risks:
Gas
Bloating
Self-limited discomfort
Intravenous access site complications
Colonoscopy could be an imperfect as a therapeutic procedure:
Possibility of incomplete treatment or recurrence
Possibility of additional surgery or medication for therapy

Table 1.3 Components of the informed consent form

Explanation of the nature and character of the procedure in nontechnical form
Material risks of the procedure
Patient's name
Date and time of consent
Disclaimer of guarantee of success
Identification of the colonoscopist
Consent to allow the physician to modify the procedure for unforeseen circumstances
Acknowledgment of opportunity to ask questions
Consent to disposal of removed tissue
Consent for transmission of results to appropriate parties

information, disclosure of appropriate information necessary to allow an informed decision, and ensuring the plan chosen by the patient is voluntary. The process involves mutual communication and decision-making, not merely the request for a signature on a standardized form that lists complications of a procedure. The four elements of risk that physicians need to consider in providing informed consent are: (1) nature of the risk; (2) magnitude of the risk (seriousness); (3) probability that the risk may occur; (4) imminence of the risk (i.e. post procedure or decades later).

About informed consent for therapeutic colonoscopy, consider information an average patient may want (Table 1.2). Should one mention the possibility of death as a result of the procedure? One study from England reported that a survey of barristers (the English equivalent of plaintiff's attorneys) indicated that serious risks should be mentioned even if as rare as one in a million [2]. Although it is generally legally safer to mention more risks (including very rare risks), there is a potential cost in unnecessarily frightening patients away from beneficial procedures by not adequately conveying the rarity of such an event.

In process of consent, the colonoscopist must ensure that the patient is competent to understand the information disclosed. Note that the medical literature contains information indicating that ordinarily competent older patients may be temporarily unable to adequately comprehend information when hospitalized with a serious illness. Having a family member present may be useful to ensure adequate consent or at least reduce the likelihood of successful consent challenge later. Informational materials may be given to the patient to facilitate understanding of the procedure. Appropriate institutional forms should be signed and witnessed, and a statement written or dictated as part of the colonoscopy note indicating that informed consent has been obtained. It is best if the witness to consent is a family member or friend, since this implies that the witness believes the patient capable of consent, and is also there to help in the process. If a member of staff witnesses the consent, it is best if this is not the person obtaining the consent or helping perform the procedure. If an issue comes to trial and those in the procedure room are named as defendants, their testimony witnessing the adequacy of consent may appear biased.

The standard core elements of informed consent (Table 1.3) include the nature and character of the procedure (preferably in nontechnical terms), the material risks of the procedure, the likely benefits, and the potential alternatives (including no treatment). Most consent forms will also include the patient's name, date and time of consent, disclaimer of guarantee of success, identification of staff who will perform the

Table 1.4 Exceptions to informed consent

Emergencies
Implied consent
Patient waives right to informed consent
Therapeutic privilege
Legal mandates

procedure, consent to allow the physician to modify the procedure for unforeseen circumstances, an acknowledgment that the patient has been given the opportunity to ask questions which have been answered, consent to disposal of removed organs, and, with new privacy concerns and regulations, consent for transmission of the results to appropriate parties.

In colonoscopies, the exceptions to informed consents could be applied with caution (Table 1.4). In an emergency situation, a healthcare provider may treat the patient without obtaining consent; consent is presumed, or "implied" in legal parlance. The definition of emergency may vary in different jurisdictions, but the principles of imminent harm by failure of prompt treatment can be applied. This issue is less likely to arise with colonoscopy. Further, attempting even a limited consent with a conscious patient is worthwhile if it will not unduly delay emergency treatment.

Patients are able to waive their right to informed consent. However, they must know they have the right to information necessary to make an informed decision. Thus when a colonoscopy patient says "You're the doctor, you decide what is best," the careful doctor may accept that responsibility but will first inform the patient of the right to information and decision-making.

Therapeutic privilege allows physicians to withhold information they generally must disclose, based upon the physician's perception that disclosure will be harmful to the patient. However, this is a disfavored exception; there is concern that it may be used as an excuse for not informing patients. Unless there is clear and convincing evidence of psychologic fragility, it would be best to ignore this exception.

The ethical and legal requirement to obtain informed consent prior to performing colonoscopy derives from the concept of personal (patient) autonomy. The competent patient, after receiving appropriate disclosure of the material risks of the procedure, understanding those risks, the benefits, and the alternative approaches, makes a voluntary and uncoerced informed decision to proceed. This is a basic ethical obligation in the practice of medicine. It should be a communication tool that cements the provider–patient relationship. It functions as a risk-management tool, transferring known standard procedural risks to the patient who has understood and accepted the premise that even competently performed colonoscopy has risks. The procedural elements involved in obtaining consent include a discussion of material risks, acknowledge of who gives and obtains consent, the scope of consent, exceptions to consent, witnessing and documentation of consent, and the use of educational materials and consent forms.

Consent is a mutual process, which occurs after appropriate disclosure, with time for answering questions, in an uncoerced process. In open-access colonoscopy, the patient has not met the colonoscopist prior to the decision to proceed with colonoscopy, prior to having undergone preparation for the procedure, or in some cases prior to arriving in the procedure room with an intravenous line in place.

1.2.2 Modulation of Medication

As the elderly population grows, more patients receiving medications such as aspirin, anticoagulants, and nonsteroidal anti-inflammatory drugs (NSAIDs), are being referred to endoscopists for therapeutic colonoscopy. For patient's convenience, polypectomy is often performed as soon as a polyp is detected to avoid another bowel preparation. Therefore, if the patient's concurrent medication increases the risk of bleeding after polypectomy, this should be considered before the colonoscopy. The patients in whom discontinuation of the antithrombotic agent poses only a low risk may stop their medication during the periendoscopic period [3–5]. However, a careful evaluation is needed in cases when discontinuation

of the antithrombotic agent is associated with a high risk of adverse effects [3–5]. A previous study showed that the use of aspirin or clopidogrel alone was not related to higher rates of post-polypectomy bleeding [6].

The management of the medications needs to be considered during the periendoscopic period in patients receiving anticoagulant agents such as warfarin, unfractionated heparin (UFH), and low molecular weight heparin (LMWH), and antiplatelet agents such as aspirin, NSAIDs, dipyridamole, thienopyridines (clopidogrel and ticlopidine), and glycoprotein II/IIIa (GP II/IIIa) inhibitors (tirofiban, abciximab, and eptifibatide) [3–5]. The management is based on the assessment of the procedure-related bleeding risk and potential thromboembolic risks related to the discontinuation of the medication [3–5].

Aspirin and/or NSAIDs are recommended to be continued during all endoscopic procedures, and clinicians may discontinue aspirin and/or NSAIDs for 5–7 days before the high-risk procedures such as polypectomy and endoscopic submucosal dissection [3–5]. In patients with a vascular stent or acute coronary syndrome, clopidogrel or ticlopidine may be withheld for 7–10 days before the endoscopy, provided that a minimum recommended period after the corresponding treatment has passed, and aspirin could be continued [3–5]. If clopidogrel or ticlopidine is used for other indications, these medications could be continued for low-risk procedures such as diagnostic colonoscopy including biopsy. However, they need to be discontinued for 7–10 days before high-risk procedures. Anticoagulant (warfarin) discontinuation is recommended in patients with a low risk of thromboembolic events [3–5] (Table 1.5).

Continuation of anticoagulation by switching to LM-WH or UFH is recommended in the periendoscopic period in patients with higher risks of thromboembolic complications [3–5] (Table 1.5). In patients with a high risk of thromboembolic events, UFH or LMWH needs to be restarted as soon as possible, and warfarin can be restarted on the day of the procedure without a significant danger of bleeding [3–5]. In patients with a low risk of thromboembolic events, warfarin may be restarted on the evening after the endoscopy without a high risk of postprocedural bleeding [5].

Table 1.5 Conditions for the risk of thromboembolic events

High-risk condition	Atrial fibrillation associated valvular heart disease, prosthetic valve, active congestive heart failure, left ventricular ejection fraction <35%, history of a thromboembolic event, hypertension, diabetes mellitus or age > 75 years
	Mechanical valve in the mitral position
	Mechanical valve in any position and previous thromboembolic event
	Recently (<1 year) placed coronary stent Acute coronary syndrome
	Nonstented percutaneous coronary intervention after myocardial infarction
Low-risk condition	Uncomplicated or paroxysmal nonvalvular atrial fibrillation
	Bioprosthetic valve
	Mechanical valve in the aortic position
	Deep vein thrombosis

In patients with acute GI bleeding receiving an anticoagulant or antiplatelet agent, this medication is recommended to be withheld until hemostasis is achieved [5].

1.2.3 Endoscopic Sedation

The purposes of procedure-related sedation include safe and effective management of pain and anxiety in addition to acquirement of a proper degree of memory loss and decreased awareness. Currently, there is no standard regimen regarding sedation in GI endoscopy [7]. The choice of sedation may differ depending on the endoscopist's preferences and the type of planned procedure. In special conditions such as obesity, pregnancy, advanced age, and chronic lung, liver or renal disease, special considerations and precautions are required regarding the dose adjustment and choice of sedative drugs [7, 8].

Midazolam is considered the benzodiazepine of choice as it provides a shorter duration of action with a better pharmacokinetic profile than diazepam [7, 8]. Pethidine and fentanyl are the

most popular [7, 8]. Reversal drugs for endoscopic sedative drugs consist of flumazenil and naloxone [8] Flumazenil, a benzodiazepine antagonist, reverses the respiratory and sedative effects of benzodiazepine [8]. Naloxone, a pure mu-opioid antagonist, reverses both the respiratory and analgesic effects of opioids [7, 8].

Unsedated endoscopic procedures are recommended for elderly patients or patients with the risk of cardiopulmonary dysfunction.

The use of propofol for sedation during diagnostic and therapeutic procedures is increasing as it enhances the quality of upper GI endoscopy by increasing the patient's acceptance of the procedure and the diagnostic accuracy [9]. In addition, it has satisfactory sedative, hypnotic, antiemetic, and amnesic properties, as well as a rapid onset of action and a short recovery profile [7, 8]. Its use is preferred in patients with advanced liver disease because of its short biologic half-life resulting in a low risk of hepatic encephalopathy [8]. With regard to side effects, propofol may induce cardiopulmonary events. It can cause a dose-dependent decrease in cardiac contractility leading to a decrease in cardiac output, systemic vascular resistance, and arterial pressure [7, 8]. In addition, it may be associated with serious adverse events such as respiratory depression, airway obstruction, and death [7, 8]. Unfortunately, there is no pharmacological antagonist for this compound [7, 8]. In a prolonged and potentially uncomfortable endoscopic procedure, intravenous midazolam along with propofol for sedation has been reported to be more effective than intravenous midazolam alone, without differences in the safety [10].

Meperidine (category B) followed by small doses of midazolam (category D) as needed is recommended for moderate sedation in endoscopic procedures during pregnancy [11]. Breastfeeding may be continued after fentanyl (category C) or propofol (category B) administration in lactating patients after sufficient recovery from general anesthesia. Infants should not be breastfed for at least 4 h after midazolam is administered to the mother [11].

Patient's age, inpatient status, higher American Society of Anesthesia grade (Table 1.6), routine use of oxygen, and trainee participation were associated with a higher incidence of unplanned cardiopulmonary events during GI endoscopy under conscious sedation [12].

Table 1.6 Definition of ASA status

Class 1	Patient has no organic, physiological, biochemical, or psychiatric disturbance. The pathological process for which the operation is to be performed is localized and does not entail systemic disturbance
Class 2	Mild to moderate systemic disturbance caused either by the condition to be treated surgically or by other pathophysiological processes
Class 3	Severe, systemic disturbance or disease from whatever cause, even though it may not be possible to define the degree of disability with finality
Class 4	Severe systemic disorders that are already life threatening, not always correctable by operation
Class 5	The moribund patient who has little chance of survival but is submitted to operation in desperation

1.2.4 Diet

Although dietary modifications alone are not sufficient for preparation for colonoscopy, they have proven to be effective when conducted together with mechanical cleansing [13]. For dietary regimens, clear liquids and low-residue diets are recommended for 1–4 days before colonoscopy [13, 14]. Patients are allowed to have water, clear soup, clear fruit juice without pulp, coffee or tea without milk, and sport drinks on the clear liquid diet [14]. In addition, patients may have white rice, white rice cakes, refined noodles or pasta, vegetable juices, grapes without skin and seeds, peaches without skins and seeds, watermelon without seeds, well-cooked potatoes without skin, tender meat, fish, chicken, and eggs on the low-residue diet [14]. Patients are forbidden to have high-fiber foods such as brown rice, whole grains, raw and dried fruits, seeds, nuts, and multigrain bread [14]. Prolonged dietary restrictions may also be an important factor for better colon preparation, but they could lead to lower

compliance [13]. Nevertheless, prolonged fiber restriction with liquid diet needs to be suggested in cases of severe constipation [15]. Furthermore, a study suggested that the fiber-free diet is more effective than the clear liquid diet if it is combined with the use of polyethylene glycol (PEG) electrolyte solution on the day before colonoscopy [16].

1.2.5 Bowel Preparation

The ideal preparation for colonoscopy needs to satisfy the requirement of emptying the colon of all solid or liquid materials in a rapid fashion with no gross or histological changes in the colonic mucosa. Additionally, shifts in fluids or electrolytes, patient discomfort, and cost should be kept to the minimum [17].

PEG-electrolyte lavage solution is the most frequently prescribed bowel-cleansing agent. As it is a nonabsorbable solution, it passes through the bowel without net absorption or secretion, and significant fluid or electrolyte shifts do not occur [13]. Therefore, PEG is considered safer than stimulant laxative/sodium phosphate (NaP) in patients with fluid or electrolyte imbalance [13]. It is preferred in patients with renal insufficiency, congestive heart failure, or liver failure [13] The drawbacks of this agent are that it should be diluted in a large volume of water (up to 4 L) to reach the desired cathartic effect and it's unpalatable taste despite flavoring, which leads to poor compliance [13]. Sulfate-free PEG (SF-PEG) was developed to improve the taste and smell of the PEG solution by decreasing the potassium concentration, increasing the chloride concentration, and eliminating sodium sulfate [13]. SF-PEG is considered to be comparable to PEG in safety, effectiveness, and tolerance, but it still requires consumption of 4 L of the diluted agent [13]. Aqueous NaP is no longer prescribed, as it may cause significant fluid and electrolyte shifts resulting in renal failure; however, NaP tablets are still available. Adjunctive agents are used to enhance the cleansing efficacy of bowel preparation conducted by the main purgative regimens such as PEG, as well as to reduce the volume of fluid that needs to be taken to achieve a cathartic effect [18]. Ascorbic acid, which is not completely absorbed and remains in the colonic lumen, exerts an osmotic effect and is used with a smaller quantity of PEG [19, 20]. Low-volume PEG solutions with ascorbic acid have been reported to be comparable to high-volume PEG solutions in efficacy and tolerability by the patients [19, 20]. Magnesium salts that show a synergic effect through their osmogenic properties are often used with picosulfate, a prodrug that is metabolized to a peristalsis-enhancing stimulant within the bowel lumen [21]. The regimen with sodium picosulfate and magnesium citrate is gradually accepted as a major bowel-cleansing regimen based on its efficacy and safety profiles [22]. Other adjuncts such as bisacodyl, senna, and metoclopramide have been reported to have the advantage of reducing the volume of the solution required for bowel cleansing; however, their exact efficacies and safety profiles remain to be established [13, 18, 23].

A meta-analysis found that a divided-dose PEG solution regimen (initial 2–3 L is given the night prior to the colonoscopy and the remaining 1–2 L on the morning of the procedure) improves the quality of bowel preparation, increases patient compliance, and reduces the incidence of nausea that leads patients to discontinue bowel preparation when compared with full-dose PEG [13, 24].

The quality of bowel preparation may be influenced by the interval between the end of the preparation procedure and the start of colonoscopy [25]. It is suggested that colonoscopy needs to be performed within 7 h from the start of PEG intake and 4 h from the end of PEG intake to improve the quality of bowel preparation [25]. If colonoscopy is scheduled in the afternoon, bowel preparation may be carried out on the same day, resulting in better feasibility, safety, and effectiveness, as well as fewer adverse events, and leading to patients' preference [25, 26].

Elderly patients tend to show higher rates of inadequate colon cleansing for colonoscopy [27]. A dietary restriction is helpful, with clear liquids and low-residue diets for 1–4 days prior to the colonoscopy [15]. Moreover, cleansing by PEG consumption <5 h prior to colonoscopy is efficient [15].

In patients with severe constipation, a longer period of staying on a liquid diet, application of

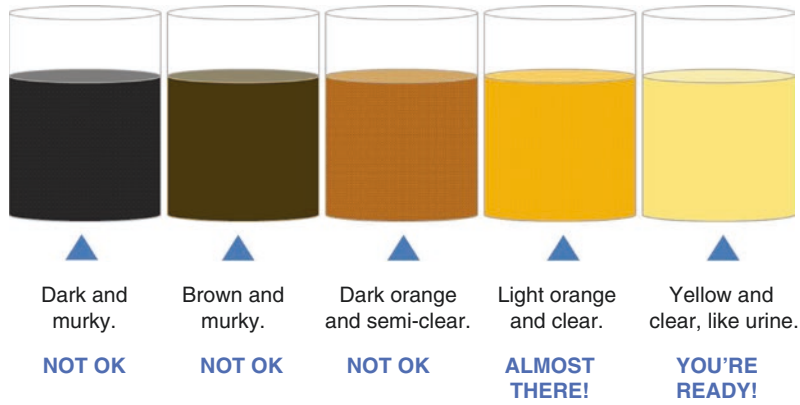

Fig. 1.1 Sample page from booklet addressing importance of bowel preparation quality: Provides instructions for how to interpret stool effluent to help ensure high-quality preparation [33]

alternating bowel-cleansing agents, use of an adjunctive laxative, and use of a double dose of the PEG solution are recommended for successful bowel preparation, as they have increased colon transit time and may be resistant to laxatives [15].

Patients with stroke may have difficulties swallowing, and patients with dementia may have difficulties taking large amounts of fluid [15]. The bowel preparation solution may be administered directly into the stomach or duodenum through an esophagogastroduodenoscope using a water irrigation pump or nasogastric tube [13, 15, 28].

In patients with lower GI bleeding, adequate bowel preparation may be beneficial for the identification of the bleeding source [15]. If the amount of bleeding is suspected to be small, bowel preparation using PEG solution may be helpful. However, enema is preferred if the bleeding source is presumed to be within the rectal area, or the amount of bleeding is suspected to be severe [15, 29].

Appropriate bowel preparation is closely related to the compliance of the patient to the preparation instructions. Therefore, patients' understanding of colonoscopy and bowel preparation may influence the outcome of the procedure. One study suggested that non-compliance with bowel preparation instructions and lower education level were independent risk factors for poor bowel preparation [30]. Education of patients is considered a very important factor to ensure compliance before colonoscopy, and many studies have suggested diverse education programs that have resulted in apparent increases in patient compliance [31–35]. Nurse-delivered education with brochures, an educational pamphlet, a novel patient educational booklet, and cartoon visual aids were suggested to be effective in increasing the quality of bowel preparation [31–34] (Fig. 1.1).

1.3 Endoscopist

1.3.1 Qualified in Therapeutic Colonoscopy

Therapeutic colonoscopy is a complex endoscopic procedure that involves therapeutic maneuvers such as polypectomy. Colonoscopy has significant potential not only to benefit patients but also to cause adverse outcomes due to incomplete or failed therapies, and complications.

Traditionally, the assessment of competence has relied on tallying total numbers of procedures performed or subjective evaluation by a proctor. The use of threshold procedure numbers at which competence may be globally assessed provides only a rough guide for evaluation of competence.

Suggested objective performance criteria for the evaluation of technical skills in gastrointestinal endoscopy are listed in Table 1.7 [36]. It has been proposed that expert endoscopists should be

Table 1.7 Suggested objective performance criteria for the evaluation of technical skills in gastrointestinal endoscopy as proposed by the American Society for Gastrointestinal Endoscopy [36]

Procedure	Performance criteria
Colonoscopy	Intubation of splenic flexure
	Intubation of cecum
	Intubation of terminal ileum (desirable skill)
Polypectomy	Successful performance
All procedures	Accurate recognition of normal and abnormal findings
	Development of appropriate endoscopic/medical treatment in response to endoscopic findings

Table 1.8 Recommendations of the American Society for Gastrointestinal Endoscopy for minimum number of procedures before competency can be assessed [37]

Standard procedure	Number of cases required
Total colonoscopy	100
Snare polypectomy	20[a]
Flexible sigmoidoscopy	25

[a]Included in total number

expected to perform at a technical success level of 95–100% [36]. The available data support as reasonable the standard of 80–90% technical success before trainees are deemed competent in a specific skill.

Recommendations of various organizations on minimum numbers of procedures required to achieve competence Medical societies have issued position papers regarding how much training is required to achieve competence in colonoscopy.

Official recommendations of organizations have included those of the American Society for Gastrointestinal Endoscopy (ASGE), which recommends a minimum of 100 colonoscopies to achieve competence [37] (Table 1.8); the British Society of Gastroenterology, which recommends 100 colonoscopies; the Conjoint Committee for Recognition of Training in Gastrointestinal Endoscopy of Australia, which recommends 100 colonoscopies; and the European Diploma of Gastroenterology, which suggests 100 colonoscopies. In contrast to gastroenterology-oriented societies, other specialties have often suggested that much lower numbers would be adequate; for example, the Society of American Gastrointestinal Endoscopic Surgery (SAGES) has recommended 25 procedures. Recently, at the urging of the ASGE, SAGES has agreed to eliminate suggested numbers of procedures (personal communication from ASGE). The American Academy of Family Practice has endorsed "short courses" during which trainees perform an average of less than ten supervised procedures [38].

It is clear that performance of a minimum number of procedures, although a prerequisite for acquiring skill, does not guarantee competence. Because subjective assessment of competence by a proctor is often inaccurate, objective assessment of performance at endoscopy is necessary to assess accurately the competence of an individual. Such objective performance data are useful not only in training but also for credentialing, obtaining hospital privileges, and perhaps even allowing patients and healthcare providers to choose their physicians.

1.4 System and Instruments

1.4.1 Training Colonoscopy Assistant

A trained gastrointestinal assistant is a necessary and important part of the endoscopy team. During the procedure, the assistant works closely with the endoscopist, often preparing the necessary equipment in advance of the physician's request, and anticipates the next set of actions. However, the intraprocedure part of the assistant's task is only one part of the overall responsibility. Other duties of the gastrointestinal assistant include: preparation of the room, ordering supplies, speaking with the patient and allaying apprehensions, cleaning and maintaining the equipment, coordinating outgoing specimens and incoming reports with the pathology laboratory, keeping track of narcotics and their proper requisition.

Because of the complex nature of the therapeutic colonoscopy and the multiple elements

that must be learned, proficiency of the assistant and efficiency of the endoscopy unit mandates that proper training is required in order to be a gastrointestinal assistant.

The role and responsibility of the assistant during colonoscopy varies according to level of licensure. The nurse and associate must function within these prescribed guidelines and hospital or facility policy.

When a patient is scheduled for the procedure, instructions for colon preparation are supplied. The patient's medical history is important in the decision of which method is used for cleansing the colon. It is at this time that the teaching process is begun. Brochures are often helpful for this initial contact, as it gives the patient a statement to take home and read in a less stressful surrounding [39].

After arrival at the endoscopy center for the procedure, the patient is escorted and instructed to change into a procedure gown. It is critical to obtain a basic medical history, including allergies, current medications, and a record of past surgical procedures.

Physical limitations and psychological issues should be included and addressed. Of special note are any medical conditions that put the patient at increased risk of developing a complication related to sedation. These include severe cardiac, pulmonary, renal or central nervous system disorders, and obesity, sleep apnea, pregnancy, and drug or alcohol abuse. The medication list should include all drugs that the patient is taking on a routine or PRN basis. This includes prescription drugs, over-the-counter medications, vitamins, and herbs. The endoscopist should be notified if the patient is taking medications that affect coagulation including warfarin, aspirin, nonsteroidal antiinflammatory drugs, and ginko. The assistant should be aware of possible adverse medication interaction with agents used for sedation, analgesia. Examples include benzodiazepines, opioids, psychoactive drugs, and monoamine oxidase inhibitors. Meperidine should not be given to a patient who has taken a monoamine oxidase inhibitor within 2–3 weeks as coma, severe hypertension, hypotension, respiratory depression, convulsions, malignant hyperpyrexia, and death may occur. There can also be a potentiating effect with the administration of any narcotic agent.

The effectiveness of the colon preparation should be established during the interview. The nurse should ask the patient what preparation he/she took and for a description of the last results. If there is a questionable or poor result, the endoscopist should be notified for a decision to perform the procedure, give an enema, or reschedule after re-prepping the patient.

1.4.2 Setting Up the Room

The equipment should be turned on and all operating systems initiated. Water bottles should be sterilized or high-level disinfected daily. If high-level disinfectant is used, a thorough rinse with sterile water should be performed to remove chemical residue. Water bottles should then be filled with sterile water to the level indicated, and the top secured and positioned according to manufacturer's instructions.

The assistant should check the procedure room for the availability of supplies (medication, accessories, biopsy forceps, specimen containers, etc.) and test all equipment for functionality. Accessories for colonoscopy are used for snare polypectomy, tissue sampling, endoscopic mucosal resection, object retrieval, size measurement, marking, image enhancement, hemostasis, ablation, and stenting. In addition, technologic advances in the design of the clipping, looping and banding devices have made their use in the colon relatively user-friendly and they should be part of the available accessories in all endoscopy units undertaking colonoscopy. Their application is mainly in the prevention and treatment of complications such as postpolypectomy hemorrhage. Appropriate use allows safer and more effective colonoscopic therapy. The colonoscope should be tested to assure that air and water channels are working. Lubricant should be ready for the endoscopist to use for rectal examination and lubrication of the instrument prior to insertion.

1.4.3 Monitoring and Sedation

There is a critical nature to the assignment of monitoring the patient who is receiving sedation and analgesia. For very ill patients and/or the complex procedures, a second nurse or associate is required to assist the physician while a registered nurse concentrates on monitoring the patient [40].

Basic life support is a standard requirement for all healthcare workers. In some centers, advanced cardiac life support is required for licensed personnel. Emergency equipment should be available and staff should be familiar with this equipment and its location. Several sizes of oral airways, and mask and bag equipment for respiratory support should be readily available.

There should be immediate access to an emergency cart with a defibrillator, emergency drugs, and intubation equipment. For a colonoscopy, most patients receive medication for sedation and analgesia. Because of this, additional training regarding the role of staff during administration of these medications may be required. Critical are the knowledge of correct doses, possible cumulative effects, interactions with other medications, and the role of monitoring the patient for respiratory depression. Staff should also be familiar with pharmacologic antagonists for opioids and benzodiazepines. The patient is escorted to the procedure room by the assistant and baseline vital signs are obtained.

The patient's vital signs will be monitored during the procedure. This monitoring should include blood pressure, pulse, and pulse oximetry, the patient's level of pain and response to the procedure. Ventilatory function should be observed visually throughout the procedure.

This information should be recorded in the patient's record. Automatic monitoring devices may enhance the ability to accurately assess the patient, but are no substitute for the watchful, educated assessment by a registered nurse [41, 42].

Depending on center policy, ongoing interval blood pressure measurement, and continuous heart rate and pulse oximetry readings are measured. Recommendations from the American Society of Anesthesiologists (ASA) include that the type and amount of medication administered, length of the procedure, and the general condition of the patient should be the factors to determine frequency of measurement. At a minimum, these measurements should be obtained and recorded prior to the start of the procedure, after administration of sedative/analgesic agents, completion of the procedure, during initial recovery, and at the time of discharge. Regular readings and recording of vital signs should be incorporated into the policy of the endoscopy unit, such as: obtain blood pressure, pulse, and pulse oximetry readings before the procedure, every 5 min during the procedure, and in the immediate recovery phase. Cardiac monitoring is done if the patient has a history of cardiac disease. When the patient is transferred to the recovery area, blood pressure, pulse, and pulse oximetry should be measured on arrival and at specified intervals, such as every 15 min, for a minimum of 30 min, until discharge. Excessive sedation may result in cardiac or respiratory depression. These symptoms must be rapidly recognized, reported to the endoscopist, and treated to avoid the risk of hypoxic brain damage, cardiac arrest, or death. The person assigned to monitor the patient should be situated facing the patient and only assist with minor interruptible tasks. A second assistant should be present for sick patients and complicated procedures [40].

If hypoxemia occurs during sedation, supplemental oxygen is to be administered immediately. The use of capnography via a nasal cannula with a CO_2 sensor in addition to pulse oximetry to monitor for hypoxia appears to be superior to close observation of the patient during the procedure [43, 44].

Despite an excellent overall safety record, cardiopulmonary complications, likely due to sedative and analgesic medications are believed to account for 50–60% of procedure-related morbidity and mortality, respectively [45].

1.4.4 The Assistant During the Procedure

Staff should be in personal protective equipment before the procedure is started. The patient is assisted to the left lateral position with knees bent

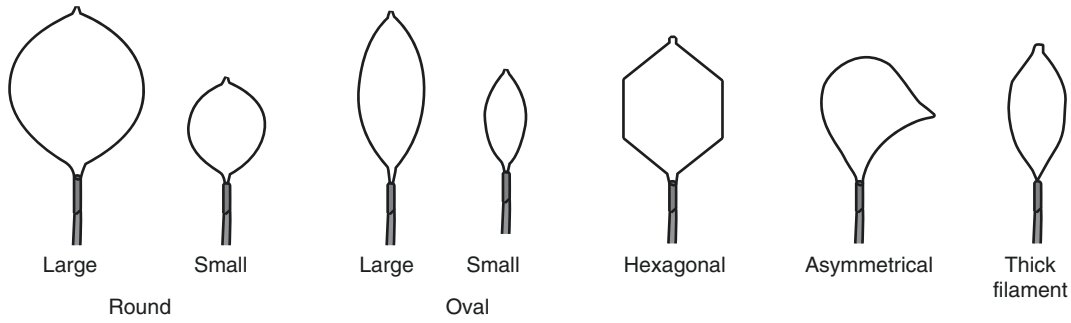

Fig. 1.2 Polypectomy snares. Snares differ in loop diameter, shape, and filament diameter. After it is embedded in the mucosa, the pointed tip can act as a fulcrum (Practical Colonoscopy Jerome D. Waye et al. Wiley Blackwell)

for the start of the procedure. Many endoscopists find that there are benefits to repositioning the patient during the procedure.

The patient may be asked to turn to supine, right lateral, and occasionally to a prone position. Although it is difficult to have an oversedated, ill, or elderly patient change position, most patients can change position with minimal assistance and verbal cues. The assistant must be aware of multiple safety issues when repositioning the patient. The patient's position in relation to the edge of the cart or table must be carefully observed. To prevent injury to the patient or damage to equipment, attachments such as monitoring wires, grounding pads, and oxygen tubing should be checked after any position change is made.

An adequate number of specimen containers and labels with appropriate patient information should be available before the start of the colonoscopy. The assistant must be observant during the procedure so that the.

Both the patient and equipment can be prepared as the procedure progresses. When a polyp requiring electrocautery is encountered, the grounding pad can be applied to the patient and an appropriate snare chosen (Fig. 1.2).

Biopsy forceps or other equipment can also be readied when need is anticipated.

Operation of a snare: Since there are a number of sizes and shapes of snares available, the choice is made by the endoscopist according to the size and location of the polyp in the colon. The assistant usually opens and closes the snare as requested. Snare cutting is dependent upon a combination of mechanical forces of the wire closing against the plastic sheath and the use of high-frequency current, which is produced by an electrocautery machine. The sheath may compress during snare closure so that the tip of the snare, which withdrew into the sheath when tested outside the patient, cannot be fully withdrawn once around a polyp because the sheath has shortened with compression. This may preclude complete resection and cause an impacted snare. To avoid this problem, verify that the tip of the wire snare retracts at least 15 mm into the sheath prior to polypectomy.

The assistant should be familiar with each electrosurgical unit being used in the endoscopy center. In some cases, current output may vary according to unit or manufacturer. Instructions and use of settings specific to the units available in the department should be readily available for training and reference purposes.

If an electrical grounding pad is used, the usual placement is on the upper thigh or lower trunk, whichever is the largest tissue mass. To ensure complete contact with the patient's skin, the chosen area should be dry and as free from hair as possible. If a polyp is to be removed, a specimen trap should be placed between the scope and the suction tubing to retrieve any tissue suctioned through the scope (Fig. 1.3). The active cord is connected between the snare and the electrosurgical unit and the dial is set as appropriate per manufacturer's directions, unit policy, and by the endoscopist's preference. Electrical currents that have a pure cutting effect are usually not employed for colonoscopic polypectomy.

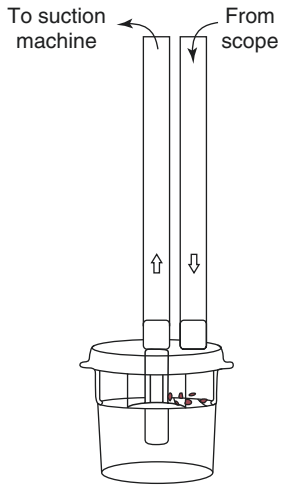

Fig. 1.3 Polyp retrieval trap. A compartmented trap permits capture of polyp from different areas of the colon. Even samples taken by biopsy forceps will be caught within the small grid that collects polyps

Electro-coagulation current alone may be used or a blend of cut and coagulation may be applied. The activation pedal for the unit is placed in position for ready access to the endoscopist.

During polypectomy, the endoscopist will position the sheath and give the order to open the snare. The assistant will extend the loop and the endoscopist will position the loop around the polyp. The assistant should be sure that the electrocautery unit is turned on before use and ensure that the active cord is securely connected. Upon the direction to close the snare, it is important for the assistant to close the snare slowly while maintaining continuous communication with the endoscopist. While visualizing the polyp and feeling for resistance, the assistant will close the loop on the snare slowly until tension is felt and the loop can be seen to be in the proper position. When ready for electrocautery, the endoscopist will depress the foot pedal and give the direction to close.

If saline injection is used to lift the polyp tissue from the mucosal wall, an injection needle and normal saline for should be available. One or two 10 cc syringes should be prepared depending on the size and number of polyps. The normal saline should be drawn up and, depending on the endoscopist's preference, a drop or two of methylene blue can also be drawn up in the syringe. The advantage of using the methylene blue is that the blush of the tissue as well as the translucent color can identify the margins of the polyp. Whenever methylene blue is used during a procedure, the patient must be advised that their urine may turn green and there may be a color change in their stool as the medication is excreted. Advising them of the possible color change before discharge will prevent a panicked phone call regarding the strange color of their urine.

The severed polyp may be retrieved in several ways. If a biopsy forceps or hot biopsy forceps are used, the tissue is removed with the forceps. Small polyps can be readily retrieved by suction into a small capture bottle (trap) attached to the main suction plug of the instrument. For larger polyps removed with a snare, suction can be used to secure it to the end of the scope. The polyp can be resnared to carry it out of the colon, or an entrapment or retrieval device such as a basket or tripod grasper can be used. For multiple polyps, each polyp specimen should be placed in an individual container with the site clearly identified in addition to the patient information. The ability to keep all specimens in their proper order (size, location, method of removal) is aided by keeping a written log of each event as it occurs.

Colorectal bleeding: When a bleeding site is encountered, several items of equipment must be available for immediate use. Review of skills on a regular basis is essential, especially with devices that are used on an irregular basis. Devices or instruments available include injection needles, bipolar probes, detachable snares, clip devices, argon ionized coagulator, laser and heater probes. As technology changes and advances, other instruments may be available in the future.

Epinephrine 1:10,000 is often the hemostatic agent of choice. Most sites are injected with 1–2 mL as instructed by the endoscopist.

A detachable snare may be used in the event that the area bleeding is clearly identified, such as a polyp stalk following transection. The snare is tightened on the bleeding area and when secure it is detached from the device and left in place. After healing occurs, the snare sloughs off and is passed with the patient's stool.

There are several options available when using a bipolar probe. There are 7Fr and 10Fr sizes available with or without a needle for injection. Having the needle built in is helpful when that need is anticipated, but can be more difficult to deploy than a standard injection needle.

It is ideal to have an additional staff member available during and after these complex procedures to assist with equipment and disinfecting the procedure area following the procedure. This enables close monitoring of the patient and the effectiveness of interventions, as well as efficient room turnover between procedures.

1.4.5 Protective Gear for Therapeutic Colonoscopy

Blood is not the only source of exposure to potentially infectious materials. Other potentially infectious materials include, but are not limited to, human body fluids such as saliva, peritoneal fluid, stool, and unfixed human tissue [46].

It is possible for almost every employee of an endoscopy center to have occupational exposure to blood or other potentially infectious material. All nurses and associates are regularly exposed to these materials and even ward clerks or secretaries may be exposed on occasion when they handle specimens.

Protective gear should be universally used to provide a physical barrier for staff during interactions with patients when there is a potential for exposure to infectious and toxic substances. Because the same measures are used in every case, body substance precautions protect the healthcare worker from unrecognized or asymptomatic cases of infectious diseases as well as recognized or symptomatic cases.

Protective gear should include a gown, eye protection, a face mask or shield if splash is anticipated, and gloves for every event which presents the possibility of exposure. Radiation and laser protection should be provided if these therapeutic measures are needed.

Semipermeable gowns can be used if excessive splash is not anticipated. Non-permeable gowns in either plastic or treated fabric are available to protect staff members from any type of splash.

Eye protection, either safety goggles/glasses, or face shields should provide adequate protection without restricting movement or vision. The equipment should be provided by the employer and should be durable, easy to clean and disinfect. Staff members should keep safety equipment clean and in good repair.

Gloves should meet the need of the staff member and the patient. Any sensitivity to latex should be noted and taken seriously as anaphylaxis can occur and is a lifethreatening event. Gloves should be removed immediately following the procedure or in the event there is a possibility of a break in the surface integrity. Hands should be washed immediately after gloves or personal protective equipment are removed. In accordance with sound occupational health principles, employee training should occur prior to the time that the employee is placed in a situation where exposure could occur. Training must be provided at the time of the initial assignment or job change that causes exposure and must be repeated annually [46].

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