Abstract

The incidence of colorectal cancer has been increasing in the Republic of Korea. Colonoscopy allows for greater diagnostic specificity and sensitivity compared with other examinations, such as the stool occult blood test, barium enema, and computed tomography colonography. Therefore, in recent years, the demand for colonoscopy has been growing rapidly. Primary care physicians have contributed to meeting this demand by performing colonoscopies. However, it is hard to learn the colonoscopy procedure due to the long length of its learning curve and high rate of complication compared with gastroscopy, such as perforation and bleeding. Thus, considerable training and experience is required for optimal performance of colonoscopy. For performing a complete colonoscopic examination, there were a few important things to learn and remember, such as position of examinee (e.g., left and right decubitus, supine, and prone) and examiner (two-man method versus one-man standing method versus one-man sitting method), basic skills (e.g., tip deflexion, push forward and pull back, torque, and air suction and insufflation), advanced skills (e.g., jiggling and shaking, right and left turn shortening, hooking, slide-by technique), assisted skills (e.g., position change of examinee, abdominal compression, breathing-holding, and liquid-infusion technique), and intubation techniques along with the lower gastrointestinal tract. In the current review article, although there were several limitations to the explanation, we will explain to primary care physicians the insertion method of colonoscopy. The authors believe that this article may be helpful to primary care physicians who want to learn the procedure.

Keywords: Colonoscopy; Primary Care Physician; Training; Procedural skills

Introduction

Colorectal cancer (CRC) is one of the most common malignancies in the developed parts of the world, such as North America, Europe, and India, and the incidence of CRC appears to be increasing in East Asian countries including Korea.\(^1\)\(^-\)\(^3\) Since its first introduction in 1969, colonoscopy has been accepted as a powerful screening tool for the early detection of CRC. Also, it plays an important role in the prevention of CRC through the diagnosis and removal of adenomatous polyps (premalignant lesions of CRC).\(^4\)\(^-\)\(^6\) As a result, the demand for screening colonoscopy is rapidly growing worldwide. However, the number of qualified endoscopists is not sufficient worldwide to meet the growing demand. One way of addressing this shortage of endoscopists is to train family physicians to competently perform colonoscopy. In Korea, most of family residency and fellow
training program include the colonoscopy procedure as well as upper gastrointestinal (GI) endoscopy (esophagogastrduodenoscopy, EGD). Hence, the trained family physicians can perform colonoscopy in primary setting, and they have contributed to meeting this demand by performing colonoscopies.

The acquisition of technical skills as manipulation of colonoscopy and cognitive skills like interpretation of colonoscopic findings were demanded for trainees. The latter is more essential than the former, but the former is always attained before the latter. Thus, we will focus on technical skills of colonoscopic examination for primary care physician herein.

**The colonoscopy equipment**

As in vehicle driving in which understanding the basics of the vehicle is helpful for learning to drive, understanding the colonoscopy equipment can be of help in developing the colonoscopy skills. Colonoscopy equipment consists largely of two sections: the main body including CPU (central processing unit) and the colonoscope. Among these, the main tool of colonoscopic examination is the colonoscope that helps the endoscopists perform colonoscopies.

1) Length of colonoscope

Unlike gastroscopes, colonoscopes have greater length and diameter. Especially, long-length adult-colonoscope is used in the cases in which cecal intubation is difficulty due to extensive stricture and/or curve of the colon.

2) Components of colonoscope

The colonoscope consists of control section, instrument channel (forcep, snare, injector, clip device), shaft (colonoscope portion actually inserted into the patient), tip (distal end of shaft; controlled from the control section), connection section and line. Also, some models have a lever of variable stiffness.

**The posture of examinee and examiner for colonoscopy**

As is the case with EGD, left lateral decubitus position is the basic posture of the examinee during colonoscopy. Also, just as a correct posture is required for an athlete for better performance and prevention of injuries, it is important for the examiner (endoscopist) to take appropriate posture while performing the colonoscopy. There are three different types of posture available to perform colonoscopic examination: i) two-man method; ii) one-man standing method; iii) one-man sitting method.

**The techniques for intubation of cecum in colonoscopy**

1. Basic technique

1) Tip deflexion

Vertical (up/down) and lateral (left/right) tip deflexion is basic technique for colonoscopy and performed by using control knob. There are two control knobs in the control section of colonoscope. The larger outer control knob is used to do vertical movement of the tip and the smaller inner knob is used to do lateral movement of the tip.

2) Push forward and pull back

‘Push forward (PF)’ is the action of pushing the colonoscope tip forward through the anus, whereas ‘Pull back (PB)’ is the action of pulling it backward. PF is essential for advancing of colonoscope. However, paradoxically, PB is more important than PF for advancing of colonoscope. PB is helpful to resolving the colonic loop and keeping the colonoscope straight and shortened.

3) Torque

Torque is applied by twisting the body of the colonoscope to the right (clockwise) or left (counter-clockwise) using the hand holding it. Applying a torque can prevent loop formation. Applying a torque when the tip is deflected upward also has the effect of turning the colonoscope to the left or right without using the left/right control knob.
4) Air insufflation and suction

Air infusion and suction is performed by using the air/water infusion valve button and the suction valve button. The colon is an easily distensible mobile elastic tube which when over inflated becomes long and tortuous, enhancing the difficulty of the intubation procedure of colonoscopy. Hence, endoscopist is needed to minimize air insufflation and suction frequently during intubation period of colonoscope.

2. Advanced technique

1) Jiggling and shaking

The jiggling technique involves moving the scope in and out in 5- to 10-cm increments. A view of the lumen should be maintained while the maneuver is performed. Such technique is helpful to shorten and straighten the colon. This technique is also helpful to advance proximally in the colon. The shaking technique involves moving the scope left and right, which prevents the colonic lumen from adhering to the colonoscope.

2) Right turn/left turn shortening

Right turn shortening (RTS) and Left turn shortening (LTS) are complex and difficult techniques in colonoscopy procedure. Turn shortening is combined technique performed by endoscopist, i.e., RTS = Rt. torque of scope + Pull back of scope (LTS = Lt. torque of scope + Pull back of scope. These techniques can resolve the loop formation of the colon and enhances the advancing of the colonoscope by shortening the colon. RTS is more common than LTS during colonoscopy.

3) Hooking technique

The hooking technique is hook and pull-back of colonoscope, which is helpful in straightening the tortuous colonic segment. In this technique, the tip of colonoscope is deflected 30 to 90 degrees behind a mucosal fold, and the scope is withdrawn approximately 5 to 10cm. This action pulls the segment of tortuous colon downward.

4) Slide-by technique

This technique is used to advance the colonoscope by repetitively pushing the tip of it slightly forward in the anticipated direction of the colon lumen, when the next direction of the colon cannot be seen due to acute angulation and/or many folds of the colon. Also, this is usually used at the risk of the occurrence of red-out phenomenon. In most cases, this technique causes pain in the examinee. Thus, this technique should not be performed by beginner and only performed by an experienced endoscopist because of high risk of iatrogenic perforation. If mucosal blanching occurs, this may be also indicative of excessive force by the colonoscope tip on the mucosa and perforation may well be imminent. Hence, the colonoscope must be withdrawn.

3. Auxiliary technique

The techniques described above are the ones used by the colonoscopists. The techniques described below are performed by the assistant or the examinee.

1) Position change of examinee

Colonoscopy usually is performed with the examinee in left lateral decubitus position and ends in that position. However, when difficulty arises, position of the examinee can be changed to supine or right lateral decubitus position or, rarely, prone position. Supine position is usually helpful during the progression of sigmoid colon, sigmoidodescending junction, descending colon, splenic flexure and transverse colon, while supine or right lateral decubitus position is usually better during the progression of hepatic flexure or ascending colon.

2) Abdominal compression

Abdominal compression is performed by an assistant at the instruction of the endoscopist by pressing the desired part of the abdomen using one hand or both hands to help advancing of the colonoscope. Although compression may be applied to any part of the abdomen, the most common applied sites are SC and SDJ.

3) Others
Other useful colonoscopic techniques include liquid infusion technique and breathing-hold technique. Liquid
infusion technique is performed as injecting water or saline solution using a liquid injector to open up the
adhered colon lumen and lubricate its inner surface. Breathing-holding technique is used to de-angulate SF
and/or HF by descending the diaphragm by letting the examinee hold the inspiration.

Procedure description

The large intestine (colon) is a long tubular organ that begins at the cecum and ends at the rectum. Therefore, the
cecum is the proximal part of the colon and the rectum is the distal part. However, since the colonoscope is
inserted from the anus and passes the rectum first, procedure will be explained here in this order.

0. Pre-intubation

The patient is initially placed on the examination in the left lateral decubitus position with the examinee knees
bent and pulled up. The examination begins with an inspection of the perianal region. A simple inspection can
detect various perianal lesion such as skin tag, scar, anal fistula and fissure, hemorrhoid, and prolapse. Also, the
digital rectal examination with topical anesthetic jelly (usually lidocaine jelly) should be performed to
prelubricate the anal canal and relax the sphincters.

1. Anal canal

The anal canal is a very short segment (about 2-3 cm) from the anal verge to the dentate line. When the
colonoscope is intubated, red-out sign usually occurs. Thus air inflation in anus using the air/water infusion
valve button is needed. After airation of anus, the colonoscope can be inserted without red-out sign. The anal
canal cannot be completely examined while intubating the colonoscope due to its shortness and anal sphincter.
Once the scope has been withdrawn to the level of the distal rectum, it should be retroflexed to look down on
itself. The retroflexion (so-called U-turn maneuver) provides an opportunity to view the distal area of the
rectum, which is difficult to observe during intubation.

2. Rectum

The rectum is the approximately 15 cm long colonic segment from the dentate line to the recto-sigmoid junction.
It is not difficult to advance the colonoscope because the rectum is attached to the retroperitoneal wall and has
almost non-mobility. Houston’s valves are characteristically observed in the rectum. They usually exist in left-
right-left alignment. Progressing the colonoscope through this area can be done easily by push forward with left
and right turns.

3. Rectosigmoid junction (RSJ)

This may be the first challenging area in the colonoscope intubation. The success in passing through RSJ almost
determines the success of colonoscopic examination itself. In most cases lumen opens to the left axis and the
junction between rectum and sigmoid colon often appears as an acute bend in the lumen. Advancing the
colonoscope with only the pushing action may cause loop formation making it difficult to further progress.
Therefore, it is generally helpful to advance the colonoscope while applying a left torque with mild pushing.

4. Sigmoid colon (Sc) and Sigmoidodescending junction (SDJ)

In general, these (Sc, SDJ) are the most difficult segments during insertion and the most common site of
iatrogenic perforation, especially the beginners. Thus, more attentions must be paid when progressing through
these area.26 The Sc is situated intraperitoneally and is highly variable in length (ranges from 20 to 90 cm). Also,
Sc have many folds making various curves, and therefore, when the scope enters the Sc, redundant folds
obliterate the lumen. Adequate air insufflation may be necessary to identify the lumen. Sc looping of some
degree is unavoidable as the colonoscope pushes inward. If the endoscopist would be minimalized such loop
formation, various techniques (jiggling, shaking, RTS) with continuous right torque will be needed. The basic
technique here is to use left and right turns while performing half-suction avoiding adhesion of the lumen. Also,
abdominal compression by assistant’s hand and changing of examinee’s position may be helpful for intubation of
colonoscope. If progress has been made up to these segments with minimum loop formation during
intubation, the inserted length of the colonoscope should be approximately 40 cm, although there are differences
among examinees. Sometimes, extensive turning of the scope tip, torquing, accordionization or dithering
techniques may be needed to negotiate the marked sigmoid turns. The endoscopist should avoid bowing out the
sigmoid, which happens acute angulation of SDJ, and therefore it is difficult to advance of colonoscope. Once
these areas are passed without loop or with minimal loop, it may be not difficult to progress up to the cecum.

6. Descending colon (Dc)

After the passage of SDJ, the Dc appears as a long tube ringed with concentric hasustae and usually has a horizontal fluid level, right side of Dc lumen. In most cases, the Dc is normally traversed in a few seconds with a short “straight” advance and simple pushing is usually enough to pass through this area, because the Dc, which is attached to the retroperitoneal wall as the ascending colon does, has low mobility.

7. Splenic flexure (SF)

The SF can be recognized by the splenic spot seen through the colonic lumen, but such spot usually is not as pronounced as in hepatic flexure. The SF is the highest section of the colon located just below the diaphragm. It is recommended to advance the colonoscope through this segment with the up/down control knob set to neutral state to avoid walking-stick phenomenon. Change of examinee’s position and/or abdominal compression may be helpful when progressing is difficult. If the examinee is non-sedation status, deep inspiration of the examinee, breathing-hold technique, may also be helpful because it widens the angle of the splenic flexure by lowering the diaphragm.

8. Transverse colon (Tc)

The lumen of Tc usually has a more triangular shape than the Dc and it has much mobility as the sigmoid colon. Air suction is helpful in this area since the colonoscope advanced relative to the air suction. If progressing is difficult, instruct the assistant to perform abdominal compression on the umbilical portion to prevent the descent of the transverse colon to the pelvis and the formation of a loop.

9. Hepatic flexure (HF)

In most cases, the end of Tc is easy to recognize because the hepatic spotr can be seen through the mucosa. The lumen of the ascending colon at the next section of the progress usually is located on the right side. In most cases, insertion through this section can easily be performed by advancing while applying a right turn in the anticipated direction of the lumen and performing the air suction. Shifting the examinee to supine position may be helpful when progressing becomes difficult.

10. Ascending colon (Ac)

The Ac also has the more-triangular shape and thicker folds than other colonic segments. Since it is attached to the retroperitoneal wall and has low mobility, advancing the colonoscope to the cecum, the end point of the colon, can be achieved easily by simple pushing.

11. Cecum (Cc)

The Cc is the part from the ileocecal valve (ICV) to the cecal base. It is important to check for the ICV and the appendix orifice to confirm the arrival of the colonoscope at the Cc. Even progressing becomes difficult, air suction into the lumen may usually resolve the problem, but changing of examinee’s position or instructing the assistant for abdominal compression may help if not.

12. Terminal ileum (Ti)

The ICV usually can be seen on the left part of the colonoscopy screen when the colonoscope reaches the Cc. It is usually closed, but can be passed through by deflecting the tip of colonoscope while approaching the ICV. Repetitive approaching to the ICV while performing air suction usually opens its entrance. Continuing the progress will cause the red-out sign followed by the display of the Ti with the opening of the ICV. The Ti is the end point of the small intestine and its characteristic villi can be observed by various methods such as water-filling, indigocarmine-dye, and narrow-band imaging mode.

**Primary care physician training in the Republic of Korea**

Colonoscopy requires practical skills obtained by extensive training. Expertise in colonoscopy can be judged by technical aspects, such as ease and completeness of intubation, precision of observation, and minimal degree of patient discomfort and pain during the examination. On the basis of many studies in a
variety of societies of various countries, to achieve competency for colonoscopy, at least 30-200 procedures have been reported to be required. However, trainees differ considerably in the rate at which they acquire the necessary psychomotor skills, although evidence suggests that most will arrive at a common end point, named procedural competence of colonoscopy. In the Republic of Korea, primary care physicians, especially beginners, can benefit from a comprehensive program on colonoscopy, such as the one offered by the Korean Academy of Family Medicine.

CONCLUSION

Changing behavior such as westernized dietary habit and lifestyle resulted in the increased prevalence of colon diseases such as colon cancer, colon polyps and inflammatory intestinal diseases in Korea. Under such circumstances, the demand for colonoscopic examination has been increasing every year. The demand can hardly be met by only specialist. Thus, the participation of primary care physicians were helpful for this situation. Since the report of colonoscopy practice by family physicians as a safe procedure in the late 1980s, additional studies demonstrated that family physicians have no problem for performing colonoscopy. Colonoscopic examination takes long time to learn and can cause complications such as perforation and hemorrhage as well as pain in the examinees. Therefore, care must be taken in teaching, learning and practicing the colonoscopy. However, complying with the basic principles and techniques and gradual building up of skills by experience will enable general practitioners to learn colonoscopy without difficulties.

REFERENCES


