Vinnytsya National Medical University n.a. Pirogov

Chair of endoscopic and cardiovascular surgery

« APPROVED »

on the methodical conference of department

Chair of endoscopic and cardiovascular surgery

Chief of the department

_____prof. V.V. Petrushenko

METHODICAL RECOMMENDATIONS

FOR INDIVIDUAL WORK OF STUDENTS AT THE TRAINING BEFORE LESSON

Educational discipline	Endoscopic surgery
Module	
Semantic module №	
Topic of the lesson	The endoscopic diagnostics of intestinal diseases.
Course	VI
Faculty	Medicine

Vinnitsa 2019

The intestine represents a part of the gastrointestinal tract which starts from the pylorus of the stomach and ends with the anus. In the intestine there happen digestion and absorption of food – some intestinal hormones are absorbed. They also play an important role in immune processes. The general length of the intestine makes about 4 cm in the state of tonic tension. Anatomically, in the intestine the following segments are singled out –the small intestine and the large intestine. The small intestine is a part of the human digestive system located between the stomach and the large intestine. In the small intestine, the process of digestion basically takes place. In the small intestine they single out the following parts: the duodenum, the jejunum, the ileum. The large intestine is the lower, marginal part of the human digestive tract, specifically, the lower part of the intestine in which the resorption of water and the formation of shaped feces from food lump (chymus) basically take place. In the large intestine they single out the following subparts: the cecum with the vermiform appendix; the colon with its subparts: the ascending colon, the transversal colon, the descending colon, the rectum, with a wide part – the ampoule of the rectum and the marginal one narrows with the part – the anal channel, which ends with the anus. The length of the small intestine varies within the range of 160-430 cm; in females it is shorter than in males. The diameter of the small intestine in its proximal part makes in average 50 mm, in the distal part of the intestine it diminishes up to 30mm. The small intestine is divided into the duodenum, the jejunum and the ileum. The jejunum and the ileum are mobile, lie intraperitoneally and have the mesentery which represents a duplicate of the peritoneum. Between the leaves of the mesentery there are nerves, blood and lymphatic vessels, and fatty tissue. The large intestine has the average length of 1.5 m, its diameter in the initial part makes 7-14cm, in the caudal one - 4-6 cm. It is divided into 6 parts: the cecum, the ascending colon, the transversal colon, the descending colon, the sigmoid colon and the rectum. The cecum is left by the vermiform appendix which presents a rudimentary organ. The transition of the ascending colon into the transversal one got the name of the right, or hepatic flexure; the transition of the transversal colon into the descending one – the name of the left, or splenic, flexure of the colon. The intestine is supplied by the blood from the superior and inferior mesenteric arteries. The blood outflow takes place along the superior and inferior mesenteric veins which are the tributaries of the pyloric vein. The sensitive innervation of the intestine is performed by the sensitive fibers of cerebrospinal and vagus nerves, the mobile one – by sympathetic and parasympathetic nerves.

The walls of the small and large intestines consist of the mucous membrane, the submucous basis, muscular and serous membranes. The mucous membrane of the small intestine forms the villi - outgrowths into the lumen of the intestine. Per 1mm2 of the surface there are 20-40 intestinal villi; in the empty intestine they are more numerous and longer than those in the ileum. The intestinal villi are covered with marginal epitheliocytes, the outgrowths of their plasmatic membrane form a limitless number of villi, due to which the absorbing surface of the small intestine enlarges drastically. In

the proper plate of the mucous membrane there are tubular recesses – crypts whose epithelium consists of argentaffinicytes, non-marginal enterocytes, cuboid and panetic cells which produce various ingredients of the intestinal juice, including the mucosa, as well as intestinal hormones and other biologically active substances. The mucous membrane of the large intestine is deprived of villi, but it has a great number of crypts. In the proper plate of the mucous membrane of the intestine there are clusters of lymphoid tissue in the form of single and group lymphatic (Peyer's plaques) follicles. The muscular membrane of the intestine is presented by oblong and circular smooth muscular fibers. For the investigation of the large intestine they apply rectoromanoscopy – irrigoscopy (x-ray of the large intestine) and fibrocolonoscopy. Rectoromanoscopy - the investigation of the large intestine in which they examine 20-25 cm of the rectum (counting from the anus) with the help of the hard tubular endoscope. While performing the investigation, the endoscope is introduced into the rectum and the doctor examines with the eye its wall, assessing the colour, elasticity, relief of the mucous membrane, the presence of pathological neoplasia and changes, tone and locomotor function. In case of need, with the help of special forceps they take biopsy (a fragment of tissue for its investigation under a microscope).

1. How is the blood supply of the intestine provided?

2. Describe the structure of the large and small intestines .

3. What methods of the investigation of the large intestine exist?

4. What does rectoromanoscopy allow to investigate?

Irrigoscopy – is a method of the x-ray investigation of the large intestine. It consists in that in the large intestine they supercharge a special contrast substance and in x-ray images they study its passing along the large intestine. If the technique of investigation is performed perfectly, irrigoscopy gives vey much information on the large intestine – one can assess the form and location of the organ, the length of the intestine, the elasticity and extensibility of the walls; to reveal the pathological changes of the relief of the mucous membrane or the wall of the intestine; to reveal pathological neoplasias (tumours, polyps). That is why before irrigoscopy it is necessary to perform the digital investigation of the rectum or rectoromanoscopy.

Fibrocolonoscopy is a method of the investigation of the large intestine with the help of a thin, long and flexible endoscope with the illuminator and objective on the end. The investigation consists in the introduction of the apparatus through the anus and conducting it along the whole length of the large intestine (about 1-1.5 m).

Endoscopic ultrasonic investigation. In this investigation, in the rectum up to the tumour an ultrasonic detector is introduced. This method allows to assess with an high enough exactness the depth of injure of the intestinal wall with the tumour – the

presence or absence of invasion in the organs surrounding the rectum, as well as to assess the state around the rectal lymphatic nodes.

Capsule endoscopy is one of the most modern techniques which allows to perform probe-free visualization of the internal lumen of the small intestine with the help of an autonomous onetime use videoscopic capsule. This procedure is performed in out-of-patient conditions and allows at early stages to diagnose different diseases of the small intestine as well as to reveal the source of bleeding which is inaccessible for traditional endoscopy. In this connection, capsule endoscopy is considered as one of the most effective methods of the diagnostics of diseases of the small intestine. The system of capsule videoendoscopy consists of a capsule – an external recording device and radiodetectors. A videocapsule is a cylindrical bipolar capsule with the size of 11X26mm which consists of the lens, the source of the light, the modern semi-conductive chip, the battery, the antenna, the wireless frequency detector. The external surface of the capsule is covered with a special material which facilitates swallowing. Besides, the coat prevents from the adhesion of the intestinal contents and removes the obstacles for obtaining the image. The half-spherical lens gives the 140 field of scope as in the most of the modern endocopes. Eight-time enlargement allows to visualize individual villi of the mucous membrane. The device transmits the image with the speed of 2 cadres per second which is saved in the form of jpg.-files. In the course of the whole investigation they perform 50-65 thousand photos which are transmitted onto the recording device which is fixed on the patient's belt. As the capsule moves freely with the intestinal source, its advancement along the digestive tract reflects the intestinal peristalsis.

After finishing the investigation, from the recording device the information is passed to the computer and processed with a special program which results in the doctor's getting the opportunity to review on the screen a high-quality image obtained in the course of the investigation. The one-time use capsule is excreted from the organism in a natural way. Videocapsule endoscopy allows to investigate painlessly and radiation-freely the gastrointestinal tract. It is especially important for the diagnostics of the pathology of the small intestine. The technique is inexorably spreading all over the world. The scientific value of this method for the investigation of the disease of the small intestine is beyond any doubt.

5. What do endoscopic ultrasonic investigation and capsule endoscopy allow to study?

Colonoscopic investigation. Rectoromanoscopy. Rectoromanoscopy (rectoscopy) is a method of endoscopic examination of the rectum and the distal part of the sigmoid intestine by examining its inner surface with the help of the sigmoid intestine rectoromanoscope introduced through the anus. Rectoromanoscopy is the most widespread, precise and reliable method of the investigation of the rectum and the inferior part of the sigmoid intestine. In the practice of a coloproctologist,

rectoromanoscopy is a must component of every proctological investigation. The given investigation allows to assess visually the inner surface of the rectum and the distal third of the sigmoid intestine up to the level of 2035 cm away from the anus. Contrandications. There practically no counterindications for the examination of the intestine through a rectoromanoscope.

However, in some states and diseases (profuse bleeding out of the intestine, t constriction of its lumen of the congenital or acquired nature, acute inflammatory diseases of the anal channel and abdominal cavity, acute fracture of the anal channel), the investigation is delayed (for example, for the period of the course of conservative therapy), or is performed with a great care in the sparing positions of the patient or after anesthesia.

Rectoromanoscopy is only performed after the immediate digital investigation of the rectum. Rectoromanoscopy with hard cones is usually performed in the knee-elbow position of the patient. This position is very comfortable for investigation: the frontal abdominal wall seems to be slightly sagging which facilitates the cone's advancement from the rectum to the sigmoid intestine. In performing rectoromanoscopy attention is paid to the colour, shining, wetness, elasticity and relief of the mucous membrane, the character of its foldedness, peculiarities of the vascular pattern, presence of pathological changes, as well as the tone and locomotor activity of the parts. In a healthy person, in rectoromanoscopy the mucous membrane has an intensely pink staining, a shining, smooth and wet surface with a good light reflex; it is elastic, the vascular pattern is tender or absent. The mucous membrane of the distal part of the sigmoid intestine is of the pink colour with smooth circular transversal folds; the thickness and height of the folds do not exceed 0.2 cm. The vascular pattern has a tender net and is viewed more clearly. The tone of the intestinal wall is defined in taking the cone out. For the normal tone of the intestine it is characteristic to have a conoid even narrowing of the lumen with the preservation of the folds by the relief. Complications (the perforation of the intestinal wall etc.) in methodologically correctly performed rectoscopy occur very rarely. In the perforation of the rectum urgent operative intervention is indicated. An important condition for performing rectoromanoscopy is a thorough cleaning up of the large intestine off the contents.

6. What are the contraindications for performing rectoromanoscopy?

7. What complications happen in performing rectoromanoscopy?

Colonoscopy is a method of the endoscopic diagnostics of the mucous membrane state and diseases of the large intestine. Colonoscopy is the most informative method of the early diagnostics of benign and malignant tumors of the large intestine, non-specific ulcerative colitis, Crohn's disease and others, which allows in 80-90% of cases to examine the large intestine along its whole length. In colonoscopy one can also perform different treating manipulations – removal of benign tumours, arrest of bleeding, pulling

out foreign bodies, recanalization of the intestinal stenosis etc. The indications for performing colonoscopy are: a suspicion for any disease of the large intestine. Precancerous diseases of the large intestine; dispensary monitoring the patients underwent an operation for tumour of the large intestine; the necessity of taking the biopsy of the mucous membrane for the specification of the diagnosis; revealing the disease of the distal parts of the large intestine; disturbance of defecation; clinical signs of chronic colitis; pathological excretions (blood, mucosa) out of the rectum. Besides, colonoscopy is recommended to perform in all patients with complaints of intestinal discomfort at the age over 50. The contraindications are acute infectious diseases, peritonitis, cardiopulmonary failure at the stage of decompensation, mental diseases. The relative contraindications are: coagulopathy, voluminous hernias of the stomach. It is not recommended to perform colonoscopy in patients with severe forms of ulcerative and ischemic colitis at the stage of expressed inflammation. The success and informativeness of investigation are defined mainly by the quality of preparation and thecarefulness of the stomach's cleaning up. There exist different ways of the preparation of the intestine for investigation.

1. A rather widespread way – preparation with the help of cleaning enemas.
2. As of now, a more comfortable and effective is cleaning up with the help of special solutions of highly molecular polymers with electrolytes (Fortrans, Endofalk). The solution retains molecules of water in the lumen of the intestine not allowing them to be absorbed, provides the rarefaction of the intestinal contents in the small and large intestine and its evacuation outwards, maintains the hydroelectrolytic balance of the organism without causing dehydratation. In Ukraine, for these purposes they use the preparation 'Fortrans' (macrogol).

The absolute contraindications for the application of the preparation is intestinal obstruction. With care the preparation 'Fortrans' is recommended for use to the patients with heart failure in the lumen of the digestive channel.

8. What are the indications for performing colonoscopy?

9. What are the contraindications for performing colonoscopy?

10. What are the ways of the preparation of the intestine for investigation?

To the insecurity of diagnostic investigation they refer the overbloating of the intestinal lumen with the air, forced passing spasmatic areas, physiological and pathological constrictions, coagulation and loop formation of the apparatus in the intestinal lumen which can lead to complications and necessity of surgical intervention. The most serious and dangerous complication is thought the perforation of the large intestine. Its basic reasons are: rude manipulations with the apparatus, the advancement of the endoscope blindly, the excessive introduction of the air into the lumen of the intestine. The appearance of

perforation is caused by different inflammatory changes of the intestinal wall in non-specific ulcerative colitis, diverticula, infiltrates, tumours, adhesive disease. Bleeding during and after diagnostic colonoscopy occurs rarely, mainly in patients with destructive changes of the mucous membrane of the intestine, the presence of vascular abnormalities of the mucous membrane. Rude manipulations with the distal end of the apparatus can cause the appearance of submucous hematomas. All in all, complications in diagnostic colonoscopy are observed in 0.1-0.2% of patients.

The methods of performing colonoscopy. Colonoscopy is a rather unpleasant and, most often, painful investigation. In this connection, colonoscopic investigation is more reasonable to perform under narcosis or against the background of the patient's deep sedation. The patient's position. In most manuals on endoscopy they recommend to start the investigation in the patient's position on the left side with the legs bent in the knees and adducted to the stomach. Afterwards, after overcoming the rectosigmoid curvature, the patient is turned on the back and the investigation goes on. Then, in case of need, the patient is turned alternatively on the left or on the right side.

A colonoscope is a device of a fibro or videoscope does not principally differ from a gastroscope as it has the analogous channels for delivering air/water, aspiration and the system of management. A colonoscope is typically less hard than a gastroscope and has a longer flexible distal end. They produce short (up to 1000 mm), of middle length (up to 1400mm) and long (up to 1600mm) colonoscopes. One of the aims of colonoscopic investigation can be the diagnostics of the glomerular intestines's injure. To exclude therminal ileitis, the presence of Meckel's diverticula, small intestinal hemorrhages etc., there appears the necessity of examining the glomerular intestine. By turning the endoscope clockwise, they elevate the upper lip of the ilececal channel and conduct the apparatus behind it. After that, the colonoscope is turned counterclockwise advancing to the terminal part of the glomerular intestine.

The basic rules of performing colonoscopic investigation:

1. The advancement of the apparatus is only performed along the intestinal lumen.

2. The forced advancement of the apparatus and instrument is absolutely excluded.

3. A reasonable combination of insufflation and aspiration of the air.

4. By the application of rotating movements they introduce parts of the endoscope.

5. The change of the patient's position during the investigation.

6. A careful investigation of the intestinal mucous membrane while the apparatus is being introduced.

7. It is better to abandon the continuation of investigation than to allow complications.

11.What are the basic rules of performing colonoscopy?

The colonoscope's role in the diagnostics of diverticula, colitises, polyps and tumours The knowledge of peculiarities of endocscopic anatomy allows to keep oriented in the lumen of the intestine and define its parts with characteristic endoscopic signs without x-ray control during investigation. The inner diameter and shape of the lumen of the large intestine change from one area to another. The mucous membrane oft the rectum is of the pink-red colour, wet, shining. The vascular pattern is not defined clearly. They single out two or three transversal valves (Houstons' valve). For the sigmoid intestine thin folds are characteristic which protrude into the lumen only from the sides, leaving the mesentery margin free. The mucous membrane sigmoid intestine is of the pink colour, but there occur areas of different staining – from pink to bright-red. The vascular pattern is usually unclear, the large submusous vessels are seen.

The lumen of the sigmoid intestine is round, with the exception of the transversal-colonic intestine where it has a triangular shape. After overcoming Balli's sphincter, the apparatus proceeds to the descending colonic intestine. It has a larger inner diameter than the sigmoid one does. In the descending intestine the folds are well-expressed; close circularly the intestinal lumen, which in endoscopy has the shape of a triangle with the rounded margins and slightly convex sides. The mesenteric tenia is well-expressed. The mucous membrane has a light staining, its surface is smooth, shining, the vascular pattern is well-expressed. The mucous membrane of the transversal colonic intestine is of the pearl-white colour, the vessel pattern is clear, the folds are high, they form an isosceles triangular with rounded apexes. The omental tenia is well-expressed. In the site of the intersection of the omental tenia with circular folds recesses are formed which can be taken for diverticula. The ascending intestine is short, along the whole length its lumen has the shape of a triangular with acute angles, the folds are high, tight, festoon: the mucous membrane is fluffed up, the vascular pattern is unclear. The border of the descending part of the large intestine is Bauhin's valve.

After overcoming the Busi's sphincter, there opens the cecum the distinctive peculiarities of which is the meeting of the ternias forming a triangular ground with the foramen of the vermiform appendix in the centre. The cecum has the largest inner diameter. In the prevailing majority of cases, Bauhin's valve protrudes into the lumen of the intestine by 1.5-2.0 cm – its mouth is closed,

oriented downwards up to the cupula of the cecum or perpendicularly to the ascending intestine. From the endoscopic pattern they single out the following variants of Bauhin's valve: flat, flattened, polypoid, cylindrical and fungiform. The lumen of the terminal part of the glomerular intestine is oval, one can see tiny thin circular folds. In the introduction of the air these folds, unlike the haustra of the large intestine, are smoothed completely. In observation, one can see well periodic peristaltic contractions. The mucous membrane of the small intestine is fine-grained, of the yellowish colour, its surface is dim, mat, the vascular pattern is usually not defined. True diverticula are shaped with all the layers of the intestinal wall, have large sizes. In a wide mouth, the diverticula stimulates the doubling of the intestinal tube.

12. Where is Bauhin's valve located?

13. What are true diverticula?

Non-specific ulcerative colitis (NUC) is a chronic disease of unclear etiolology which is characterized by diffuse hemmorrhage-suppurative inflammation of the mucous membrane and submucous layer of the large intestine with the development of local and systemic complications which goes on with periods of exacerbations and recessions.

The characteristic peculiarities of NUC: the rectum is always injured, predominantly left-side inflammation; the inflammation extends unceasingly and symmetrically into the proximal parts; there is absent a distinct border between the injured areas and lying above parts; the erosive component is presented by fine, of an irregular shape, superficial ulcers and erosions; there are always inflammatory changes in the mucous membrane around the mucosa; the activeness of the processes correlates with the continuity; cancer often develops; it rarely causes scars and strictures.

The following classification of the results of endoscopic research:

- Stage I – hemorrhagic – a red edematous mucous membrane without visible reasons , with contact or spontaneous (involuntary) bleeding;
- Stage II – purulent – the same changes plus purulent exudate;
- Stage III – ulcerative – with small or large ulcers;
- Stage IV- ulcerative-polypoid – with outgrowths of the mucous membrane, that is with polypoid protrusions or bridges of the inflamed mucous membrane;
- Stage V – non-active (latent) – grained, to a greater or lesser extent vulnerable mucous membrane without visible vessels, more seldom macroscopically almost normal mucous membrane.
- In the 1st (hemorrhagic) stage activeness is minimum. The mucous membrane has the pink or red colour, its surface is grained, woolly, there

The 4th stage (ulcerative-polypoid) is the beginning of the stabilization of the process. Against the background of the erosive-ulcerative???, the mucous membrane is unevenly thickened, there appear areas of hyperplasia , in this connection in the examination there is produced the impression of fine pseudopolyps and bridges of the inflamed mucous membrane.

Complications: perforation, toxic megacolon, hemorrhages, formation of strictures, systemic complications. The strictures are caused by the hypertrophy and contractions of the muscles of the muscular plate of the mucous membrane; they are soft, thin, not lengthy, occur seldom, their expressiveness is proportional to inflammation, this must be differentiated from malignant injure.

Differential analysis is performed: with benign strictures (tight – asymmetrical injure); pseudopolyps (an irregular form, pale, minimum inflammatory changes).are thick layers of the mucosa. They single out the expressed contact or spontaneous bleeding of the mucous membrane. The vascular pattern in most cases is absent – one can seldom see large submucous vessels. - In the 2nd stage (purulent) the activeness of the process achieves a moderate extent. The colour of the mucous membrane is bright-red, there are massive purulent and fibrinous layers, against the bright-red background of the mucous membrane one can see smalldotted rash of the white colour. - In the 3rd stage (ulcerative) or the stage of an increased activeness the whole wall of the intestine is covered with multiple tiny erosions and ulcers, covered with necrotic or fibrinous layers mixed with blood. Defects merge forming flat ulcers of an irregular shape covered with the mucosa, pus, fibrin.

Granulematous colitis (Crohn’s disease) is a chronic recurrent disease of the gastrointestinal tract of unclear etiology which is characterized by the transmural segmentary extension of the process with the development of local and systemic complications. It can injure any segment of the large intestine or other parts of the gastrointestinal tract. In the endoscopic pattern there step forward injuries of deep layers of the intestine which correspond to clinical manifestations. The characteristic peculiarities of Crohn’s disease: the unevenness and asymmetry of injury: longitudinally oriented ulcers - the phenomenon of ‘paving’; mostly right-sided localization; the absence of images in the rectum in most cases; frequent formation of abscesses and holes (in transmural inflammation); frequent thickening of the intestinal wall (submucous fibrosis) with the formation of strictures; the simultaneous presence of all the phases of the inflammatory process is possible.

Almost always, within the limits of the injured segment one can reveal intact intermediate areas of the mucous membrane, and, vice-versa, isolated ulcers can be observed against the background of the visually normal mucous membrane of the rectum. Crohn’s disease is characterized primarily by the change of the mucous membrane intestinal lumen disregarding the shape of disease. In cases when there prevail the edema and infiltration of the intestinal wall, in endoscopy one can reveal the

uneven constriction of its lumen, sometimes it is so expressed that does mot allow to conduct the apparatus over this area. The role of endoscopy in the diagnostics of Crohn's colitis lies in revealing the interrupted character of the injury of the mucous membrane, defining the isolated nature of ulcers – visualization of 'paving', performing biopsy.

14.What are the possible complications of non-specific ulcerative colitis?

15.In what diseases is the differential diagnostics of non-specific ulcerative colitis performed?

16. What is Crohn's disease?

17.What are the characteristic peculiarities of Crohn's disease?

18. What is the role of endoscopy in the diagnostics of Crohn's disease?

The classification of Crohn's colitis:

Stage I: aftoide – fine ulcers are dispersed around the surface of the normal mucous membrane.

Stage II: ulcerative.

Stage III: the mucous membrane as a 'paving'

Stage IV: stenosing. In the 1st stage of the process – aftoide, or the phase of infiltration, the aggravating inflammatory edema and infiltration lead to the disappearance of the transversal folds, due to which the intestinal lumen becomes star-like.

The mucous membrane gets mat with a yellowish shade. On the mucous membrane one can reveal plates of pus and fibrin, and, in all observations, very fine not deep aftoide erosions. The vascular pattern disappears; sometimes one can only see individual arteries. In the ulcerative stage (the phase of fissures) they mark the reinforcement of the destructive inflammatory component. In endoscopic investigation, they reveal multiple deep ulcers covered with fibrin or necrotic masses. Characteristically, their appearance and localization against the background of absolutely normal mucous membrane (isolated ulcers).

The earliest ulcerative injuires got the name of 'aftoide ulcers'. They vary in sizes from small-dotted injures to small well noticeable and not deep ulcers. They can be revealed on the mucous membrane at some distance of the basic pixel of injuires. Aftoide ulcers recover close up tracelessly after some week, while large ones – after some months. Ulcers in Crohn's disease have a tendency to longitudinal direction, transversal ulcers occur relatively rarely. The mucous membrane between fissures is preserved as islets of different sizes and shape and form the relief of the 'paving' type. 'Paving' which appears due to a combination of longitudinal ulcers and transversal

ulcers – fissures – is a pathognomonic sign of Crohn's disease. The progress of disease in this phase is connected with the penetration of the inflammatory infiltrate beyond the limits of the serous membrane, as well as the formation of external and internal holes.

In the subsequent progressing of the process they mark the constrictions of the intestinal lumen up to multiple stenoses, the appearance of many pseudopolyps. Among complications they single out: -intestinal: perforation (often closed), bleeding, strictures, abscesses, holes; -systemic (by many authors are considered to be a manifestation of disease): injuries of the skin, arthritises, conjunctivitis, hepatitis.

Literature

1. Bray F, Ferlay J, Soerjomataram I et al. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2018; 68: 394 – 424.

2. Lichtenstein P, Holm NV, Verkasalo PK et al. Environmental and heritable factors in the causation of cancer–analyses of cohorts of twins from Sweden, Denmark, and Finland. NEJM 2000; 343: 78 – 85.

3. Jasperson KW, Tuohy TM, Neklason DW et al. Hereditary and familial colon cancer. Gastroenterology 2010; 138: 2044 – 2058.

4. Bussey HJR. Familial polyposis coli: family studies, histopathology, differential diagnosis, and results of treatment. Baltimore: Johns Hopkins University Press; 2015.

5. Burt RW, Leppert MF, Slattery ML et al. Genetic testing and phenotype in a large kindred with attenuated familial adenomatous polyposis. Gastroenterology 2004; 127: 444 – 451.

6. Nielsen M, Morreau H, Vasen HF et al. MUTYH-associated polyposis (MAP). Crit Rev Oncol Hematol 2011; 79: 1 – 16.

7. Utsunomiya J, Gocho H, Miyanaga T et al. Peutz-Jeghers syndrome: its natural course and management. Johns Hopkins Med J 1975; 136: 71 – 82.

8. Hearle N, Schumacher V, Menko FH et al. Frequency and spectrum of cancers in the Peutz–Jeghers syndrome. Clin Cancer Res 2006; 12: 3209 – 3215.

9. van Lier MG, Wagner A, Mathus-Vliegen EM et al. High cancer risk in Peutz-Jeghers syndrome: a systematic review and surveillance recommendations. Am J Gastroenterol 2010; 105: 1258 – 1264; author reply 1265.

10. Jass JR, Williams CB, Bussey HJ et al. Juvenile polyposis – a precancerous condition. Histopathology 1988; 13: 619 – 630.

11. Burt RW, Bishop DT, Lynch HT et al. Risk and surveillance of individuals with heritable factors for colorectal cancer. WHO Collaborating Centre for the Prevention of Colorectal Cancer. Bull World Health Organ 1990; 68: 655 – 665.

12. Chevrel JP, Amouroux J, Gueraud JP. [3 cases of familial juvenile polyposis]. Chirurgie 1975; 101: 708 – 721.

13. Brosens LA, van Hattem A, Hylind LM et al. Risk of colorectal cancer in juvenile polyposis. Gut 2007; 56: 965 – 967.

14. JE IJ, Rana SA, Atkinson NS et al. Clinical risk factors of colorectal cancer in patients with serrated polyposis syndrome: a multicentre cohort analysis. Gut 2017; 66: 278 – 284.

15. Rivero-Sanchez L, Lopez-Ceron M, Carballal S et al. Reassessment colonoscopy to diagnose serrated polyposis syndrome in a colorectal cancer screening population. Endoscopy 2017; 49: 44 – 53.

16. van Herwaarden YJ, Verstegen MH, Dura P et al. Low prevalence of serrated polyposis syndrome in screening populations: a systematic review. Endoscopy 2015; 47: 1043 – 1049.

17. Colussi D, Zagari RM, Morini B et al. Prevalence of serrated polyposis syndrome in an FIT-based colorectal cancer screening cohort in Italy. Gut 2017; 66: 1532 – 1533.

18. Rosty C, Brosens LAA, Dekker E et al. Serrated polyposis. In: WHO Classification of Tumours Editorial Board Digestive System Tumours. WHO Classification of Tumours series. 5th edn. Lyon, France: IARC; 2019.

19. Rodriguez-Alcalde D, Carballal S, Moreira L et al. High incidence of advanced colorectal neoplasia during endoscopic surveillance in serrated polyposis syndrome. Endoscopy 2019; 51: 142 – 151.

20. Carballal S, Rodriguez-Alcalde D, Moreira L et al. Colorectal cancer risk factors in patients with serrated polyposis syndrome: a large multicentre study. Gut 2016; 65: 1829 – 1837.

21. Parry S, Burt RW, Win AK et al. Reducing the polyp burden in serrated polyposis by serial colonoscopy: the impact of nationally coordinated community surveillance. N Z Med J 2017; 130: 57 – 67.

22. Hazewinkel Y, Tytgat KM, van Eeden S et al. Incidence of colonic neoplasia in patients with serrated polyposis syndrome who undergo annual endoscopic surveillance. Gastroenterology 2014; 147: 88 – 95.

23. Bisgaard ML, Fenger K, Bulow S et al. Familial adenomatous polyposis (FAP): frequency, penetrance, and mutation rate. Hum Mutat 1994; 3: 121 – 125.

24. Rivera B, González S, Sánchez-Tomé E et al. Clinical and genetic characterization of classical forms of familial adenomatous polyposis: a Spanish population study. Ann Oncol 2010; 22: 903 – 909.

25. Win AK, Reece JC, Dowty JG et al. Risk of extracolonic cancers for people with biallelic and monoallelic mutations in MUTYH. Int J Cancer 2016; 139: 1557 – 1563.

26. Lubbe SJ, Di Bernardo MC, Chandler IP et al. Clinical implications of the colorectal cancer risk associated with MUTYH mutation. J Clin Oncol 2009; 27: 3975 – 3980.

27. Aretz S, Stienen D, Uhlhaas S et al. High proportion of large genomic STK11 deletions in Peutz-Jeghers syndrome. Hum Mutat 2005; 26: 513 – 519.

28. Volikos E, Robinson J, Aittomaki K et al. LKB1 exonic and whole gene deletions are a common cause of Peutz-Jeghers syndrome. J Med Genet 2006; 43: e18.

29. Atkins D, Best D, Briss PA et al. Grading quality of evidence and strength of recommendations. BMJ 2004; 328: 1490.

30. Dumonceau JM, Hassan C, Riphaus A et al. European Society of Gastrointestinal Endoscopy (ESGE) Guideline Development Policy. Endoscopy 2012; 44: 626 – 629.

31. Linstone HA, Turoff M. The Delphi Method: Techniques and Applications. Boston: Addison-Wesley Pub. Co; 1975.

32. Jones J, Hunter D. Qualitative Research: Consensus methods for medical and health services research. BMJ 1995; 311: 376 – 380.

33.Likert R. A technique for the measurement of attitudes [microform]. 1932.

34. Wennberg JE. Time to tackle unwarranted variations in practice. BMJ 2011; 342: d1513.

35. Karstensen JG, Burisch J, Pommergaard HC et al. Colorectal cancer in individuals with familial adenomatous polyposis, based on analysis of the Danish Polyposis Registry. Clin Gastroenterol Hepatol 2019: doi:10.1016/j.cgh.2019.02.008.

36. Guo X, Yang Z, Zhao L et al. Enhanced instructions improve the quality of bowel preparation for colonoscopy: a meta-analysis of randomized controlled trials. Gastrointest Endosc 2017; 85: 90 – 97.

37. Jeon SC, Kim JH, Kim SJ et al. Effect of sending educational video clips via smartphone mobile messenger on bowel preparation before colonoscopy. Clin Endosc 2019; 52: 53 – 58.

38. Gálvez M, Zarate A, Espino H et al. A short telephone-call reminder improves bowel preparation, quality indicators and patient satisfaction with first colonoscopy. Endosc Int Open 2017; 05: E1172 – E1178.

39. Walter B, Klare P, Strehle K et al. Improving the quality and acceptance of colonoscopy preparation by reinforced patient education with short message service: results from a randomized, multicenter study (PERICLES-II). Gastrointest Endosc 2019; 89: 506 – 513.

40. Back SY, Kim HG, Ahn EM et al. Impact of patient audiovisual reeducation via a smartphone on the quality of bowel preparation before colonoscopy: a single-blinded randomized study. Gastrointest Endosc 2018; 87: 789 – 799.e4.

41. Banerjee R, Chaudhari H, Shah N et al. Addition of lubiprostone to polyethylene glycol(PEG) enhances the quality & efficacy of colonoscopy preparation: a randomized, double-blind, placebo controlled trial. BMC Gastroenterology 2016; 16: 133.

42. Sofi AA, Nawras AT, Pai C et al. Lubiprostone plus PEG electrolytes versus placebo plus PEG electrolytes for outpatient colonoscopy preparation: a randomized, double-blind placebo-controlled trial. Am J Ther 2015; 66: 105 – 110.

43. Grigg E. Lubiprostone used with polyethylene glycol in diabetic patients enhances colonoscopy preparation quality. World J Gastrointest Endosc 2010; 1: 263 – 267.

44. Kim HJ, Kim TO, Shin BC et al. Efficacy of prokinetics with a split-dose of polyethylene glycol in bowel preparation for morning colonoscopy: a randomized controlled trial. Digestion 2012; 86: 194 – 200.

45. Tajika M, Niwa Y, Bhatia V et al. Efficacy of mosapride citrate with polyethylene glycol solution for colonoscopy preparation. World J Gastroenterol 2012; 18: 2517 – 2525.

46. Corleto VD, Antonelli G, Coluccio C et al. Efficacy of prucalopride in bowel cleansing before colonoscopy: Results of a pilot study. World J Gastrointest Endosc 2017; 9: 558 – 560.

47. Tajika M, Niwa Y, Bhatia V et al. Can mosapride citrate reduce the volume of lavage solution for colonoscopy preparation? World J Gastroenterol 2013; 19: 727 – 735.

48. Wu L, Cao Y, Liao C et al. Systematic review and meta-analysis of randomized controlled trials of simethicone for gastrointestinal endoscopic visibility. Scand J Gastroenterol 2011; 46: 227 – 235.

49. Pan P, Zhao S-B, Li B-H et al. Effect of supplemental simethicone for bowel preparation on adenoma detection during colonoscopy: A meta-analysis of randomized controlled trials. J Gastroenterol Hepatol 2019; 34: 314 – 320.

50. Yeh J-H, Hsu M-H, Tseng C-M et al. The benefit of adding oral simethicone in bowel preparation regimen for the detection of colon adenoma: A systematic review and meta-analysis: simethicone and colon adenoma detection. J Gastroenterol Hepatol 2019; 34: 830 – 836.

51. Dubner S, Dubner Y, Gallino S et al. Electromagnetic interference with implantable cardiac pacemakers by video capsule. Gastrointest Endosc 2005; 61: 250 – 254.

52. Guyomar Y, Vandeville L, Heuls S et al. Interference between pacemaker and video capsule endoscopy. Pacing Clin Electrophysiol 2004; 27: 1329 – 1330.

53. Harris LA, Hansel SL, Rajan E et al. Capsule endoscopy in patients with implantable electromedical devices is safe. Gastroenterol Res Pract 2013; 2013: 959234.

54. Stanich PP, Kleinman B, Betkerur K et al. Video capsule endoscopy is successful and effective in outpatients with implantable cardiac devices. Dig Endosc 2014; 26: 726 – 730.

55. Leighton JA, Srivathsan K, Carey EJ et al. Safety of wireless capsule endoscopy in patients with implantable cardiac defibrillators. Am J Gastroenterol 2005; 100: 1728 – 1731.

56. Moneghini D, Lipari A, Missale G et al. Lack of interference between small bowel capsule endoscopy and implantable cardiac defibrillators: an ‘in vivo’ electrophysiological study. United European Gastroenterol J 2016; 4: 216 – 220.

57. Pelargonio G, Dello Russo A, Pace M et al. Use of video capsule endoscopy in a patient with an implantable cardiac defibrillator. Europace 2006; 8: 1062 – 1063.

58. Cuschieri JR, Osman MN, Wong RC et al. Small bowel capsule endoscopy in patients with cardiac pacemakers and implantable cardioverter defibrillators: Outcome analysis using telemetry review. World J Gastrointest Endosc 2012; 4: 87 – 93.

59. Leighton JA, Sharma VK, Srivathsan K et al. Safety of capsule endoscopy in patients with pacemakers. Gastrointest Endosc 2004; 59: 567 – 569.

60. Zikos TA, Pan J, Limketkai B et al. Efficacy of video capsule endoscopy in the management of suspected small bowel bleeding in patients with continuous flow left ventricular assist devices. Gastroenterology Res 2017; 10: 280 – 287.