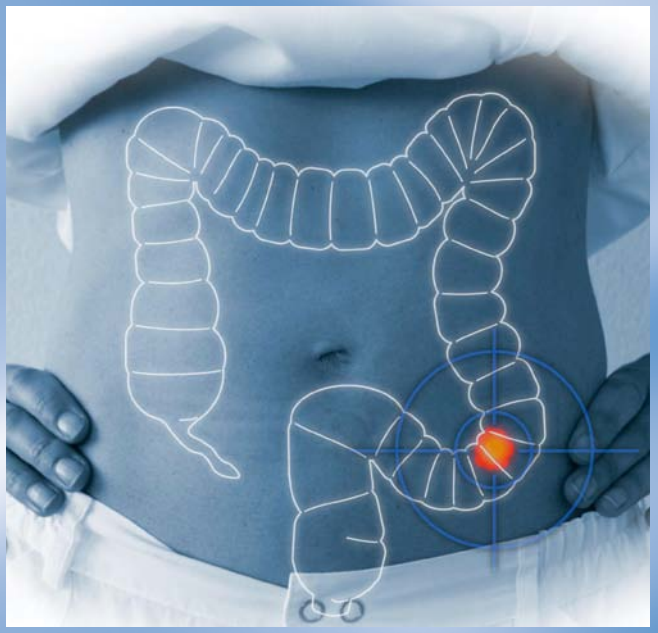
Colorectal cancer

Colon carcinoma
Rectal carcinoma



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This booklet is dedicated to all colorectal cancer patients.

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Introduction: What you need to know

1.1 What are the colon and rectum? Where are they located?

The large bowel, or colon, and the rectum are located at the end of the digestive tract. The colon is about 1.5 meters long and forms a frame around the abdomen. The digested food passes out of the small bowel into the ascending colon. From there, it is transported into the transverse colon. After passing through this bowel segment, it moves into the descending colon, which extends along the left side of the abdomen downwards into the hypogastric region. In the left lower abdomen, the colon forms a gentle S-shaped curve which gives this segment the name "sigmoid" or "sigmoid colon" *(Fig. 1)*.

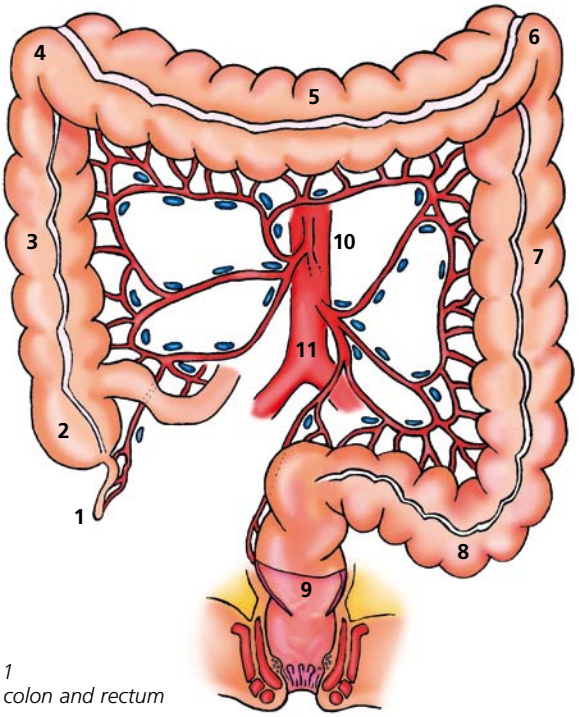


Fig. 1
The colon and rectum

This S-shaped segment is the final part of the colon. The remaining 16 cm of the bowel is known as the rectum and is connected via the anal canal to the anus. The rectum is divided into three segments: the upper third, middle third and lower third. This division into thirds is of clinical relevance because treatment of tumours differs according to which third of the rectum they are located in (*Fig. 2*).

1 *Upper third of the rectum*
2 *Middle third of the rectum*
3 *Lower third of the rectum*
4 *Anal canal*
5 *Anus*
6 *Sphincter*

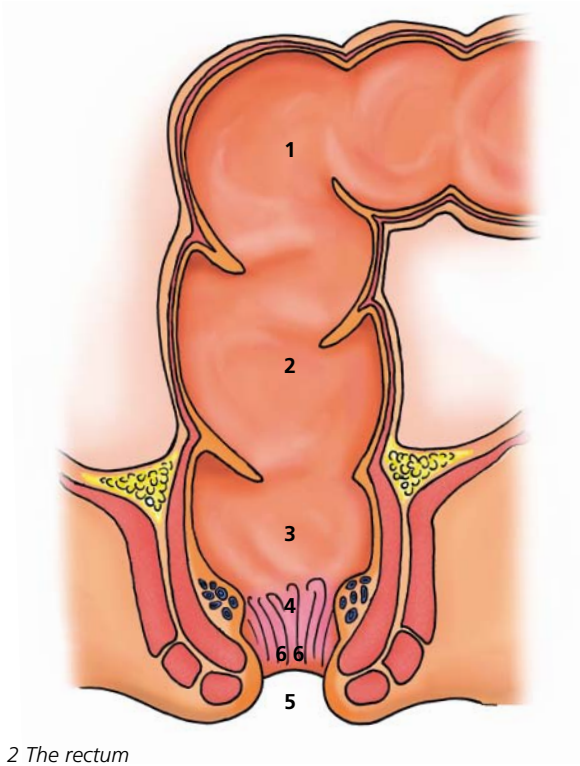


Fig. 2 The rectum

1.2 What is the importance of blood vessels and lymphatic vessels in colorectal cancer?

Arteries supply the bowel with blood. Veins carry the blood into the liver and back to the heart. The superior mesenteric artery (*10, Fig. 1*) branches directly off of the abdominal aorta (the central artery that originates from the heart and descends through the abdomen) and, after splitting into two main branches, supplies the ascending and transverse colon with blood. The descending colon and sigmoid are supplied from the inferior mesenteric artery (*11, Fig. 1*). This artery also has a branch which supplies the upper part of the rectum. The middle and lower thirds of the rectum are supplied by branches of the internal pelvic arteries.

Lymphatic vessels are responsible for the drainage of fluid (lymph) and small amounts of protein. The lymphatic vessels of the colon and rectum run alongside the blood vessels and branch into the regional lymph nodes (depicted as blue ovals in Fig. 1). Removal of the lymph nodes is an important part of colorectal cancer surgery, as the finding or exclusion of dissemination of the tumour to regional lymph nodes is a decisive factor in determining the patient's prognosis and in treatment planning. Increased removal of these lymph nodes also improves outcomes.

1.3 What is the structure of the bowel wall?

The structure of the bowel wall is uniform throughout the intestine. The layers of the bowel wall are as follows, starting from the innermost layer outward:

1st layer: **the mucous membrane (mucosa)**. The mucous membrane is the inner lining of the colon and contains secretory cells for forming chyle, cells for nutrient uptake and cells involved in immune response.

2nd layer: **submucosa**. This layer contains the blood vessels, lymphatic vessels and nerve fibres. Colorectal cancer is present once a tumour has spread beyond the bound-

ary between the mucosa and submucosa. In this layer, the colorectal tumour will have contact with blood and lymphatic vessels, meaning that at this stage of the disease there is a slight possibility that the tumour cells have spread to the lymph nodes or other organs.

3rd layer: **muscularis**. This layer contains muscle fibres arranged along the longitudinal and transverse axes of the bowel, allowing the bowel to contract and propel its contents forward.

4th layer: **outer layer (serosa)**. This outer covering comprises thin connective tissue. In some bowel segments, the outermost layer is formed directly from the peritoneum (inner layer of the abdominal wall).

Knowledge of the structure of the bowel wall is important for understanding the depth of tumour growth. The deeper a tumour grows, i.e. the more layers it invades, the poorer the patient's prognosis. The increasing invasion of the tumour produces a corresponding increased probability that tumour cells can gain access to the lymphatic system or blood vessels and form colonies (metastases) in distant tissues.

1.4 How does digestion work?

In the digestive process, food is broken down with the aid of enzymes as it passes through the digestive tract. The resulting nutrient components can then be absorbed by the body. In humans, digestion largely takes place in the mouth, stomach, duodenum and the rest of the small bowel, but nutrients are absorbed almost exclusively in the duodenum and small bowel. Around 80% of the water contained in the porridge-like mass of digested food (chyme) is absorbed in the small bowel. The chyme is further thickened in the colon, where 19% of the remaining water is absorbed. The colon is inhabited by microorganisms which make up the so-called intesti-

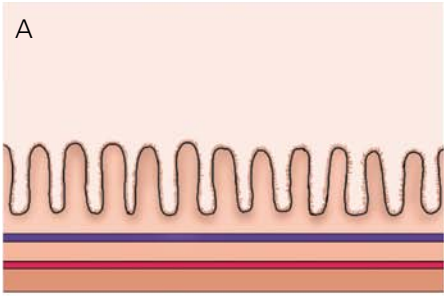
nal flora. These microorganisms break down certain vegetable substances by fermentation, making them easier to process. Substances which are not broken down by digestive enzymes in the small bowel and are not subject to fermentation by microorganisms in the colon are excreted unchanged through the rectum. No digestion takes place in the rectum. The colon and the rectum are not digestive organs which are necessary for life. Following surgery, the remaining bowel can assume most of their functions. Patients can therefore expect a good quality of life and bowel function after surgery.

1.5 How does an adenoma develop into cancer?

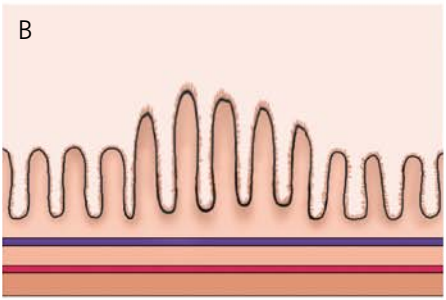
Colorectal cancer is one of the best-researched malignancies. The majority of cases develop from benign precursors (adenomas). The degeneration of adenomas into cancer is known as the adenoma-carcinoma sequence *(Fig. 3)* and is a process which may extend over a number of years. Causes of this degeneration include successive changes (mutations) to genes in the cells of the mucous membrane, which lead to a loss of the natural mechanisms which curb growth.

The mutated cells begin to ignore the normal boundaries between tissues and spread into the bowel wall. This is known as "invasive tumour growth". These cancer cells may escape from their originating cell mass and be carried by the blood or lymphatic fluid to other parts of the body, where they form daughter tumours (metastases).

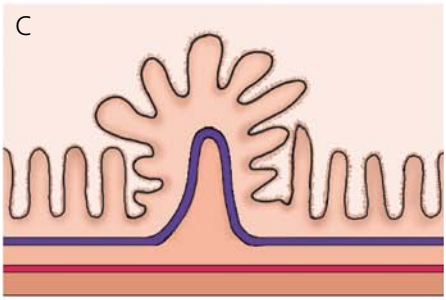
It is estimated that colorectal cancer can develop from an adenoma within five to ten years. The risk of cancer increases with age. Most patients with colorectal cancer are over 50. Gene mutations may also be hereditary, i.e. they are inherited from the patient's parents. In such cases, patients may develop cancer at a much younger age. Special attention is needed in cases of hereditary or familial risk.



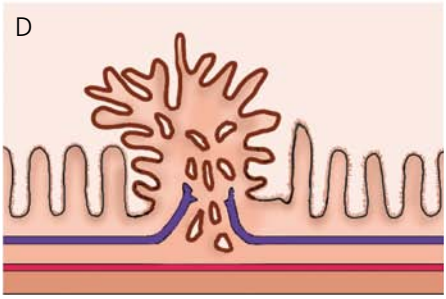
Normal colon mucosa. The violet line marks a layer of muscle, the so-called muscularis mucosae. This layer separates the mucosa from the submucosa.



Early-stage adenoma.



Late-stage adenoma; still benign but already exhibiting cell changes.



Colorectal cancer. The submucosa has been invaded by tumour cells.

Fig. 3 The adenoma-carcinoma sequence

1.6 How is colorectal cancer studied?

Besides activities directly related to the treatment of patients, academic hospitals are also involved in other important research and teaching activities. They conduct clinical and basic research into long-term improvements of treatments for all patients with colorectal cancer.

Clinical studies

Clinical research involves testing drugs or treatment methods under controlled conditions in the clinical setting. Care of the patient always remains the top priority. Despite the great progress made in colorectal cancer treatment, there are still countless unanswered questions which can only be reliably investigated in the context of clinical studies. Participation in these studies is always strictly voluntary. An advantage of taking part in a study is that the patient has the opportunity of being treated with the latest, most promising drugs and/or therapeutic methods.

Basic research

Although colorectal cancer is among the best studied types of cancer, there are still many unanswered questions concerning its origin, growth and metastasis. A number of research groups throughout the world have taken on the task of gaining a better understanding of the origin of these tumours, their growth patterns, interaction with surrounding tissues and invasion of other organs. It is hoped that in the long run this research will contribute to better methods of early detection and treatment (*Fig. 4*).

Fig. 4 Lab research

Colorectal cancer

Colorectal cancer

2.1 What is cancer?

"Cancer" is the term used to designate a malignant new growth of cells arising from the pathological degeneration of the body's own cells. Characteristic of cancer cells is their altered cell structure (cell atypia), their capacity to invade neighboring tissues or organs (invasiveness) and their capacity to seed distant organs, giving rise to daughter tumours (metastases). Cancer can start in any tissue of the human body. There are three main types of cancer, depending on their tissue of origin:

1. **Carcinomas** arise from skin, mucous membranes or glandular tissue. They are the most frequent type of cancer in humans. Colorectal cancer belongs to this group.
2. **Sarcomas** arise from connective, supporting or neural tissues.
3. **Lymphomas** and **leukaemias** develop from lymphatic cells and bone marrow cells.

2.2 What is colorectal cancer and how frequently does it occur?

As the name implies, colorectal cancer develops in the colon (colon carcinoma) or rectum (rectal carcinoma). Cancers of the small bowel and the anal region (anal carcinoma) are rarer. Colorectal carcinomas are among the most frequent malignant diseases in western industrial countries. Colorectal cancer has become the second most frequent type of malignant tumour in Europe and the third most frequent worldwide. Every year, about 450,000 people in Europe develop colorectal cancer, with about 230,000 deaths annually. Colorectal cancer can affect anyone. Around 6 out of every 100 people develop colorectal cancer during the course of their lifetime, corresponding to one in 17 of us.

Colorectal cancer can develop in any segment of the colon and rectum, but the most commonly affected locations are the lower 40 cm of the colon and the rectum (about 60% of cases).

2.3 Risk factors for the development of colorectal cancer

Although the reasons for developing colorectal cancer are not fully understood, scientists have identified certain factors which increase the risk of developing colorectal carcinoma.

An increased risk of colorectal cancer is associated with

- Diet high in meat and fat and low in fibre, smoking and alcohol consumption, as well as being overweight and inadequate exercise
- Inflammatory bowel diseases (ulcerative colitis, Crohn's disease)
- Certain bowel polyps (adenomas)
- Family history of colorectal cancer or bowel polyps (adenomas)
- The presence of certain other types of cancer, such as uterine or ovarian cancer

2.4 What are the signs of colorectal cancer?

Colorectal cancer does not develop and grow overnight. It takes months and years for this to happen. This is why no or only very few signs of the disease (symptoms) are evident. Intestinal bleeding and impaired bowel movements are key symptoms which affect patients as the disease progresses.

The following symptoms can occur with colorectal cancer:

- Altered stool habits, alternation of constipation and diarrhoea, "pencil stool", or frequent urges to defecate without passage of stool
- Blood in or on the stool (never simply blame this on haemorrhoids!)
- Repeated, cramping abdominal pains
- Loud bowel sounds, persistent bloating, foul-smelling stools
- Palpable masses in the abdomen
- General symptoms such as lack of energy, fatigue and weight loss

These symptoms do not confirm colorectal cancer. They may also be found in a variety of other conditions. This makes it all the more urgent to obtain careful clarification of these complaints.

2.5 How can colorectal cancer be detected early (preventive screening)?

As with other forms of cancer, the general rule with colorectal cancer is that the chances of cure are better the earlier the tumour is detected and treated. With early diagnosis, colorectal cancer can be prevented or cured.

Early diagnosis depends on patient participation in early detection programs which are available from primary care physicians. This is particularly crucial because of the absence of symptoms or their non-specific nature at disease onset. Colonoscopy plays an important part in the early detection of cancer, even if patients don't have any symptoms.

Members of families with a history of colorectal cancer should have a colonoscopy earlier than people without a family history of colorectal cancer. This colonoscopy

examination should take place ten years earlier than the age at which the family member was diagnosed with colorectal cancer.

Please seek advice from your primary care physician or gastroenterologist regarding the form of preventive screening you should take so that it works effectively, given your personal risk factors. Preventive screening is unfortunately unable to eliminate the risk of colorectal cancer completely.

With early diagnosis, colorectal cancer has a very good prognosis and can be cured.

2.6 What methods are available for prevention and early detection?

Palpation of the rectum
(digital rectal examination)

In this procedure, the physician examines the lower part of the rectum by inserting a gloved and lubricated finger through the anus. During this examination, the sphincter muscle is also evaluated, as well as the prostate gland in men. Any unclear or suspicious findings in the rectum need to be clarified by means of a colonoscopy.

Test for occult blood in the stool (haemoccult test)

This test involves laboratory testing of three consecutive stool samples for the presence of blood which is invisible to the eye (occult blood). Presence of blood in the stool does not necessarily mean that a person has colorectal cancer. Other causes such as haemorrhoids, bowel polyps or intestinal inflammation are in fact more common, but the source of the blood must be identified by means of colonoscopy.

Colonoscopy

Colonoscopy is the best method for detecting colorectal cancer. Colonoscopy is the only method by which tissue samples can be obtained to be examined for signs of colorectal cancer (*Fig. 5*). In addition, adenomas, which are precursors to cancer, can be diagnosed and removed before cancerous transformation occurs. Colonoscopy is the first step to effective cancer prevention.

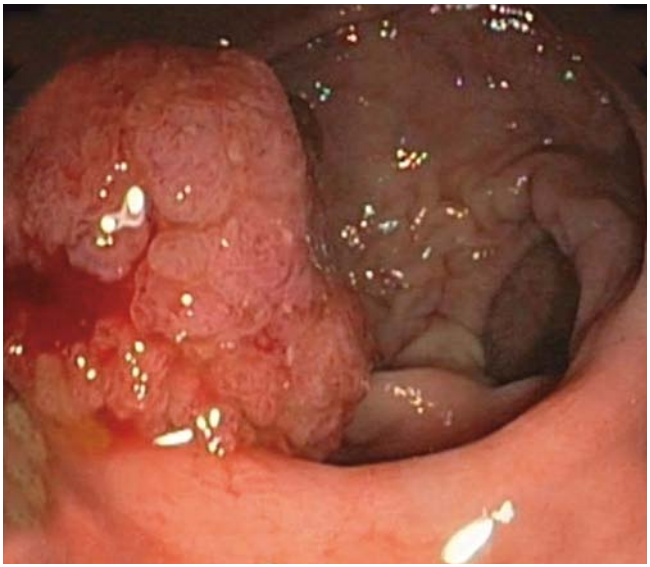


Fig. 5
Visualization of colorectal cancer by colonoscopy

2.7 What examinations will I undergo with a clinical suspicion or diagnosis of colorectal cancer?

If symptoms or abnormal findings at screening examinations arouse suspicion of colorectal cancer, there are a variety of diagnostic procedures available. The aim of these procedures is to determine whether a patient does in fact have colorectal cancer (tumour detection) and, if so, to determine how advanced the cancer is (tumour stage).

Procedures to confirm diagnosis of colorectal cancer:

- Colonoscopy (examination of the entire colon using a flexible instrument)
- Sigmoidoscopy (examination of the lower colon and rectum using a flexible instrument)
- Rectoscopy (examination of the rectum of up to 15–20 cm using a rigid instrument)
- Virtual colonoscopy
- Radiological examination of the bowel (barium enema)

Colonoscopy

Colonoscopy is the single most informative method of examining the colon. It is the method of choice for diagnosing colorectal cancer. It consists of introducing a flexible tube (endoscope) through the anus, which allows illumination and examination of the entire colon (colonoscopy). For optimal visualization of the colonic mucosa, the colon must first be adequately cleansed by drinking a special irrigation solution or using a laxative. Colonoscopy and obtaining a tissue sample (biopsy) is the sole means of confirming colorectal cancer. Furthermore, colonoscopy allows adenomas, which are precursors to cancer, to be identified and removed.

In the majority of cases, colonoscopy is performed under sedation. This involves administering an anaesthetic (usually propofol) which puts the patient into a deep sleep. During the procedure, his/her breathing and cardiovascular system are continuously monitored.

In addition to taking tissue samples, this examination determines the location and extent of colorectal cancer and therefore forms the best possible basis for planning surgery (*Fig. 6, 7*).

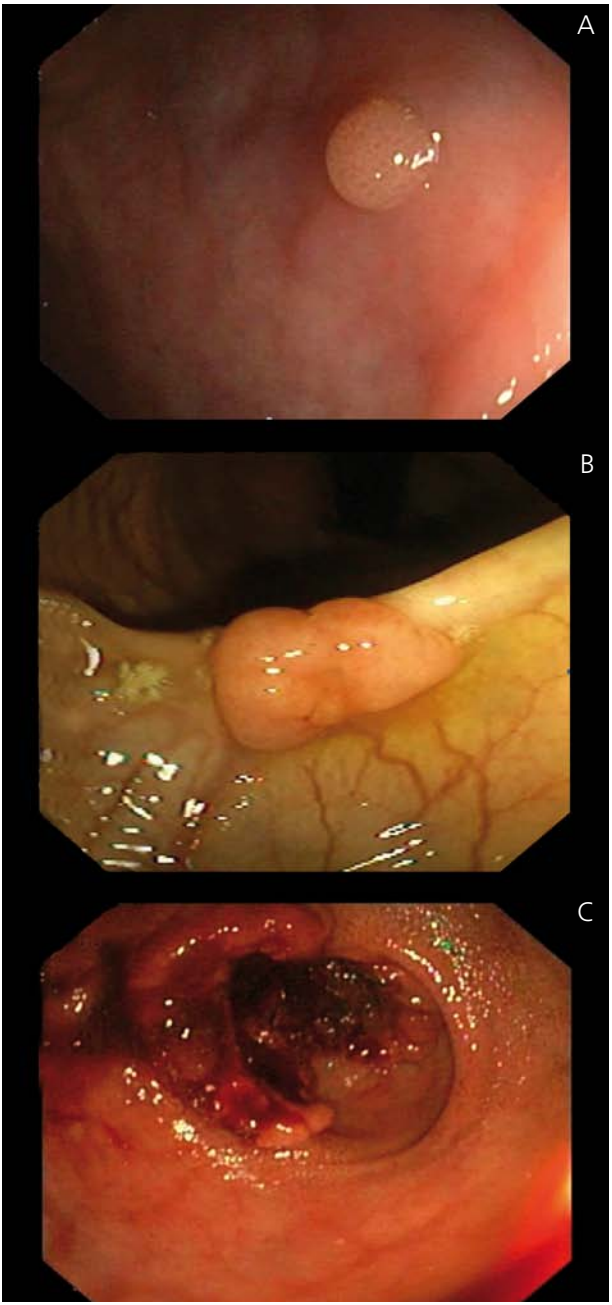
Fig. 6
Layout and equipment of a modern endoscopy unit

Small-scale colonoscopy
(sigmoidoscopy and rectoscopy)

This smaller version of colonoscopy comprises endoscopic examination of the sigmoid colon (lower section of the colon prior to the rectum = sigmoidoscopy) or the rectum (rectoscopy). This examination cannot replace a full colonoscopy as a means of fully determining the presence of colon disease. Although 60% of all colorectal tumours are located in the lower section of the colon or the rectum, 40% of them may be overlooked if a small-scale colonoscopy is carried out alone. Therefore, a full colonoscopy should be performed whenever possible.

Neither sigmoidoscopies nor rectoscopies are carried out under sedation, meaning that patients remain awake during these procedures.

Fig. 7
Colonoscopic images of bowel polyps (A, B) and colorectal cancer (C)


A
B
C

Endoscopic ultrasound examination of the rectum

An endoscopic examination of the rectum looks at the mucous membrane in the rectum and is able to confirm the size and location of both benign and malignant rectal tumours. Furthermore, an ultrasound transducer that is introduced through the anus allows the rectum to be examined using ultrasound. This procedure is known as endoscopic ultrasound and determines the spread of the tumour through the bowel wall layers and their surrounding tissue, in addition to assessing the neighboring lymph nodes *(Fig. 8)*. It is also possible to visualize the position of the tumour in relation to the sphincter muscle. This is a key examination for rectal cancer as it provides the information needed to decide whether radiation treatment ought to be performed prior to surgery. Combined with a test of sphincter muscle function, this examination also helps to decide whether it will be possible to preserve the sphincter or whether it is preferable to create an artificial bowel outlet (ostomy).

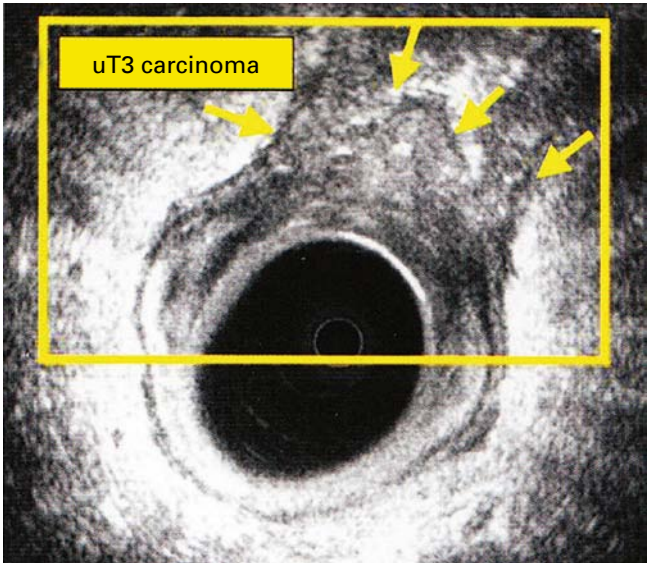


Fig. 8
Endosonographic image of rectal carcinoma

Virtual colonoscopy

Computed tomography (CT colonography) and magnetic resonance imaging (MRI colonography) are techniques which generate images of slices of the body. Using special computer programs, the data can be further processed to produce a three-dimensional image of the interior of the bowel (*Fig. 9*).

The advantage of this non-invasive examination technique is that it does not require an endoscope to be inserted, as the bowel is not examined directly but depicted "virtually". As with a "real" colonoscopy, the bowel still has to be cleansed beforehand to allow adequate visualization of the bowel wall. The disadvantages of a virtual colonoscopy are a reduced ability to distinguish between inflammation and smaller polyps, the exposure to radiation, and its limited application in patients with metal implants, heart pacemakers (has to be discussed with radiologist) or claustrophobia. A further disadvantage of the technique is that it is not possible to remove suspicious lesions or obtain tissue samples for further study. For these reasons, conventional colonoscopy remains the method of choice in the diagnosis of colorectal cancer.

Capsule endoscopy

In special cases, it is possible to examine the entire gastrointestinal tract using capsule endoscopy. This procedure involves the patient swallowing a small capsule containing a camera that then takes photos of the interior of the bowel at regular intervals while being pushed through the digestive tract by the constriction and relaxation of the bowel muscles (peristalsis) without the need for any human intervention. The images are subsequently analyzed on a computer. This special technique is only used in a few specifically selected cases, predominantly for examining the small bowel.

Radiographic examination of the bowel (barium enema)

Barium enema is a method by which the colon is imaged radiographically after being filled with a contrast medium (such as barium) applied through the anus (*Fig. 10*). This examination is greatly inferior to colonoscopy and is rarely used today.

Ultrasound examination (sonography)

Ultrasound is the simplest method for examining internal organs such as the liver, kidneys or spleen. It is completely safe and painless. In order to lessen the effects of overlying intestinal gas and thereby enhance examination quality, patients are asked to abstain from eating and drinking for several hours before the examination. Patients with colorectal cancer are given a diagnostic ultrasound of the abdomen in order to determine whether the cancer has spread to other organs (metastases). The chief focus of the examination is on the condition of the liver. The colon itself can only be studied to a limited extent by ultrasound.

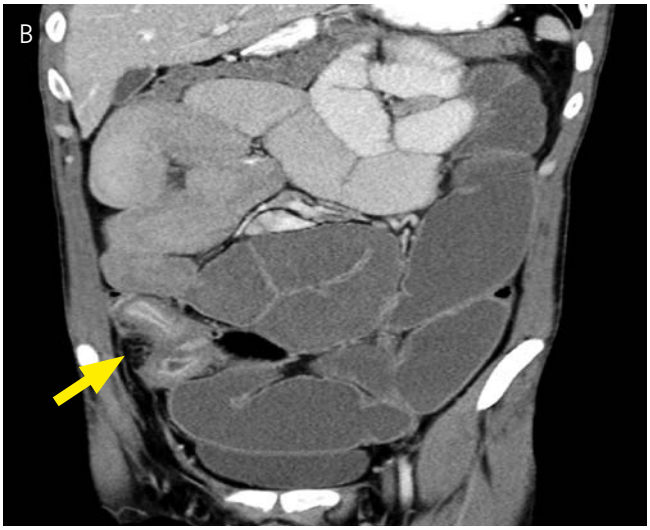


Fig. 9
Virtual colonoscopy with 3D reconstruction (A), computed tomography with coronal reconstruction (B); the arrow marks an area of narrowing of the bowel (stenosis) caused by colorectal cancer

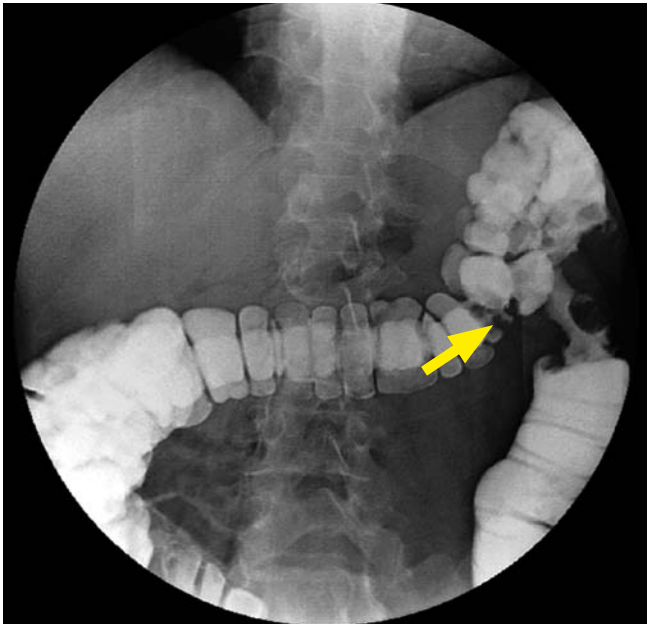


Fig. 10
Colon contrast image with evidence of stenosis and the typical contours resembling an apple with a bite taken out of it (arrow)

Computed tomography (CT)

Computed tomography (CT) is a special radiologic method which allows the human body to be visualized in slices (*Fig. 11*).

The exposure to radiation caused by modern devices is relatively low. In patients with colorectal cancer, a CT scan of the abdomen and pelvis can reveal not only the bowel tumour but also potentially enlarged lymph nodes and metastases in other organs. For enhanced definition of the gastrointestinal tract, the patient drinks a contrast medium about one hour prior to the examination. Immediately before the CT scan, the colon is filled with a contrast medium applied through the anus. During the examination, a contrast medium is injected directly into a vein to improve visualization of the blood vessels and abdominal organs. Besides visualizing the tumour itself, this method is particularly suitable for detecting spread of the cancer to other organs.

Fig. 11
Modern computed tomography equipment


Sensation

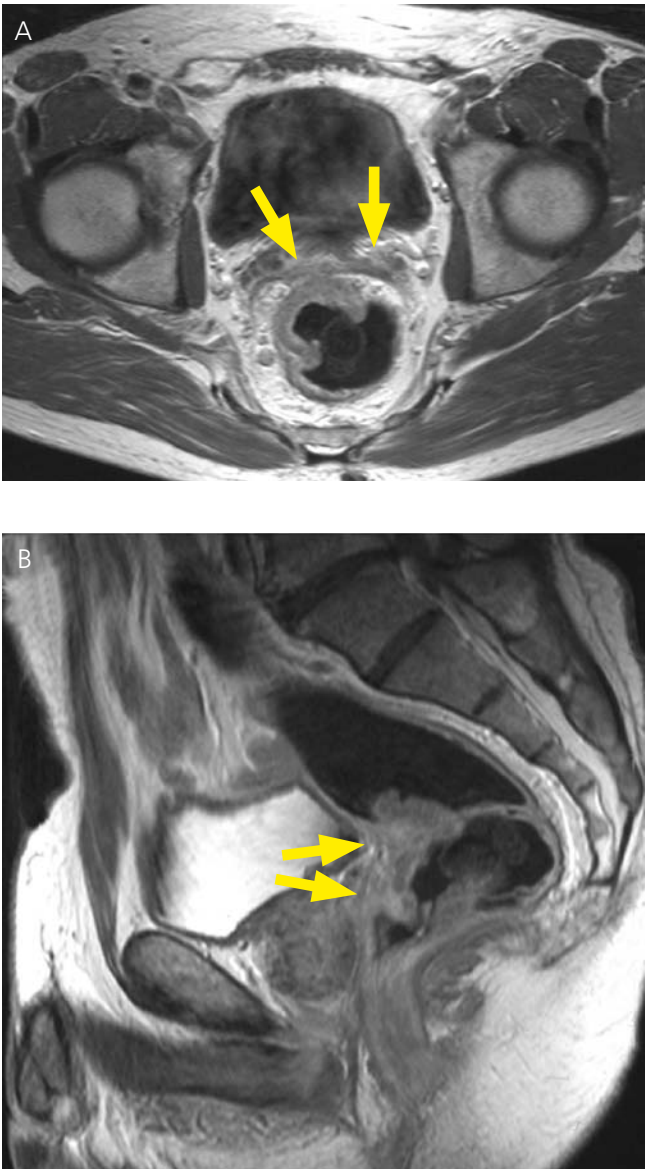


Fig. 12
Magnetic resonance imaging (MRI) of the pelvis showing rectal cancer; arrows indicate the tumour. (A) transverse slice, (B) sagittal slice

Magnetic resonance imaging (MRI)

Like CT, magnetic resonance imaging (MRI) provides imaging of the body in slices. A key difference, however, is that MRI uses alternating magnetic fields instead of radiation. Besides detecting possible enlargement of lymph nodes and metastatic lesions in other organs, MRI produces extremely precise images of the anatomy and the extent of the tumour in the pelvis. This is especially important with rectal cancer. As mentioned above with regard to endoscopic ultrasound of the rectum, the location of the tumour in relation to the sphincter muscle and the extent of invasion into the bowel wall layers are of decisive importance when planning treatment and surgical intervention (*Fig. 12*). Use of MRI is limited in patients with heart pacemakers and metal implants and those suffering from claustrophobia. Besides its advantages in imaging the pelvis, MRI is also very useful for detecting changes in the liver.

Positron emission tomography (PET)

Since cancer cells grow faster and therefore require more energy and glucose (a type of sugar) than healthy cells, these characteristics can be used to detect tumours and metastases. In positron emission tomography (PET), a radioactively labeled glucose analogue is injected intravenously and is taken up by rapidly growing, metabolically active cells (especially cancer cells). The concentration of the labeled glucose in the tumour can be made visible and subsequently displayed on images taken during the examination. Unlike other imaging methods such as CT or MRI, PET does not produce an anatomic depiction of the body, but detects the metabolism and vitality of (cancer) cells, as well as their ability to divide. PET examinations are not 100% tumour-specific and are reserved for special tasks. They are not used for the routine tumour staging of colorectal cancer.

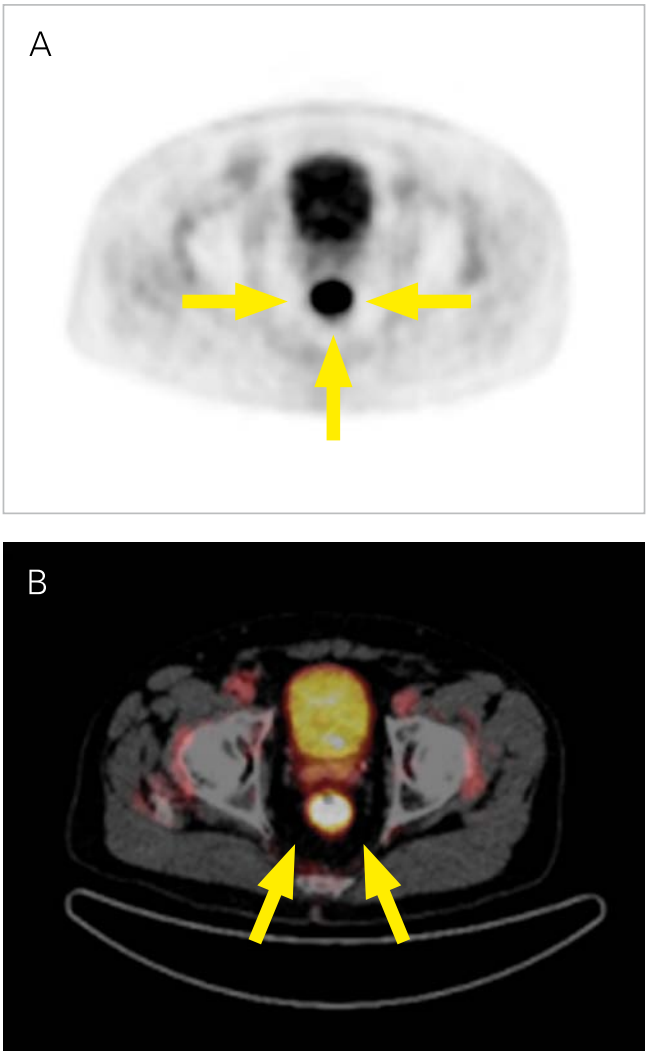


Fig. 13
Imaging of rectal carcinoma with positron emission tomography (PET) (A) and combined PET/CT (B); arrows indicate the tumour

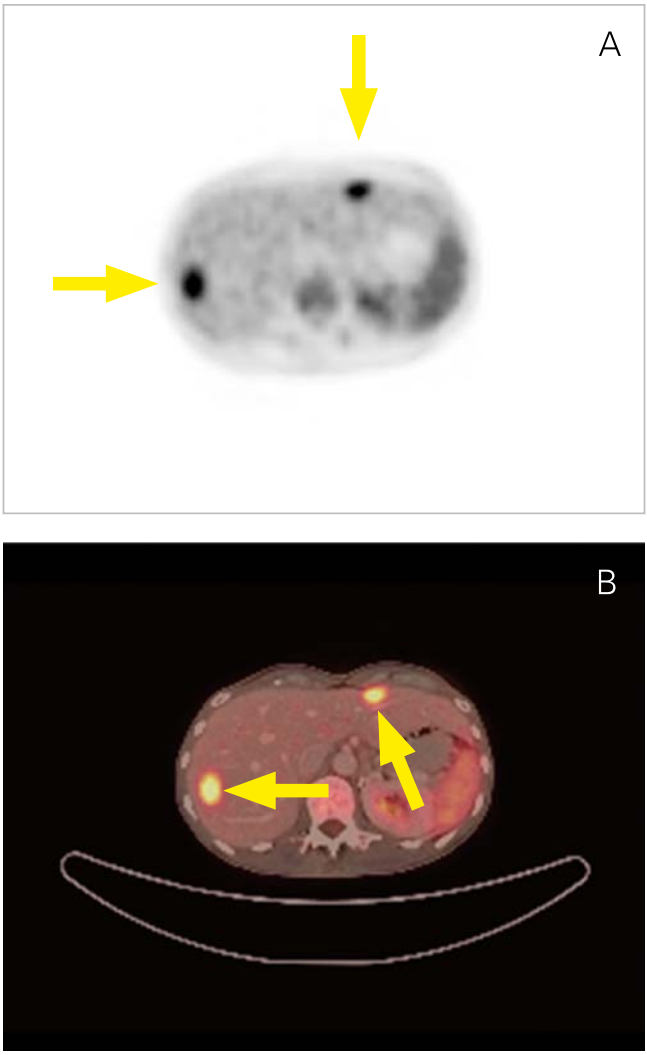


Fig. 14
Imaging of two liver metastases with positron emission tomography (PET) (A) and combined PET/CT (B); arrows indicate the metastases

Special tasks include searching for metastases in the entire body, detecting possible recurrence of colorectal cancer as part of follow-up monitoring or carrying out studies to assess the tumour's response to chemotherapy or radiotherapy (*Fig. 13, 14*).

Chest X-ray

In patients with colorectal cancer, this standard radiological examination is used for a general evaluation of the heart and lungs and also to detect any metastases in the lungs. In the event of suspicious findings, a CT examination of the chest is performed to provide further clarification.

Blood tests

General blood tests assess the condition and function of individual organs such as the kidneys or the liver. In patients with cancer, the levels of so-called "tumour markers" can also be determined.

"Tumour markers" are substances which are often produced in greater quantities by tumour cells but are otherwise unspecific and are also present in healthy people. This means that a negative or normal tumour marker level does not completely rule out cancer. Nor does an elevated tumour marker level in itself confirm cancer.

A more typical use of tumour markers is for post-surgical follow-up monitoring of patients whose levels were previously elevated. During follow-up monitoring, a new increase in a tumour marker may indicate disease recurrence. The most important tumour marker for colorectal cancer is CEA (carcinoembryonic antigen).

Possible staging examinations (quantifying the extent of the cancer):

- Blood tests, including tumour markers (CEA)
- Ultrasound examination of the abdomen (sonography)
- Chest X-ray
- Computed tomography of the chest, abdomen and pelvis (CT)
- Magnetic resonance imaging of the liver and pelvis (MRI)
- Ultrasound examination of the rectum (endoscopic ultrasound)

Apart from examinations to determine the extent of the cancer, preparation for surgery always includes the evaluation of a patient's surgical risk. The main objective is to ensure patients will be able to tolerate the planned operation.

Assessment of operative risk:

- Blood tests
- Chest X-ray
- Pulmonary (lung) function tests
- Cardiological examination (electrocardiogram = ECG, stress test, echocardiogram, heart catheterization)
- Vascular studies
- Kidney and liver function tests
- Initial examination by the anaesthesiologist prior to the operation

Your physician will inform you of the nature and purpose of the tests required in your particular case.

How is colorectal cancer treated?

How is colorectal cancer treated?

3.1 Treatment principles

Before the course of treatment for patients with colorectal cancer can be determined, the extent of disease must be completely examined. Once the examinations (colonoscopy, taking a tissue sample from the tumour to ensure the diagnosis is correct and to determine the markers essential for prognosis and treatment, taking blood to ascertain the tumour markers of colorectal cancer [CEA, CA 19-9] and computed tomography of the lungs and abdomen) have been completed, all of the findings are discussed by a tumour board or MDT (Multi Disciplinary Team) Meetings. Tumour boards serve as regular meeting places for the various specialists who are involved in the multidisciplinary assessment and treatment efforts involved in modern cancer care. These specialists jointly determine the best possible treatment recommendations for each patient, based on established treatment guidelines and individual patient and disease characteristics (*see chapter 6 for more information*).

The surgical removal of the tumour is the only method which offers a chance of curing cancers of the colon and rectum. Consequently, surgical removal of the tumour is the key component of the therapeutic concept.

"Cure" of any cancer is generally only possible once the spread of tumour cells to other organs such as the liver or lungs has been excluded. This is why the extent and spread of the tumour is always determined prior to surgery. Before surgery can be performed, it is necessary to determine whether the tumour is limited to the bowel or is generalized (i.e. has spread throughout the body). Even in the case of generalized disease, curative treatment is still possible under certain circumstances.

In colon cancer (colon carcinoma), surgery is generally performed as soon as the diagnosis has been made, the extent of the disease determined and the operability (risk estimate for the planned surgery) confirmed. Cure necessitates the complete removal of the tumour. Following surgery, the surgical specimen (tissue removed during surgery) is examined by the pathologist, who determines the extent of the primary tumour and the presence of lymph node metastases (*see p. 62ff*). The results of these examinations will determine whether additional, prophylactic chemotherapy is advisable.

In patients with rectal cancer (rectal carcinoma), the extent of the disease, operability and the depth of the tumour are also determined following diagnosis. Depending on the findings, current practice is to remove smaller tumours immediately. Larger tumours are treated prior to surgical removal by radiation. There are currently two main methods of carrying out pretreatment. The first includes radiation of the rectal tumour using high single radiation doses administered daily for a period of one week. The second consists of a combination of lower individual radiation doses administered daily and a generally well-tolerated chemotherapy for five weeks. As large studies have shown, the goal of pretreatment is to reduce the risk of local recurrence (i.e. the probability that the tumour will recur after surgery). Whether pretreatment by radiation is advisable and the question of which treatment concept is to be followed are matters which should be discussed with the physician prior to surgery. Radiation after surgery has been shown to produce poorer outcomes than radiation before surgery. The advisability of an additional, prophylactic course of chemotherapy following surgery for rectal cancer depends on various characteristics of the tumour and should be determined on the basis of the histopathological findings.

Treatment of colon and rectal cancers involves a number of different specialists all working together to ensure the patient receives the best possible care. Each cancer patient is discussed by a tumour board in modern hospitals so that the optimum treatment strategy can be jointly determined by the specialists. Patients who are uncertain if the recommended treatment is best for them are entitled at any time to turn to another independent hospital or a colorectal cancer center for a non-binding second opinion.

3.2 What is necessary in preparing for surgery?

To avoid complications when carrying out colorectal cancer surgery, patients must be carefully prepared preoperatively. This includes general measures to improve heart and lung function, such as abstaining from smoking, breathing exercises using an incentive spirometer and climbing stairs. In the majority of cases, it is no longer necessary to clean the bowel completely prior to the operation, meaning patients benefit from a simpler preparatory process.

3.3 Open (classic) or laparoscopic (minimally invasive) surgery?

There are two different surgical methods available for treating colon and rectal cancer. The so-called "classic" (open) method involves making a larger incision to gain access to the abdomen. The other method is the "keyhole" technique (laparoscopic surgery), whereby special fine instruments and camera optics operate inside the abdomen via minute incisions. Both techniques give experienced surgeons the necessary overall view of the abdomen, which contributes to reliable removal of the tumour.

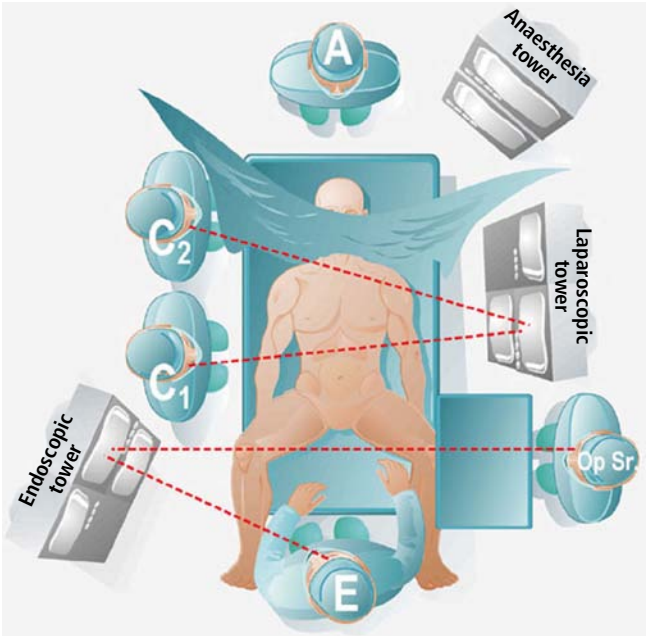


Fig. 15
Surgical suite equipped for minimally invasive surgery (C1 = surgeon, C2 = assistant, E = gastroenterologist, Op Sr = surgical nurse, A = anaesthesiologist)

Use of the "keyhole" technique has increased over the past years and has the major advantage that the abdominal incision is considerably smaller (*Fig. 15, 16*). This technique is considered to be gentle on the tissues and for the patient. The camera optics give an excellent overview of the abdomen. Patients recover faster with the keyhole technique than with conventional open surgery and usually experience significantly lower levels of pain. The risk of wound infections and incisional hernias is also lower. In experienced hands, the results of laparoscopic surgery are outstanding. However, the classic surgical technique of making a large incision on the abdomen also has very good results. Be sure to ask your surgeon which technique is most suitable for you.

Fig. 16 (A, B)
Modern surgical suite with a computer system to control the navigation of instruments for minimally invasive surgery (keyhole surgery). Baden Cantonal Hospital (Kantonsspital Baden), Switzerland

Laparoscopic operations need longer times of operation and not every patient and tumour is suitable for laparoscopic surgery. Previous operations, abdominal adhesions or an extensive tumour may sometimes make laparoscopic surgery more difficult or even impossible. In these cases, it is always possible – even during surgery itself – to switch to open surgery.

The most suitable method must be decided on together with your physician. Major studies of colon and rectal cancers have shown equally successful oncological results for both surgical methods. Most hospitals are now equipped with the latest technology and necessary levels of expertise to perform laparoscopic surgery. Don't hesitate to ask if it is an option for you!

3.4 What surgical methods are available?

Curative surgery consists of removal of the bowel segment containing the tumour along with the corresponding lymph drainage region, as well as ensuring there is an adequate safety margin. The tumour should be removed as a package ("en bloc resection"), not in parts. Removal of the lymph drainage vessels is essential because the tissue may include lymph nodes containing cancer cells. These are of vital importance in assessing the patient's further prognosis.

In recent years, substantial improvements have been made with regard to general preparation for surgery, knowledge concerning the necessity of cleaning the bowel prior to surgery, use of antibiotics in the operating theater and optimization of and increase in anaesthetic techniques in order to control pain. Advances also include improved ways of preventing blood clots, earlier mobilization and swifter resumption of oral intake after surgery. As a result of these improvements, complication rates in high-quality and volume hospitals are very low.

Depending on the site of the tumour as revealed by colonoscopy, the following standard operations are performed by open ("classic") or laparoscopic ("keyhole", minimally invasive) surgery:

Colon carcinoma

1. Right hemicolectomy (removal of the ascending colon)

If the tumour is located in the right portion of the colon (the ascending colon), the surgical procedure is known as a right hemicolectomy, meaning removal of the right segment of the colon (*Fig. 17*). Bowel continuity is re-established by attaching the small bowel to the transverse or descending colon. This means that besides the small bowel, the left side of the colon (descending colon) and rectum still remain. After a period of adaptation, patients can be expected to produce formed stools again.

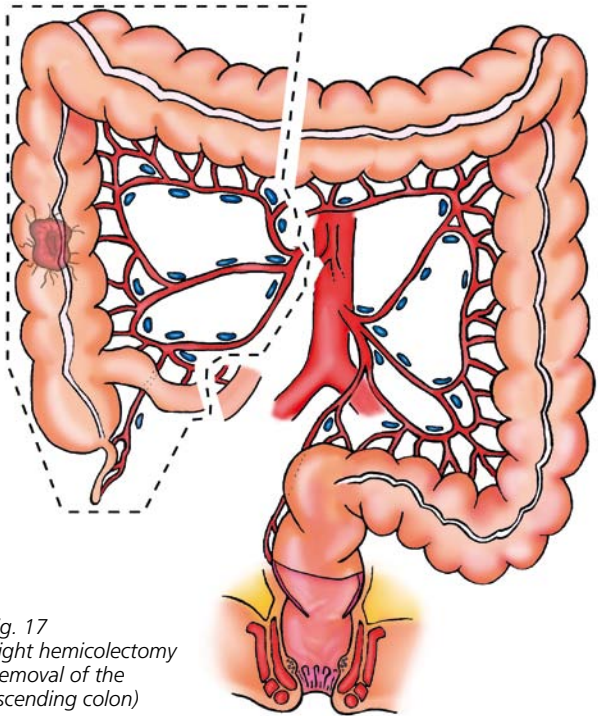


Fig. 17
Right hemicolectomy (removal of the ascending colon)

2. Left hemicolectomy (removal of the descending colon)

If the tumour is located in the left segment of the colon (the descending colon), the surgical procedure is known as a left hemicolectomy, meaning the left portion of the colon is removed (*Fig. 18*). After removing the diseased bowel segment, the ascending or transverse colon is attached to the rectum. The remaining bowel consists of the small bowel, the right side of the colon (ascending colon) and the rectum.

3. Sigmoid resection (removal of the connecting segment between the colon and rectum)

If the tumour is located in the sigmoid colon, which connects the descending colon and the rectum, patients undergo sigmoid resection (*Fig. 19*). Bowel continuity is re-established by connecting the descending colon to the rectum. The remaining bowel is sufficient for good stool quality.

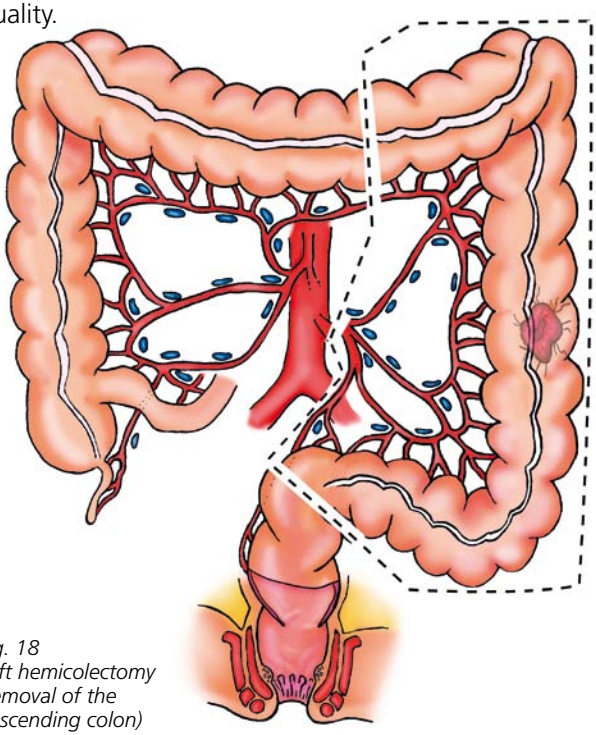


Fig. 18
Left hemicolectomy (removal of the descending colon)

Rectal carcinoma

The choice of surgical procedure in patients with rectal cancer depends to a large extent on the location of the tumour. Prior to the operation, it must be determined whether it will be possible to preserve the sphincter muscle and thereby maintain continence. This decision is based on the distance of the tumour to the sphincter and the pelvic floor. If there is not an adequate margin of healthy tissue between the tumour and these structures, the rectum must be removed completely, which means that a lifelong ostomy is required. Even with an ostomy, however, patients can and do achieve an excellent quality of life. Despite this fact – and depending on the location of the tumour – the goal is always to preserve the sphincter muscle whenever it is safe and possible to do so.

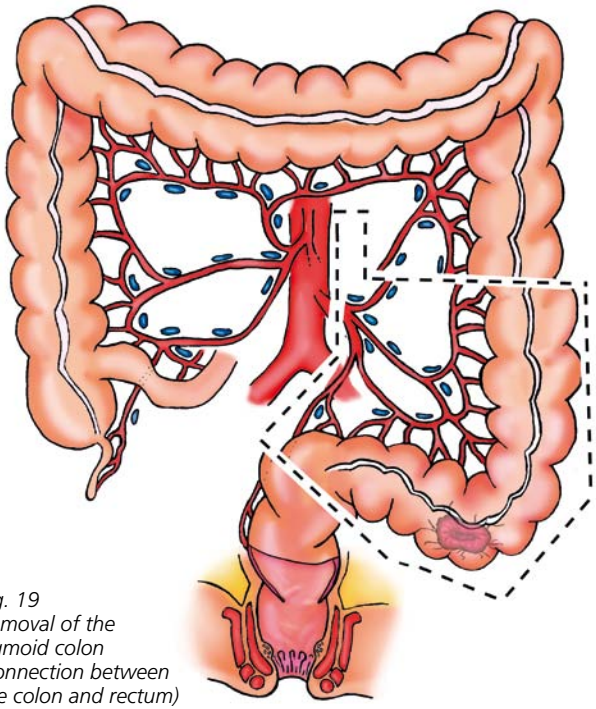


Fig. 19
Removal of the sigmoid colon (connection between the colon and rectum)

In more than 80% of cases, the need for a permanent ostomy can be avoided even in cases where the tumour is found deep in the pelvis. This can be achieved by performing radiochemotherapy prior to the operation, which is generally able to reduce the size of the tumour significantly, and by using modern suture staplers and reconstruction techniques in the sphincter area (coloanal anastomosis).

4. Anterior rectum resection (removal of the rectum with preservation of the sphincter)

Anterior or deep anterior rectum resection involves the removal of the sigmoid and the part of the rectum affected by the tumour (*Fig. 20*). The operation is able to leave a large enough section of healthy rectum so that continence (the ability to control bowel movements) is maintained. Once the part of the bowel containing the tumour has been removed, the descending colon is attached to the rectum. An important part of tumour removal is that the circular fatty tissue which surrounds the rectum and contains blood vessels and lymph drainage vessels is also removed completely. This important surgical technique is known as partial or total mesorectal excision. This process removes the appropriate parts of the rectum by following the anatomically predetermined layers and is comparable to peeling an onion. It spares the nerves in the lesser pelvis which are necessary for sphincter muscle function, normal bladder control and sexual functioning.

There are several surgical procedures for creating a "pouch" to restore the limited reservoir function of the "new" rectum (*Fig. 21*). Your surgeon is able to discuss the different options available to you. The objective in recreating a reservoir is to make it possible to pass formed and portioned stools, whose passage can be controlled. Depending on how close to the sphincter muscle the remaining bowel is attached, and depending on whether the patient has undergone radiation prior to surgery, it may be advisable to create a temporary ostomy (artificial

bowel outlet) from the small bowel. Anastomoses (sites at which the bowel is sutured) tend to heal more slowly in the vicinity of the sphincter muscle and in patients who have undergone prior radiation. Because the new anastomosis needs to be protected, it is common in such cases to place a temporary ostomy, which is removed after two to three months. The ostomy allows temporary passage of stool through an artificially created opening in the abdominal wall, thus avoiding passage through the new bowel connection. You must seek advice from your surgeon as to whether an ostomy is required in your individual case.

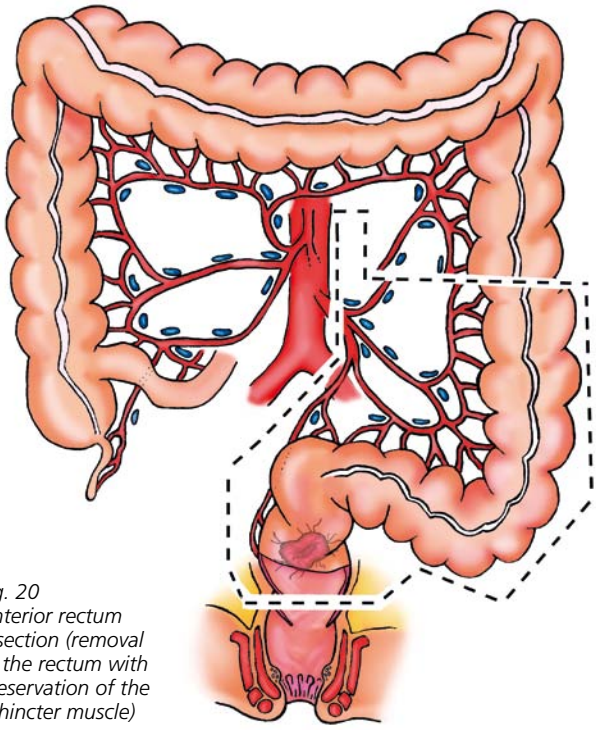


Fig. 20
Anterior rectum resection (removal of the rectum with preservation of the sphincter muscle)

5. Complete removal of the rectum and sphincter muscle (abdominoperineal rectum extirpation = Miles' operation)

Abdominoperineal rectum extirpation, also known as Miles' operation, involves the complete removal of the sigmoid colon, rectum and anal sphincter along with the anus (*Fig. 22*). This procedure is virtually the same as the anterior rectum resection described above except that the bowel cannot be connected because no residual healthy rectum remains beneath the tumour due to its proximity to the sphincter. For this reason, complete removal of the tumour requires total excision of the sphincter, including parts of the pelvic floor.

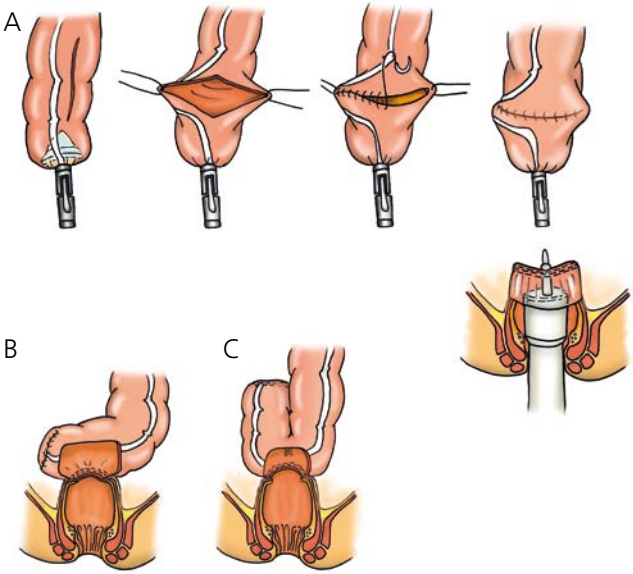


Fig. 21
Various techniques for creating pouches following rectum removal (A = transverse coloplasty; B = side-to-end anastomosis; C = colon J-pouch)

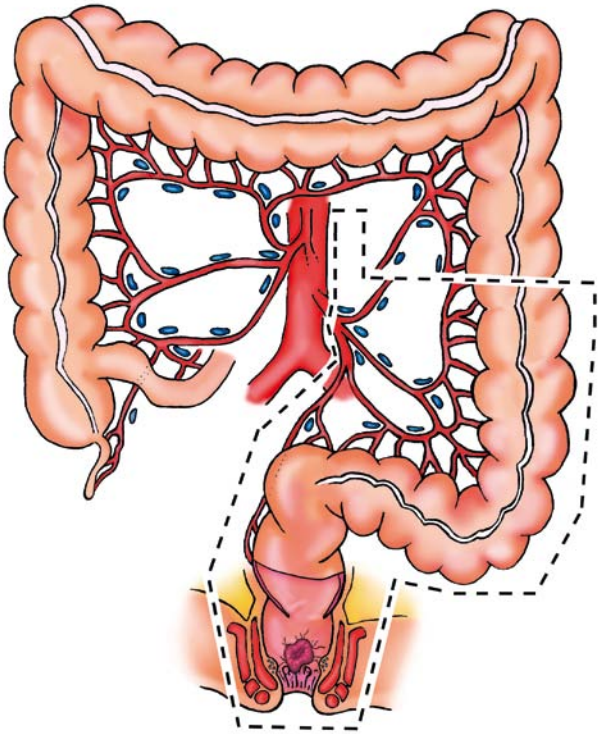


Fig. 22
Complete removal of the rectum and sphincter muscle (abdominoperineal rectum extirpation = Miles' operation)

After complete removal of the tumour, the defect in the pelvic floor is closed. The descending colon is then attached to an ostomy created in the left lower abdomen. An artificial bowel outlet is something that patients have likely never been confronted with before and at first, life with an ostomy may seem unimaginable to them. Experience gathered from numerous patients and major studies, however, shows that patients routinely achieve an excellent quality of life in spite of having an ostomy. Complete removal of the tumour is the highest priority, meaning no compromises should be made during the operation.

Patients confronted with complete removal of the rectum should receive counseling from their physician, healthcare providers and specially trained ostomy therapists prior to the operation (*see p. 90ff*). After surgery, they are given detailed instructions on caring for their ostomy and how to carry on with their normal everyday activities. This includes sports and recreational activities, including swimming, as well as the intimate relationship with spouse or partner.

Minimally invasive operations

As already mentioned, all of the above-described operations can generally be performed on a minimally invasive (laparoscopic) basis. The advantages and disadvantages have already been discussed in chapter 3.3. In addition to the above procedures, the following minimally invasive techniques are also available:

6. Limited bowel resection

Laparoscopic surgery is ideally suited to remove bowel polyps (broad-based adenomas) which cannot be removed completely by colonoscopy instruments. The keyhole technique is used to remove a very limited part of the bowel in the form of a small segment (*Fig. 23*). The operation can be carried out on any section of the colon. Surgery is performed under endoscopic guidance to ensure removal of only the diseased bowel segment along with an adequate safe margin (rendezvous technique). This method is generally only performed at specialized centers. Before it was developed, patients had to be operated on via a large abdominal incision.

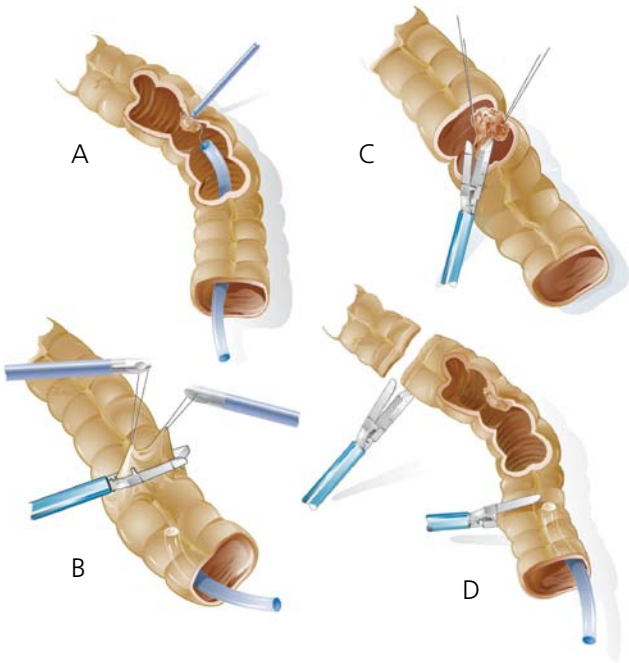


Fig. 23
(A) Laparoscopically assisted endoscopic resection
(B) Endoscopically assisted laparoscopic wedge resection
(C) Endoscopically assisted laparoscopic transcolic resection
(D) Endoscopically assisted laparoscopic segmental resection.
Center for Minimally Invasive Technology, Klinikum rechts der Isar, Prof. Dr. H. Feußner, Munich, Germany

7. Bowel surgery through the anus (transanal endoscopic microsurgery = TEM)

In cases of benign or early malignant changes in the rectum, patients are given the option of transanal endoscopic mucosectomy (full wall resection). This is a less radical alternative to anterior rectum resection or abdominoperineal rectum extirpation (*Fig. 24*).

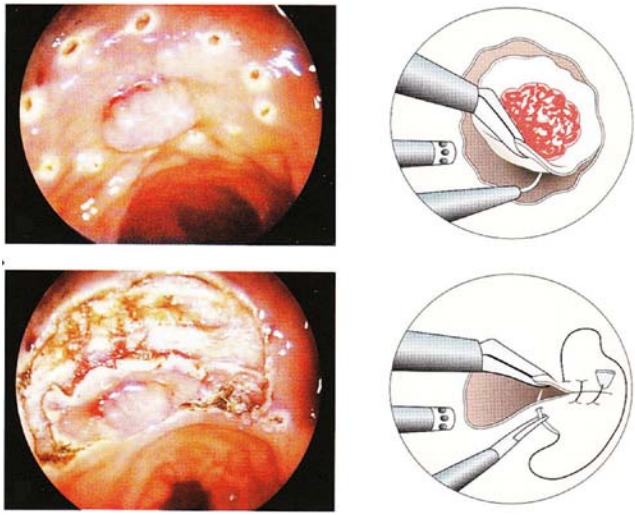


Fig. 24
Transanal excision of broad-based polyps or early carcinoma of the rectum

This surgical technique does not require an abdominal incision as the entire operation is performed via the anus. Using specially developed instruments, the surgeon excises the benign or malignant lesion in the form of a block which includes adequate safety margins, and subsequently sutures the defect in the rectum (*Fig. 25*). An advantage of this method is the patient's rapid recovery after surgery. A disadvantage is the lack of information about potentially affected lymph nodes. For this reason, this method should only be used in the case of patients with very early malignant changes in the rectum where the probability of lymph node metastases is very small. If the rectal tumour has already grown larger, patients have to undergo a more radical procedure involving an abdominal incision and removal of the tumour along with lymph drainage pathways, as described above (*see Fig. 20*). Transanal surgery should only be performed by specially trained surgeons.

Fig. 25
Modified TEM (transanal endoscopic microsurgery) equipment for endoscopic removal of adenomas or early carcinomas of the rectum

3.5 What treatment remains after surgery?

With most planned procedures, post-surgical treatment follows the so-called "fast-track" principle. This is based on the idea that "low stress means quick recovery." Following the operation, the patient is returned directly to his/her room following a short monitoring period. The tube used by the anaesthesiologist for artificial respiration during the operation is removed before the patient leaves the operating room. Tubes for draining wound secretions from the abdomen (drains) are used only rarely today, and if they are needed, they are removed after a short time period. The nasogastric tube is also removed in the operating theater. The urinary catheter, which drains urine from the bladder, does not cause any pain and is usually removed within a few days of surgery.

From the first day after the operation, patients are usually at least allowed to have tea and soup. In certain circumstances, they can already eat solid food. Their fluid balance is regulated by intravenous infusions for a few days. In order to control pain after surgery, each patient receives an individually formulated pain control regimen. If necessary, this can include an epidural catheter which carries anaesthetic medication directly to the vicinity of the spinal cord. Of prime importance is each patient's active participation in the recovery process.

It is possible for patients to be discharged starting from the fifth post-operative day, but they must continue to be monitored closely. In the typical case, discharge does not take place until the eighth post-operative day once the critical seventh day following the operation has passed.

Patients should be out of bed, i.e. sitting in a chair or walking, as much as possible. They are fitted with compression stockings and/or receive heparin injections to help prevent the development of venous thromboembolism (pathological blood clots which can have serious consequences), the risk of which is heightened with cancer and following surgery. Skin sutures can usually be removed after ten days.

Patients with cancer in Germany are entitled to apply to social services for follow-up treatment if so desired. In Switzerland, it is possible to apply to the health insurance companies for rehabilitation care.

4 Risks and complications of an operation

Risks and complications of an operation

4.1 What complications can occur with surgery of the bowel?

Every operation, even a routine procedure, has its risks and dangers. This does not just apply to the procedure itself. Complications may also arise after the operation as a result of concomitant diseases of the heart and lungs and metabolic disorders. Before a patient undergoes surgery, all potential risk factors must be assessed and, where possible, minimized by taking appropriate preventive measures. This generally helps make the operation a success and shortens the period of hospitalization. A key aspect of pre-surgical preparation is to inform the patient in detail of the exact nature of the preparations, the surgery itself and the post-surgical follow-up treatment. It is important for the patient to understand the significance of each component of his/her treatment so that he/she is motivated to play a full and active role.

Thanks to the advances in modern surgery, anaesthesia and intensive care, even the most extensive operations today cause significantly less stress to the organism and are associated with fewer risks and complications than was the case just a few years ago. After the operation, the patient should be almost free of pain. Bowel activity generally resumes very quickly and it should not be long before the patient is up and about again. Nevertheless, major abdominal surgery may be followed by problems which can interfere with the patient's general wellbeing, affect his/her health and prolong his/her stay in the hospital. Serious complications following bowel surgery include:

Bleeding

Haemostasis (control of haemorrhage) is monitored with the greatest care during an operation. The highest risk of post-surgical bleeding is in the first 24 hours after surgery. Tiny blood vessels or wounds which did not bleed at the end of the operation may start to bleed afterwards. Bleeding from larger vessels is extremely rare but must be treated swiftly. Patients are carefully monitored for rapid detection of any bleeding. The risk of clinically significant post-operative bleeding is low, at about 1% of cases.

Anastomotic insufficiency (leaking bowel connections)

A particularly troublesome complication is suture leakage at the site of the two freshly connected bowel ends. Typically, this may occur around the seventh post-operative day. It is caused by areas of poorly perfused tissue (poor blood circulation) around the connection (anastomosis), which may lead to the bowel contents leaking. There is an increased risk of leakage through the anastomosis in rectal surgery performed in proximity to the sphincter muscle and in cases of pre-surgical radiation.

A hospital's rate of anastomotic insufficiency in patients operated on for colon cancer should be less than 2–3%. In patients undergoing rectal tumour operations, however, this should stand at 10–15%. Warning signs include increasing abdominal pain and fever after the operation.

Wound infections

Every bowel operation is associated with a risk of contaminating the abdominal incision with bowel bacteria. During surgery, special preventive measures such as hygiene and sterility regulations and administration of antibiotics are employed to minimize this risk. Despite these measures, wound infections may occur in the area surrounding the abdominal incisions in up to 5% of cases. Although these usually turn out to be harmless, they may prolong the period of hospitalization.

Paralysis of the bowel

Following bowel surgery, the bowel initially does not work at all. This is known as post-operative paralysis of the bowel. The goal is to make this period as short as possible. In an effort to get the bowel working again, patients are given liquids from the first day after surgery and, in certain circumstances, a temporary course of medication to stimulate the bowel. They are also ambulated (encouraged to get out of bed and start walking) as soon as possible. Patients should normally be passing stool or gas within three to four days after surgery.

Pain

Each patient responds to an operation with a different level of pain. Improved pain control means earlier ambulation. This in turn reduces the risk of thrombosis of the leg veins or pneumonia associated with long periods of lying in bed. Physiotherapy, which is important for recovery, can also begin earlier with adequate pain control.

Good pain management also improves breathing. For these reasons, patients are automatically given regular treatment for pain after surgery as well as medication on demand to relieve bouts of residual pain. Although pain following an operation is a normal reaction of the body to the procedure, there is no reason why this should be undergone without the help of available pain medications. Therefore, each patient receives tailored pain medications to ensure that his/her stay in the hospital following the operation is as comfortable as possible.

4.2 What are the long-term effects?

Digestive problems are among the most common side effects of bowel surgery. The problems encountered depend on the extent of the bowel segment which has been removed. In most cases, however, there is no major change in stool quality once the post-surgical adaptation period is over.

Removal of bowel segments may be followed by porridge-like stools or diarrhoea. Depending on the length of colon removed, there may be restriction of the body's ability to thicken the digested food, which means that more water remains in the bowel and is excreted in the stool. The body adapts itself to this situation, however, and stool quality improves in the course of time with diarrhoea becoming less severe. Persistent diarrhoea can be treated with medication to slow down the intestinal passage of food or thicken the stool.

If the rectum is removed, patients may initially experience increased stool urgency and varying degrees of incontinence (inability to control the passage of gas or stool). If this occurs or persists, the problem can often be rectified by appropriate training.

In some cases, major bowel surgery may be followed by a temporary or permanent artificial bowel outlet (ostomy).

In general, surgery involving the rectum may lead to functional disturbances of the bladder. Men sometimes experience sexual problems such as erectile dysfunction. This is a result of irritation of, or damage to, nerves located in the immediate vicinity of the surgical field. These complaints are often only temporary. Thanks to pioneering and improved surgical techniques, persisting problems are rare.

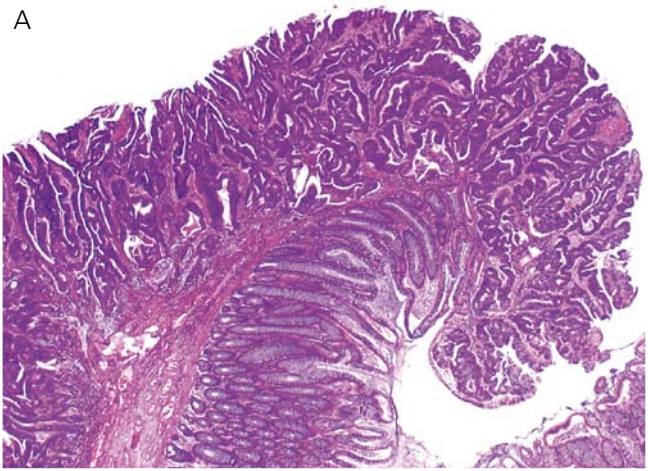
What information does the pathological examination of the surgical specimen reveal?

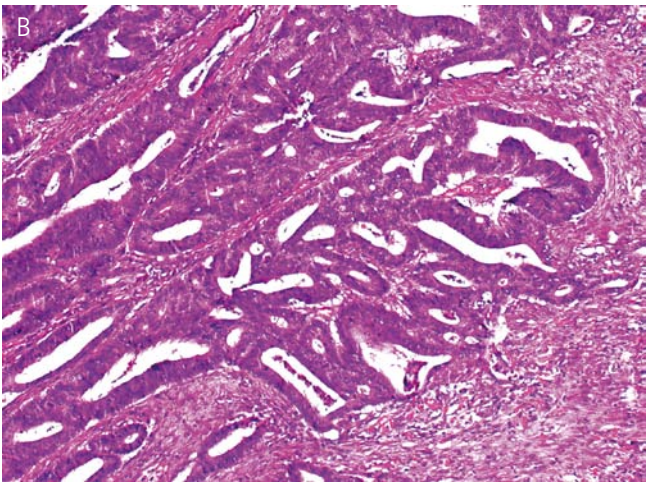
Fig. 26 (A, B)
Microscopic image of colorectal cancer
Above:
Transition of normal colon mucosa (right) into adenocarcinoma (left)
Below:
Detailed view of adenocarcinoma from the above image

What information does the pathological examination of the surgical specimen reveal?

Once the operation is complete, the surgical specimen (tissue removed during surgery) is examined by a pathologist. Pathologists are physicians who have been trained to evaluate the tissue structure and molecular pathology of tissue samples (biopsies) before the operation and of surgical specimens.

A





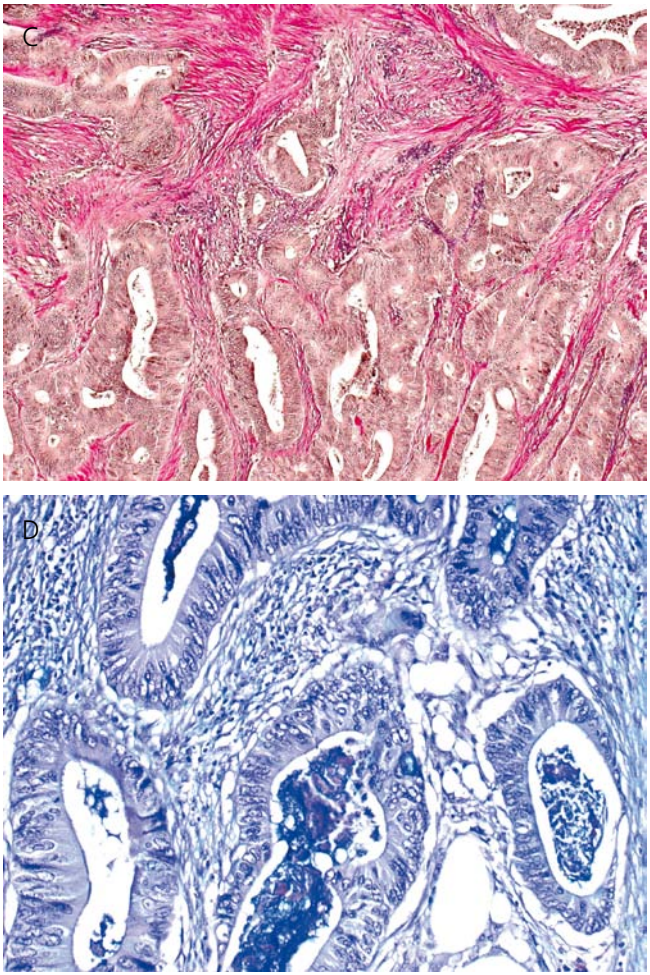


Fig. 26 (C, D)
Microscopic image of colorectal cancer
Above:
Adenocarcinoma with surrounding new connective tissue growth
(Elastica van Gieson stain)
Below:
Mucus production in adenocarcinoma
(alcian blue periodic acid-Schiff; mucus stained blue)

Once it has been prepared according to a special method and its tissues have been stained by various dyes, the specimen is examined under a microscope (*Fig. 26, A–D*). In doing so, the pathologist examines all of the lymph nodes to determine the tumour stage. The depth to which the malignancy has spread and its degree of differentiation are of particular interest. The lymph nodes in the surgical specimen are counted, as is the number of nodes which have been invaded by malignant cells. Evidence that all of the surfaces of the resected tissue are free of tumour is of vital importance. Assessing a surgical specimen generally takes between three and five working days. During surgery, a pathologist may perform a "frozen section procedure" to determine whether the margins show any evidence of tumour.

Examination of the surgical specimen may yield the following important information:

1. Tumour position and size
2. Tumour classification (TNM stage)
3. Additional molecular pathological (genetic) studies

The patient's hospital discharge sheet or medical report should contain the tumour classification, which characterizes the patient's colorectal cancer. This is specified in terms of the TNM stage according to the internationally recognized criteria established by the UICC (Union for International Cancer Control).

The TNM classification characterizes the overall extent of the individual patient's malignant disease and is crucial for planning his/her further therapy.

The TNM stage covers the following characterizations:

- T = tumour: The T stage quantifies the extent of the tumour in the individual bowel wall layers. The T stage ranges from T1 to T4.
- N = node (lymph nodes): The N stage quantifies the degree to which regional lymph nodes have been

affected by metastases. The presence of lymph node metastases is always associated with a worse prognosis for the patient. If lymph nodes are affected, patients are usually advised to undergo subsequent chemotherapy. The N stage ranges from N0 to N2.

- M = metastases: The M stage reflects whether or not distant metastases are found in other organs. The M stage ranges from M0 to M1.

UICC tumour stage

Based on the tumour findings and the resulting T, N and M classifications, it is possible to establish a tumour stage for each patient according to UICC criteria. Current guidelines establish four stages from I to IV (*Fig. 27*).

Stage I:	T1 or T2	N0	M0
Stage II:	T3 or T4	N0	M0
Stage III:	T1–T4	N1 or N2 (lymph node metastases present)	M0
Stage IV:	T1–T4	N0–N2	M1 (distant metastases present)

3.1 Grading

Grading quantifies the tumour's degree of differentiation. Current criteria distinguish between a grade of G1 for well differentiated colorectal cancer, G2 for cancer which is moderately differentiated, and G3 for poorly differentiated cancer. Differentiation describes the extent to which the tumour tissue still resembles the normal tissue from which it originated when viewed under a microscope. G1 tumours are biologically less aggressive than G3 tumours.

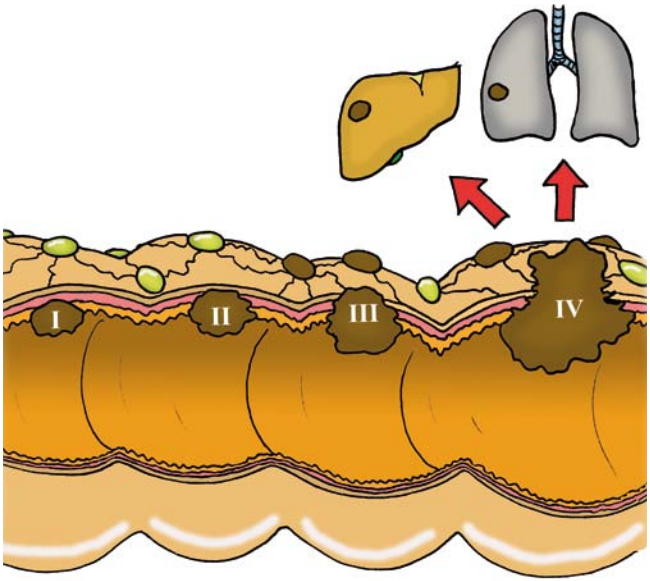


Fig. 27
The four tumour stages of colon cancer

4. The R classification

The R classification describes the patient's residual tumour status, i.e. whether there is still any tumour left in the body at the site of the surgical removal. It specifies any tumour tissue remaining in the body and whether the margins of the surgical specimen are free of malignant tissue. The greater the distance between the edge of the surgical specimen and the tumour, the better the patient's prognosis. The R classification is as follows:

- R0 = No tumour visible to the naked eye or microscopically.
- R1 = Microscopic evidence of residual tumour.
- R2 = Residual tumour visible to the naked eye (macroscopically).

6

Tumour boards (MDT)

Tumour boards (MDT)

Today, the cases of patients with colorectal cancer must be discussed by interdisciplinary tumour boards. These serve as regular meeting places for specialists working in a variety of fields involved in the treatment of colorectal cancer patients so that they can jointly determine the best treatment recommendations for patients (*Fig. 28*). Tumour boards guarantee a rapid course of treatment and ensure the best possible treatment decisions are made. The following specialists should sit on the tumour board to determine the course of treatment: surgeons, oncologists, gastroenterologists, radiologists, interventional radiologists, pathologists and radiotherapists. In addition to the actual findings relating to the tumour, the patient's current overall physical and mental health, any concomitant diseases, his/her current medications and his/her social environment must be taken into account when making treatment decisions.

Together, the board decides whether the patient should be operated on immediately, whether pretreatment in the form of radiotherapy and/or chemotherapy should be recommended to increase the chance of long-term cure or whether systemic therapy in the form of chemotherapy, immunotherapy or antibody therapy is necessary.

In cases where the cancer has spread to other organs (metastasis), it is important that the appropriate chemotherapy is combined with assessing the possibility of surgically removing the metastases or the colon cancer. If it is not technically possible to remove the metastases or if it is deemed that this is not beneficial, the tumour board decides whether the colorectal cancer should be operated on before systemic therapy (chemotherapy) begins. According to current knowledge, surgery must only be performed on such types of patients when they are symptomatic, i.e. if following clinical assessment, it is determined that they might develop bowel obstruction

or that they are losing so much blood as a result of the tumour that anemia has developed and a blood transfusion is needed to combat this.

If primary curative surgery is impossible, the course of tumour progression as it is treated systemically should be discussed by the tumour board every two to three months. Drugs available today make it possible for secondary resectability (the removal of the tumour and metastases following the reduction of the extent of the tumour by these drugs) to take place. The necessity of additional treatment following successful surgery should be discussed in a similar way by specialists on the tumour board, as soon as it is possible to draw on a histopathological assessment of the colorectal cancer.

Fig. 28
The interdisciplinary tumour board

What are the rates of cure?

What are the rates of cure?

The chances of cure and the patient's prognosis depend first and foremost on whether it was possible to remove the primary tumour completely, along with its associated lymph nodes. If tumours are recognized at an early stage and promptly removed, the chances of cure are very good. About 50% of all patients with colorectal cancer can be cured nowadays. The prognosis is worse if the cancer has already spread to other organs such as the liver or lungs at the time of initial diagnosis. In advanced tumour stages, the extent to which these other organs are affected determines how the patient will be treated.

Besides the established methods, therapy in such metastatic cases may include a more individualized therapeutic strategy which should be developed in cooperation with a team of cancer experts. Many large clinics hold special tumour conferences to discuss these complex cases (*see chapter 6*).

A patient's prognosis can be estimated based on the tumour stage, but this may not be an exact estimate, as there are many other factors which play a role in prognosis. Each patient is an individual case. The outcome can be positively affected by the patient's mental attitude and whether or not help is available to cope with the fears and concerns associated with the disease. Psycho-oncology specialists are on hand at all times if you feel that you require psychological support.

8 What is the follow-up for colorectal cancer?

What is the follow-up for colorectal cancer?

8.1 General recommendations

Patients with UICC stage II or III colorectal cancer whose age and general health do not exclude them from therapy for recurrent or metastatic disease should receive follow-up monitoring. Tumour follow-up monitoring should be coordinated by the patient's primary care physician or a specialist with the participation and constant feedback of the medical practitioners involved, including the surgeon, gastroenterologist, oncologist, radiation oncologist, radiologist, etc. A key component is complete colonoscopy before bowel surgery or as soon as possible afterwards (preferably within the first three months).

After surgery to remove a tumour, the patient is advised on whether tumour follow-up monitoring is required and, if so, how frequently this should take place. The primary goal of follow-up monitoring is the earliest possible detection of disease recurrence or the appearance of metastases and prompt initiation of treatment. Even if the disease does recur or metastases appear, the options for treatment are generally quite good. The first two years after surgery are the most important ones, as this is the time during which the risk of developing recurrent disease is highest.

The risk of disease recurrence declines with the passing of years, meaning that tumour follow up is generally concluded after five years.

8.2 What does tumour monitoring entail?

1. The standard follow-up monitoring protocol includes an interview with the physician, a physical examination, laboratory tests (including the tumour marker CEA) and an ultrasound examination of the abdominal organs. According to the monitoring plan in place, patients should be monitored every three to six months for the first three years and once a year in the fourth and fifth years. Follow-up monitoring to check for the recurrence of a tumour may be terminated after five years. This does not, however, exclude monitoring for new tumours (secondary tumours or new bowel polyps).

2. A further important component of the monitoring program is colonoscopy. It is recommended that patients with colon cancer are examined in this way every three years.

3. Rectoscopy (endoscopic examination of the rectum) is recommended for patients with rectal cancer every three months during the first year and every six months during the second and third years. Annual rectoscopies are generally considered sufficient in the fourth and fifth years.

4. There are currently no established recommendations for the routine use of computed tomography (CT) as part of tumour follow-up monitoring. In patients with colorectal cancer, a post-operative CT scan of the lungs, abdomen and pelvis can be performed three to six months after surgery to establish baseline status. Guidelines published by the American National Comprehensive Cancer Network (NCCN) recommend that patients with stage II and III cancer receive an annual CT scan of their lungs and abdomen during the first three to five years. Routine chest X-rays and PET examinations are not recommended.

9 Will I need additional therapy after surgery?

Will I need additional therapy after surgery?

9.1 When is chemotherapy recommended?

Adjuvant chemotherapy

Chemotherapy is generally recommended when there is a high-risk situation or pathological examination of the surgical specimen reveals lymph nodes to which the tumour has spread. Despite complete removal of the tumour, there is still the possibility in such cases that not all viable cancer cells were removed during surgery. The tumour may have already spread to distant sites in the body. There is an approximately 50% chance that tumour cells are hidden elsewhere in the body and cannot yet be detected with the available methods. Major international studies have shown that preventive, or "adjuvant" chemotherapy significantly lowers the risk of recurrence in such patients. Physicians offer these patients the option of chemotherapy. Why "preventive"? Although the tumour has been completely removed, therapy recommendations are based on the probability that there may still be tumour cells hidden somewhere in the body. The physicians' focus is still on complete cure of the malignant disease (curative intention). Adjuvant chemotherapy reduces the absolute risk of the tumour recurring by 10%. There are also other special situations in which adjuvant or preventive chemotherapy may be recommended. If any of these conditions apply, the physician will discuss the advantages and disadvantages of chemotherapy with the patient and they will reach an agreement together. Such situations arise if the tumour has been broken up during surgery or has already spread to other organs or if fewer than twelve lymph nodes have been removed.

Neoadjuvant radiochemotherapy

As a rule, patients with locally advanced rectal tumours in the middle and lower thirds of the rectum undergo "neoadjuvant" therapy prior to surgery. This consists of a combination of chemotherapy and radiation of the tumour (radiochemotherapy). The objective of this procedure is to reduce the probability of tumour recurrence after successful surgery. The efficacy of this approach has been confirmed in international studies. In cases where the rectal tumour is found directly in front of the sphincter, it is often possible for continence to be maintained following surgery if neoadjuvant radiochemotherapy is performed. For locally advanced rectal tumours, there is also a form of neoadjuvant therapy consisting of radiation alone, i.e. without chemotherapy, prior to surgery. The best approach, based on the individual case, will be recommended by the physician.

Palliative chemotherapy

"Palliative" chemotherapy is used in cases in which daughter tumours (metastases) have already developed in distant organs such as the liver or lungs. The goal of chemotherapy in such cases is to improve the quality of life and prolong life. Generally speaking, it is no longer possible to cure these cases, but it is not completely out of the question. In certain cases, metastases may respond so well to chemotherapy that they can be surgically removed. This is possible in the case of liver and lung metastases, for example.

9.2 What does chemotherapy entail?

The underlying principle of chemotherapy is the destruction of rapidly dividing cells, i.e. tumour cells. The drugs used for chemotherapy are called cytostatic agents. When administered into the blood stream, they are distributed throughout the body (systemic therapy) and, in addition to attacking cancer cells, may also affect healthy

tissues that have a high rate of cell division. This causes various side effects, which will be discussed below. Chemotherapy is administered by a specially trained team consisting of a physician (oncologist) and nursing staff. A wide variety of drugs are available today, such as 5-fluorouracil (5-FU), folinic acid or leucovorin, UFT (tegafur-uracil), oxaliplatin, irinotecan, capecitabine, cetuximab, bevacizumab and panitumumab, and the choice of medication depends on the stage of the disease, other illnesses present and the patient's general health. Although the medications chosen are normally combined in regimens such as the FOLFOX regimen, they may sometimes be used alone (monotherapy). Chemotherapy can generally be administered on an outpatient basis unless certain health issues require inpatient treatment. In most cases, cytostatic agents are administered intravenously (through a vein). The placement of a venous catheter beneath the collarbone (clavicle) is usually more advantageous and comfortable for the patient and is even obligatory in patients receiving cytostatic regimens containing 5-FU. Only capecitabine is taken in tablet form.

Adjuvant chemotherapy is usually given for a period of six months. In metastatic disease, response to treatment is the primary factor which determines the length of therapy. Depending on disease progress, various regimens can be employed, including those with antibodies such as cetuximab or bevacizumab, in addition to the classic cytostatic agents. Antibodies are proteins which attach themselves to certain molecular targets, in this case surface structures of the cancer cells which are important for tumour growth. They can inhibit growth signals in the cancer cells or interfere with the blood supply of the tumour. To date, antibodies have not been shown to be of benefit in "adjuvant" therapy. Finally, under certain circumstances it is possible to supplement treatment of liver metastases using local methods such as chemoembolization, cryotherapy or radiofrequency ablation.

9.3 What are the side effects?

As mentioned above, chemotherapeutic agents attack not only cancer cells but also affect the cell division of healthy tissues. This can cause various side effects which sometimes, but not always, occur in patients receiving these treatments. Bone marrow, which produces white and red blood cells as well as blood platelets, is very sensitive to these agents. This can result in patients developing infections, anemia or bleeding during therapy. Regular monitoring of the blood count can help identify problems early on. Especially important are the white blood cells (leukocytes), which protect against infections. Therapy may need to be interrupted due to a low white blood cell count and is resumed when the blood count returns to acceptable levels. Further side effects include nausea and vomiting. Prophylactic use of antiemetic agents (drugs to prevent nausea) administered by infusion prior to each chemotherapy session can be effective in preventing nausea and vomiting. Patients may also experience loss of appetite, changes in their sense of taste, and diarrhoea. Side effects resolve once therapy is completed. One side effect many patients find disturbing is hair loss. Complete hair loss is not usually expected with the combinations of medication routinely used for colorectal cancer, and hair will grow back again on completion of therapy. The above-described antibodies are generally well tolerated. As they are proteins, allergic reactions may occur. Cetuximab sometimes causes acne-like skin eruptions, while bevacizumab is associated with bleeding, thrombosis and hypertension (high blood pressure).

9.4 When is radiotherapy recommended?

Tumour cells can also be successfully targeted by means of radiotherapy. The radiation used for this purpose is comparable with that used for radiologic examinations (X-rays) but contains much more energy. As with chemotherapy, radiation treatments are administered by a specially trained team led by a specialist in radiotherapy (radiation oncologist). Radiotherapy kills a significantly greater number of

cancer cells compared with chemotherapy, but its effects are only local. Unlike chemotherapy, radiation is not suitable for attacking distant tumour cells (micrometastases). The two methods can be combined as radiochemotherapy. In this case, chemotherapy supports the local effects of radiotherapy. Radiation or radiochemotherapy are often used in patients with rectal tumours either prior to the planned operation (neoadjuvant therapy) or following surgery (adjuvant therapy). With colon carcinoma, radiotherapy is only used in exceptional cases.

Prior to radiotherapy, several preliminary examinations are required in order to determine the individual tissue volume to be irradiated, establish the boundaries of the radiation and calculate the radiation dose in detail. The radiation treatment only takes a few minutes and is administered five days a week, usually for a period of five to six weeks. There are also shorter treatment protocols which use higher individual radiation doses. In most cases, radiotherapy is performed on an outpatient basis. The most common side effects are irritation of the bowel and bladder (increased frequency of bowel movements and urination, bowel and bladder urgency, diarrhoea) and skin irritation (redness, dryness). Should these side effects occur, they normally resolve within days or weeks of completed radiotherapy.

Late reactions such as skin discoloration and hardening of the subcutaneous fatty tissue may occur. Radiotherapy can also be useful in the treatment of daughter tumours (metastases) of colon or rectal tumours. A course of radiotherapy lasting approximately two weeks, for example, can bring about a rapid reduction of symptoms in painful tumour metastases to the bone, with long-term stabilization of the bone in the irradiated area. In the case of metastases in the liver, lungs, brain or soft tissue, high-precision (stereotactic) radiotherapy consisting of just a few high radiation doses can result in long-term control (size reduction or inhibition of further growth) of these metastases. This very well tolerated method is used in particular when there are only a few metastases (one to three) in an organ.

10 Dietary recommendations after bowel surgery

Dietary recommendations after bowel surgery

10.1 General recommendations

Bowel surgery for treatment of colorectal cancer involves removal of a segment of the bowel. This can result in changes in stool habits. Stools may be harder or softer than they were before surgery. The severity of the symptoms is influenced by the length of the bowel segment which was removed and the bowel site at which the resection was performed (which part of the bowel was removed). While careful dietary planning can influence stool consistency, reduce bloating and improve the patient's general sense of wellbeing, no special dietary recommendations are necessary. General restrictions or elimination of certain foods are not applicable.

Dietary recommendations for patients after bowel operations are similar to those of a normal, healthy diet. In order to help identify any individual intolerances, it is a good idea to keep a **diary of foods and digestive problems.** Patients are especially unfamiliar with any new dietary needs that may arise during the initial few weeks following surgery. The digestive system must be given time to regulate itself again. However, as every patient reacts differently to surgery, it is important that each individual finds out which foods are good for his/her body and which are best avoided.

Basis of nutritional therapy: "Light general diet"
The "light general diet" is an aid for patients in avoiding foods and beverages commonly known to cause intolerances. These include mushrooms, cabbage, raw onions, garlic, leeks, (deep-)fried foods, whole grain breads with unmilled seeds, freshly baked bread, hard boiled eggs, acidic foods, grilled or smoked foods, highly spiced foods, foods and beverages which are too hot or too cold for them, carbonated beverages and unripe fruits.

Fresh fruit (apart from bananas), lettuce, raw vegetables, tomatoes, cauliflower, peas and green beans may not be well tolerated in the period shortly after the operation.

Constipating effects (desired):	Laxative effects (not desired):
Bananas, grated apples (with peel), raisins, blueberries (dried), baby food: apples with blueberries or apples with banana	Raw vegetables, cabbage, onions, beans, spinach, sauerkraut juice
White bread, graham bread, spelt bread, plain biscuits, rusks	Whole grain products
Polished rice, pasta, oats, semolina	Salads Raw fruit, figs, prunes, prune juice
Strong black or green tea	Alcoholic beverages, beer, caffeinated beverages, undiluted juices
Cooked carrots and potatoes (Bitter) chocolate, cocoa powder, cocoa with water Dry cheese (hard cheese)	Hot spices Fried foods, very fatty foods
Coconut flakes, fruit gums	Nicotine

Table 1
Effects of foods on stool consistency

Tables 1 and 2 provide an overview of the effects of foods on stool consistency and the formation of intestinal gases.

Reduces bloating (desired):	Increases bloating (not desired):
Cranberries (4–6 teaspoons per day), blueberries (blueberry juice)	Cabbage, bell peppers, onions, garlic, mushrooms
Caraway seeds, caraway seed oil, caraway seed tea, black caraway seeds, fennel, parsley	Fresh fruit, pears, rhubarb Fresh bread, pumpernickel
Fennel tea, aniseed tea	Carbonated beverages, sparkling wines, beer, fermenting new wine, caffeinated beverages
Yoghurt	Eggs, egg products, mayonnaise

Table 2
Effects of foods on the formation of intestinal gases

In cases where bowel surgery requires placement of an artificial bowel outlet (ostomy) connected to the small bowel (ileostomy or jejunostomy), the colon's ability to make stools more solid is missing. This means there is no longer adequate reabsorption of water, sodium and other electrolytes. Patients have thin, porridge-like stools and increased frequency of bowel movements. There is also the danger of the body dehydrating, since the small bowel excretes more liquid through the ostomy. Patients should keep an eye on the amount of urine they produce and must contact their primary care physician if this level drops. They should also contact their primary care physician if the stools excreted through the ostomy are very watery for a period of several days.

10.2 Dietary recommendations with a small bowel ostomy

It is important for patients with small bowel ostomies to remember that each intake of food or drink produces ostomy output. Eating and drinking slowly and chewing carefully can be most helpful in this respect.

Please note:

1. Drink plenty of fluids. Daily fluid requirements are about 2.5–3 liters.
   Suitable beverages:
   Black tea, herbal teas (not peppermint or fruit teas)
   Salty meat or vegetable broths
   Still mineral water
   Urine output should amount to at least 1 liter per day.
2. Low-fibre foods
   Foods with a constipating effect are preferable (*see Table 1*).
3. Foods which irritate the ostomy may lead to skin irritations. Such foods include hot spices, fruit acids, tomatoes and pickled vegetables.

Long-term preventive nutrition can be oriented to the principles of the Mediterranean diet. Mediterranean cuisine not only helps to prevent heart disease but also reduces the risk of becoming overweight and developing certain forms of cancer.

10.3 Characteristics of the Mediterranean diet

- Daily intake of plenty of fruit, vegetables and salads
- Emphasis on vegetable fats, such as rapeseed, olive or soy oil, as well as nuts in small quantities
- Daily intake of low-fat dairy products
- Fish, poultry and eggs about 3 times per week
- Red meat and sausages only a few times per month
- Frequent consumption of fish (2–3 servings per week)
- Moderate alcohol intake (1 glass at mealtimes)
- Emphasis on regional foods and fresh foods in season

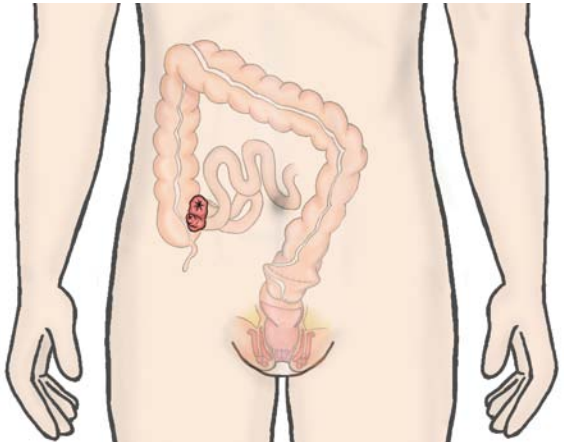
The principles of the Mediterranean diet can easily be applied today. Mediterranean customs also include a healthy lifestyle. Take time with your meals and enjoy them in an atmosphere of peace and quiet. Get plenty of physical exercise, especially in the fresh air.

How will I live with an ostomy?

How will I live with an ostomy?

Modern colorectal cancer surgery tries to avoid placement of an artificial bowel outlet (ostomy) whenever possible. In certain cases, a temporary or lifelong ostomy may be necessary for safety reasons (*Fig. 29, A, B*).

A



B

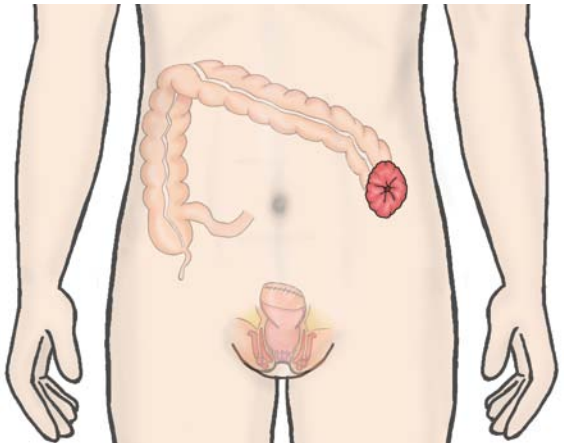


Fig. 29 (A, B)
A = Removal of bowel tumour with a temporary ostomy connected to the small bowel (protective ileostomy);
B = Removal of bowel tumour without re-establishment of bowel continuity and with an ostomy connected to the colon (colostomy)

11.1 General recommendations

Ostomy comes from the Greek word stoma, meaning "mouth" or "opening". In the medical sense, an ostomy is a surgically created opening in the abdominal wall, e.g. for allowing the passage of stool from a section of the bowel. The term previously used, anus praeter, means an artificial bowel outlet, and does not give any further information on the position of the ostomy. The word *ostomy* is normally used in compound words to reflect the anatomic position of the outlet, e.g. *enterostomy* (outlet from the small bowel) or *colostomy* (outlet from the colon). More precise definitions are also possible, such as *ileostomy* (outlet from the ileum, the final segment of the small bowel), *descendostomy* (outlet from the descending colon) or *sigmoidostomy* (outlet from the sigmoid colon).

A further distinction is made between a temporarily placed artificial outlet and one which must remain in place for the rest of a patient's life. A temporary ostomy is created for the purpose of protecting a segment of bowel following surgery. Stools are temporarily diverted through the ostomy and collected in a pouch. Once healing of the lower bowel segment is complete, the ostomy is removed during a second operation and the continuity of the bowel system is re-established. A lifelong ostomy is necessary in cases where a malignant or inflammatory process has affected the rectum and/or sphincter muscle to such an extent that re-connection of the bowel with normal passage of stool through the anus is no longer possible.

A distinction is also made between single-arm and double-arm artificial bowel outlets, depending on whether the bowel segment emptying at this point is proximal (above the ostomy in the normal course of the bowel) or both proximal and distal (emptying from both above and below the ostomy). Temporary ostomies are generally double-armed, while lifelong, or permanent, ostomies are mostly single-armed.

Today, a variety of modern appliance systems are available for use with artificial bowel outlets and there are specially trained personnel (ostomy therapists) to provide ostomy patients with comprehensive support and services at home. The object of these improvements is to help every ostomy patient achieve an optimum quality of life. Once the initial adaption phase is over, this usually means a return to career, resumption of sports and recreational activities, and satisfying intimate relationships.

11.2 One-part ostomy system

The plate for protecting the skin and the ostomy pouch are joined together. This provides the ostomy patient with a good, flexible, tight adaptation to the skin, permitting maximum freedom of motion and protecting the skin from leakage. The appliance should be changed every day (*Fig. 30, 31*).

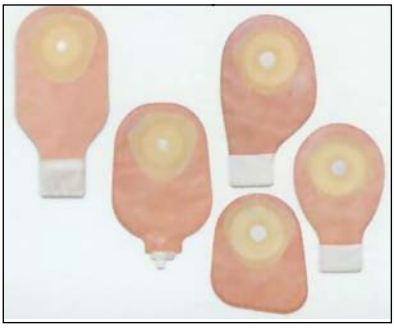


Fig. 30
One-part post-operative ostomy system

Fig. 31
Various one-part ostomy systems

11.3 Two-part ostomy system

These systems consist of a skin-protection plate and integrated flange ring, to which a removable pouch is attached, which can be changed every day (*Fig. 32*). The plate is generally changed every two to four days, the frequency depending on the type of ostomy and the consistency of the excreted stools.

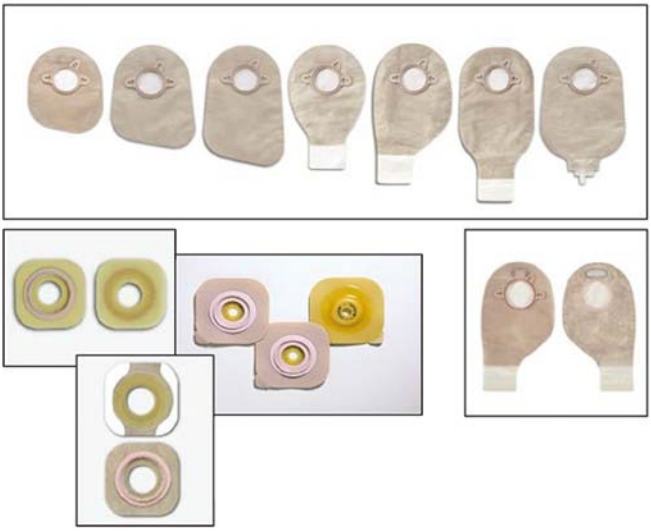


Fig. 32
Various two-part ostomy systems

Choosing an ostomy system depends on a variety of factors, including skin condition, anatomic location, shape and size of the ostomy site, patient's clothing preferences and any physical limitations such as vision problems, arthritis in the hands or fingers, etc. The ostomy therapist and the nursing staff will assist you in selecting the best system for your particular needs.

All ostomy systems are waterproof, which makes it possible for you to shower, bathe and swim. Because intestinal gases also pass through the ostomy, an integrated filter prevents inflation of the ostomy pouch. Immediately after the operation, the nursing staff will use transparent pouches in order to assess the ostomy and the excreted stools and monitor for leakage. On discharge from hospital, you can switch to skin-colored pouches. Becoming familiar with your ostomy and its care are subjects you will learn during your hospital stay.

On your return home, care and support can be provided by a home-care agency. The agency you choose should continue to provide you with support and services. Specially trained personnel will not only provide the materials you require but also train you in their use and answer your questions. The only cost to you is the statutory prescription fee for the supplies needed to care for your ostomy, which are prescribed by your primary care physician.

11.4 Tips and tricks

- Having an ostomy means changes in toilet habits. Allow yourself peace and quiet to perform these tasks.
- Change your pouch before breakfast as there is little or no active digestion at this time.
- Change your appliance regularly. This prevents skin complications.
- Artificial sweetener tablets reduce stool odor. Place at least four tablets in the pouch after each emptying.
- Change or empty your appliance before leaving the house (change the pouch with a one-part system; empty the pouch with a two-part system).
- Whenever you take a shower or bathe, cover the filter with the adhesive tabs provided. Moisture interferes with the filter function.
- Patients who take part in sports may benefit from sport-oriented appliances supplied by the same manufacturers, such as mini pouches and ostomy caps *(Fig. 33)*. Avoid sports which put undue stress on the abdominal wall, such as rowing, wrestling, martial arts, etc.
- When playing soccer or other ball games, protect your ostomy by using a plastic prolapse cap. These are available from the same source as your other supplies.
- Bermuda-type shorts with a net-pouch to contain the ostomy pouch are available for male swimmers. Special ostomy bathing suits for women are not yet available.
- Avoid heavy lifting (maximum 10 kg) in order to prevent the ostomy from slipping forward (ostomy prolapse) or hernia. If heavy lifting is unavoidable, you should use a specially made bandage with a gap for the ostomy pouch.
- When driving, a stoma protection plate prevents irritation of the ostomy. Ostomy patients are not exempt from the requirement to wear seatbelts.
- When traveling, take adequate ostomy supplies with you in your hand luggage.
- Your first-aid travel kit should always contain medication against diarrhoea and constipation.
- Patients with a permanent ostomy can apply for handicapped status. In Germany, this affords extra protection against losing your job and allows you additional holidays.
- In patients fitted with an ostomy, it is normal for stools and mucus to pass through the anus occasionally and this does not cause any danger.

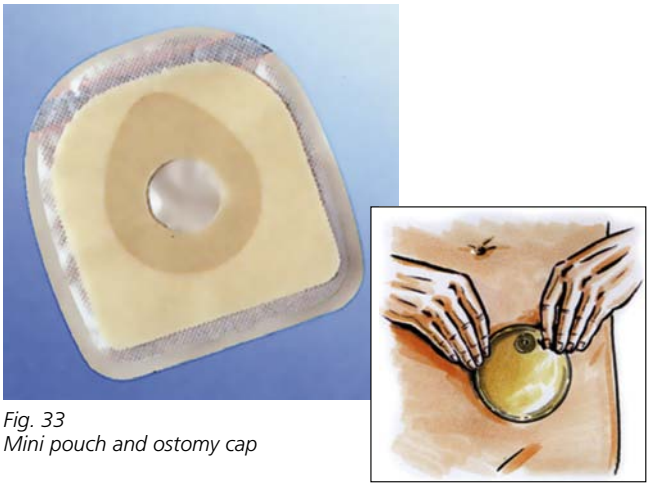


Fig. 33
Mini pouch and ostomy cap

A European disabled toilet key for access to disabled toilets can be purchased at a low cost. A variety of books on ostomies give useful information on general ostomy questions, recreation, sports, spa cures, diet, etc.

Patients with permanent ostomies may benefit from bowel irrigation every morning to help empty the bowel. Assurance of continence for 24–48 hours improves your quality of life by minimizing your care needs and giving you greater independence in your daily life.

11.5 Dietary recommendations for ostomy patients

An artificial bowel outlet does not require any special diet. Following the operation, you can return to your normal eating habits, although you should watch out for any changes in food intolerances. An easily digested, balanced diet which is rich in vitamins and low in fat is generally recommended. Choose fresh, minimally processed foods rather than pickled and smoked items.

Gas-producing vegetables like mushrooms should be avoided. Cranberries reduce gas production and inhibit stool odour. Dietary fibre stimulates bowel activity, binds

toxins and supports the intestinal flora (bacteria). Finely milled whole grain products such as graham bread are generally well tolerated. Foods high in tannins, pectins and potassium are recommended in order to reduce loss of water and electrolytes. Tannins slow down bowel peristalsis, while pectins bind water. Loss of sodium can be adequately replaced by foods salted in the normal way. Drinking 2.5–3 liters of water a day can also have a positive influence on stool regulation, but you should also let yourself be guided by your natural sense of thirst. Your daily urine output should be at least one liter.

It is advisable to eat slowly and chew well. A non-irritating diet is better tolerated and does not irritate the gastric and bowel mucosa. Very sweet, fried, roasted or spicy foods should be avoided initially. Other tips can be found in chapter 10.2.

Living with an ostomy does not mean renouncing the pleasures of life!

11.6 The ostomy and its psychological aspects

Each person reacts differently to changes in his/her body image and has his/her own individual way of coping with them. Ostomies are "hidden" body image changes. A person's sense of wellbeing depends on his/her attitude toward the ostomy. Acceptance of the ostomy makes it easier to cope with the demands of everyday life. Changing the appliance regularly helps you develop a routine which makes you feel secure and reduces anxiety. When your self-confidence and comfort increase, your quality of life also improves.

Take as much time as you need to adapt to your new situation. Talk about your feelings and thoughts with your spouse, your family and other people you trust. Support and good advice can also be obtained from self-help groups.

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Colorectal cancer and quality of life – What does psycho-oncology offer?

Colorectal cancer and quality of life – What does psycho-oncology offer?

Quality of life is a term which is used a lot and often misunderstood. In this particular context it means your personal experience with cancer and your feelings and problems as far as the psychological, physical and social aspects of life are concerned. Research has shown that there are no general factors which improve or worsen our quality of life. People may suffer from the same disease and have the same prognosis objectively speaking, but be completely different in their reactions to the disease. Some cancer patients actually have a better quality of life than the average person. Confronted with their illness, they make up their minds about what is really important to them and start living life with greater awareness than they did before. It all depends on how each individual patient adapts to the stressors inherent to the disease and to its treatment.

Situations of stress may occur during different phases of the disease and may be related to a variety of factors such as cancer in general, the specific diagnosis of colorectal cancer, the prescribed treatment and the potential consequences. Many of these stressors may be temporary, while others persist and may require psychological treatment.

Many patients are anxious and worried while they are in the hospital because they are afraid of the surgery or the outcome. These concerns are normal and understandable but they can often be relieved by a frank talk with your physician. It is important to ask as much as you want and can take in. Do not hide your concerns and anxiety. It is helpful to play as active a role as possible in working out your plan of care and to have confidence in your physician.

After being discharged from the hospital or rehabilitation center, it is advisable to return to normal life as quickly as possible. This is not always easy, and there are sure to be new challenges. These include social issues such as work, pension or disabled status and your relationships with family, friends and acquaintances. There is also the fundamental question of whether you want to make basic lifestyle changes or go on living the same way as you did before.

Research shows that the greatest fear of all cancer patients is that the disease might come back again or spread ("progression anxiety"). This concern is natural and justified, but if such fears gain the upper hand it may be helpful to face up to them and try to analyze them in detail. Some good solutions may present themselves as a result of such an activity. It can also help to just talk things over, take your mind off things for a while or give yourself a special treat.

Research on patients with colorectal cancer has concentrated on the question of whether quality of life is affected more in those with or without artificial bowel outlets. As mentioned above, there is no generally accepted answer. Patients of both groups may experience bowel problems, digestive complaints, social uncertainties and sexual problems. It has proved beneficial to include the patient's spouse or partner in discussions from an early stage and encourage frank communication. In some cases, the spouse or partner is more stressed than the patient. Patients with ostomies require comprehensive and competent ostomy counseling to help them with their questions.

Increased recognition of the importance of psychological handling of the disease has led to a variety of support options becoming available today.

13 Physical activity and colorectal cancer

Physical activity and colorectal cancer

13.1 Risk reduction

Key risk factors for developing colorectal cancer include lifestyle choices such as smoking and excessive alcohol consumption, unhealthy eating habits, being overweight as well as physical inactivity. In recent years, studies have shown that physical activity and a healthy diet can significantly reduce the number of new cases of colorectal cancer. People who exercise regularly have around a 25% lower risk of developing the disease than those who lead an inactive lifestyle. The higher the weekly level of physical activity, the lower the risk of colorectal cancer. It is not yet sufficiently clear whether the level of physical activity pursued at a young age or that carried out at an older age is more relevant. The assumption is that those who exercise regularly throughout their entire lives benefit the most.

13.2 Improvements in prognosis and sense of wellbeing

Investigations into whether physical activity can improve the prognosis of colorectal cancer patients have been under way for a number of years. The question of whether regular exercise following diagnosis influences patient survival and relapse rate is also being examined as part of these investigations. Promising results from four major observational studies have indicated that physical activity is linked with an improvement in prognosis among colorectal cancer patients. Exercise allows patients to influence the course of the disease. Drawing on these studies' results, an activity level of at least four hours of brisk walking a week is recommended for colorectal cancer patients.

Keeping active can also have a positive influence on mental and physical factors. Regular exercise has been proven to improve patients' quality of life and reduce the

frequency of symptoms such as fatigue, drowsiness and a decrease in productivity. Increasing physical fitness fights against an overall drop in activity and thus considerably improves patients' subjective sense of wellbeing and independence.

It is not yet sufficiently clear through which mechanisms physical activity influences tumour growth in colorectal cancer patients. However, the beneficial effect of physical activity on insulin resistance (reduction in cells' response to the insulin hormone) seems to play a part in the mechanism. Insulin and insulin-like growth factors (IGFs) influence cell growth and/or cell reproduction as well as cell death. Specialized insulin binding sites are located on both the normal bowel mucosa and the bowel's tumour cells. Studies have proven that chronically increased insulin levels, impaired glucose tolerance and diabetes mellitus are linked with an increased risk of colorectal cancer. Physical activity stimulates the cells' response to insulin and lowers increased levels of insulin in the blood.

The way in which regular physical activity increases bowel movements has also been examined. It has been found that exercise reduces the amount of time stools are in contact with the bowel mucosa, thereby also minimizing exposure to potentially cancer-causing substances. Interestingly, it has been shown that the positive effect of physical activity does not stem from any resulting reduction in body weight or body mass index (BMI).

13.3 What forms of exercise are recommended?

Moderate endurance training with the aim of improving overall fitness forms the basis of exercise for colorectal cancer patients. In accordance with current findings, moderate endurance training in which the intensity and duration equates to at least four hours of brisk walking a week is recommended. The amount of exercise performed, however, should begin slowly at first before being increased gradually depending on the patient's resilience.

The general health of individual patients must always be taken into account before an exercise program commences. Patients differ according to their age, tumour stage or concomitant diseases, meaning that they each have different levels of fitness and resilience. It is therefore important that a medical examination is conducted prior to starting an exercise program so that contraindications to carrying out physical exercise can be ruled out and patient fitness can be assessed objectively. Individual thresholds in terms of patient resilience allow exercise programs to be structured without over or under exerting patients. Pursuits such as walking, Nordic walking and hiking are particularly suitable. Ultimately, patient preferences should always be taken into account and enjoyment should be a priority as well.

13.4 Ostomy patients

Patients with an ostomy should bear a few pieces of targeted advice in mind. Movements which stretch the whole body (tennis, throwing, badminton, volleyball, etc.), sharp turning movements and jerky and powerful movements (competitive sports, contact sports) are highly unsuitable and should only be performed under the supervision of a medical expert. Furthermore, heavy weights that exert pressure on the abdomen or back must not be lifted. Undue pressure on the abdominal wall must be avoided at all costs, as must exhalation against closed air passages (Valsalva manoeuvre). It is possible to swim with an ostomy, as the pouch adheres reliably even in water.

14 Do my family members have an increased risk of colorectal cancer?

Do my family members have an increased risk of colorectal cancer?

14.1 General remarks

Relatives of patients with colorectal cancer or bowel polyps have a statistically higher risk of developing colorectal cancer themselves. Family members should be aware of this increased risk early on and make sure they get adequate colorectal cancer screening.

There is a difference between hereditary colorectal malignancies and increased incidence of malignant disease of the colon or rectum in a particular family. In about 25% of patients with colon cancer, there is increased family incidence of the disease. About 5% of patients with colon cancer have hereditary forms. These known kinds of hereditary malignancies include hereditary non-polyposis colorectal cancer (HNPCC = hereditary colorectal cancer without multiple bowel polyps) or Lynch syndrome and hereditary polyposis syndromes (occurrence of multiple bowel polyps). The latter includes familial adenomatous polyposis (FAP) as well as other, rarer syndromes.

14.2 Hereditary colorectal cancer

If several people in one family develop colorectal carcinoma or other tumours, the likelihood of hereditary cancer should be considered. The development of multiple tumours in a patient, or the occurrence of a solitary tumour at a young age, may also point towards hereditary colorectal cancer. A molecular pathological examination of the tumour tissue by a pathologist may be able to confirm this. The purpose of genetic studies is to identify high-risk persons who would benefit from a careful early detection program while excluding other high-risk persons with no genetic predisposition for tumour, as these do not have a higher tumour risk than the general population.

Mutations of various genes have been associated with particular hereditary colorectal cancers. If hereditary cancer is suspected in a family and/or a molecular pathological examination has suggested this may be the case, genetic counseling should be recommended. After obtaining a detailed medical history (anamnesis) including analysis of the family tree and documentation of any cancers in the family, it is possible to conduct targeted genetic studies.

14.3 Do my family and I have an increased risk of colorectal cancer?

By answering the following questions, you can determine whether there is an increased risk of colorectal cancer in your family. It is important to find out as accurately as possible who in your family has or had colorectal cancer or bowel polyps and at what age these occurred.

Question 1:
Did a direct relative (parents, siblings, children) develop colorectal cancer before the age of 50 years?

Question 2:
Has a direct relative (parents, siblings, children) been diagnosed with a bowel polyp (adenoma) before the age of 40 years?

Question 3:
Does your family have more than three cases of colorectal cancer, stomach cancer, uterine cancer, ovarian cancer or cancer of the renal pelvis or ureter?

Screening recommendations

If you have answered "no" to all of the above questions, there is no increased risk of colorectal cancer in your family.

If you have answered "yes" to one or more of the above questions, there may be a form of hereditary colorectal cancer in your family. All direct relatives (parents, siblings, children) of the person who has developed colorectal cancer have a significantly greater risk of developing colorectal cancer themselves and should be sure to consult their primary care physician, gastroenterologist or geneticist for advice on the preventive measures they should take.