28. Gastrointestinal diseases

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Introduction

Symptoms from the gastrointestinal tract are common with vigourous physical activity and training. It is estimated that approximately half of everyone who participated in endurance sports experience symptoms in the form of nausea, vomiting, abdominal pain, bloating, diarrhoea, stomach cramps, or even blood in the stool.

The gastrointestinal tract is thus not an "athletic organ" that adapts to increased levels of physical and mental stress. The intestine's most important task is to take up nutrients during the body's resting periods. During physical activity, the intestine can be thrown off course and lose its normal function. For this reason, proper nutrition and a nutritional balance during rest is considered fundamental for effective exercise training and intense competition. Balanced nutrition (nutrient intake) is fundamental for preventing symptoms from the gastrointestinal tract. It can also prevent unexpected gastrointestinal symptoms caused by vigourous training, which can reduce physical capacity.

There are several conditions of the gastrointestinal tract that can be exacerbated by exercise training, and where the symptoms of gastrointestinal disease may be expressed. This applies in particular to the inflammatory intestinal diseases of Crohn's disease and ulcerative colitis, in which the catabolic disease with increased demands for extra energy, tissue healing and immunological defense mechanisms does not permit further load on the organism through an increased exercise-induced physiological demand on metabolism. A summary of these conditions is given at the end of the chapter.

The collective knowledge today suggests that a small number of functional conditions of the gastrointestinal tract can be improved through exercise training. This applies above all to diseases of the colon (large intestine) and in particular to the concept of constipation (obstipation). The symptom picture for such diseases is not only affected by the organism's physical fitness, but also by psychological and mental factors, which complicate the picture for diseases of the gastrointestinal tract.

Constipation (obstipation)

Summary

Running and power walking stimulate the intestinal motor function in constipation. The body's movements thereby provide mechanical stimulation of the gastrointestinal tract, which increases passage of the contents from the large intestine to the rectum during motion. When the rectum becomes full, the defecation reflex is induced. During physical work, blood flow is steered away from the intestine to the working muscles. The reduced blood flow leads to a deficiency of oxygen in the tissue, which can lead to the release of several different hormones from the gastrointestinal tract, which in turn stimulate functions of the gastrointestinal tract. A cornerstone in the treatment of constipation is regular exercise together with a high fibre content in the diet (20–30 g per day) and, naturally, going to the toilet when the urge to empty the bowel occurs.

Definition of the concept

The concept of constipation/constipation means different things to different individuals. The stool can be too small, too hard, too difficult to pass, occur too seldom, and some also experience incomplete emptying of the rectum after a bowel movement. An estimated 2 per cent of the population of working age have problems with constipation and the condition is six times more common in women than in men. In old age, it is estimated that constipation occurs in a third of the population.

Normal stool weight is 35–225 g per bowel movement. Low stool weight indicates constipation. There are also significant geographical differences. In Northern Europe and the USA, stool weight is normally 100–200 g per bowel movement, while in India, the average is 311 g, and in Uganda 470 g.

The frequency of bowel movements provides the most practical measure of the degree of constipation. Several studies show that people in Northern Europe and the USA have at least three bowel movements per week. Even here there are large geographical variations, with higher bowel movement frequency with higher stool weights.

The cause of chronic constipation is unknown. The condition is most common in women and, as a rule, onset begins in puberty and problems become worse after childbirth. Investigations of the intestinal motor function have shown a reduced response of motor stimulating gastrointestinal hormones (gastrin, cholecystokinin, motilin) released after meals. The tissue in the large intestine also shows low levels of the neurotransmitters, substance P (SubP), vasoactive intestinal peptide (VIP) and motilin.

The symptoms, mainly abdominal pain and distension, develop steadily between bowel movements. The intervals between bowel movements also become longer and can at worst be up to about a month. Upon examination, one finds no deviating pathological findings, and the abdomen is soft and not tender. The rectum is, paradoxically enough, often empty.

The condition is diagnosed through the patient giving his or her disease history, where fewer than three bowel movements per week is considered to be diagnostic. The diagnosis

can be further confirmed by a transit examination with the aid of radiopaque markers. The markers then collect in the large intestine and the transit time can be calculated.

Most patients can usually manage the treatment on their own by taking large amounts of laxatives or daily enemas. Temporary stimulation of increased bowel movements can be achieved with stimulant laxatives (Pursennid, Dulcolax, Microlax) and also water enemas. In the long term, however, these drugs make the constipation worse. For long-term use, lactulose combined with a fibre supplement in the diet is recommended, which is considered to yield the best results. The fibre supplement can in some cases exacerbate the condition by increasing the intestinal volume load and production of gas. Fibre supplementation should therefore occur successively, to achieve a target level of 20–30 g per day.

Effect of physical activity

Acute effects

Past experience suggests that exercise training stimulates colon motor function and improves the condition in constipation. Urges to empty the bowel that arise in connection with intensive physical activity and training are likely a direct effect on the colon. Animal trials have shown that stimulation of the sciatic nerve gives rise to increased blood flow and increased motor function of the colon (1). The sympathicotonic stimulation during exercise yields a relaxation and inhibition of the gastrointestinal tract's functions in humans (2). Experience also suggests that long-distance runners experience urges relatively late during training (after approx. 30–40 minutes), which suggests that nerve activity has significance for the intestinal effect. Running, and to a lesser extent cycling and swimming, lead to dramatic pressure changes in the abdominal cavity (3). During high intensity work, the diaphragm presses down against the abdominal organs, which is believed to be the cause of the sensation of "stitches" (4)

Exercise training has large effects on the blood flow in the intestine. The blood flow is also affected considerably more during aerobic (submaximal) training in untrained than in well-trained individuals (5). This also has effects on the release of several hormones and neurotransmitters in the intestine. VIP and the neurotransmitter-like peptide histidine-methionine (PHM) is released in large amounts from intestinal tissue when blood flow to the organ is cut off. Mechanical stimulation of the gastrointestinal tract can also cause a release of VIP. These neurotransmitters reduce the sodium uptake in the intestine and increase secretion, which can lead to watery diarrhoea (6). Other hormones, such as secretin, glucagon, gastric inhibitory peptide (GIP) and prostaglandines, are also released during intensive, long-lasting training, and all of which can lead to fluid secretion from the small intestine and thereby also influence the colon. During exercise training, insulin levels in the blood stream drop, while another hormone, pancreatic peptide (PP), rises, which helps to relax the colon (7, 8). The internal anal sphincter can also be relaxed by both VIP and PHM, which can rise to very high levels during physical work combined with lack of fluid and dehydration (9).

Together, these effects explain why, above all, running, which entails a combination of blood flow effects and mechanical stress on the gastrointestinal tract, leads to a greater

release of neurotransmitters and more gastrointestinal symptoms than cycling and swimming. Long-distance walking can give symptoms such as increased intestinal motor function and flatulence, but yields fewer symptoms in general due to the lower work intensity (10). To this can be added that mental stress in itself can increase intestinal motor function (11), but this should be limited to the actual competition situation.

Long-term effects

Many long-distance runners experience symptoms from the colon, with diarrhoea, cramp-like abdominal pain or increased problems with gas, as well as the urge to empty the bowel during or immediately after running. Our knowledge on the exact relations of this are limited. In one study, it was shown that 30 minutes of aerobic training, 3 times a week for a total of 6 weeks, at a level corresponding to 70–80 per cent of maximum exertion, shortened intestinal transit time from 35 to 24 hours, while the transit time for the control group remained unchanged (2). Experience from treatment of patients with constipation also suggests that physical activity, above all power walking and running, had a good effect on constipation. To a lesser extent other sports such as cycling and swimming stimulate intestinal function even in the long term (compare the "after-dinner stroll").

Experience from long-distance running also suggests that, above all, young women suffer from gastrointestinal symptoms with diarrhoea and the urge to empty their bowel (12). This has been observed in a number of studies and must be considered an established concept today in connection with strenuous physical exertion and competition.

A determining factor in this context is that increased exercise if often tantamount to a complete change in lifestyle and should therefore be seen as a change over a very long time.

When the treatment is to begin, the patient must be prepared for some increase in abdominal symptoms, particularly an increased sense of pressure, which may even be experienced as painful. This can nevertheless to be seen as a first sign of a successful treatment outcome and should lead to further encouragement in efforts to a more movement-oriented lifestyle.

Indications

Constipation as a condition can be treated primarily with increased physical activity.

Prescription

In the first place, the recommendation is running at a submaximal level (pulse just over 110) for 30 minutes every other day. This should not be seen as a one-time treatment, but as a change in lifestyle pattern for a very long time to come. In the second place, power walking at a corresponding level of exertion can be recommended, but is evidently not as effective.

The first step in the treatment of constipation thus involves regular exercise and a diet high in fibre (20–30 g per day) along with the individual's own sensitivity to natural signals and the urge to empty the bowel.

Functional mechanisms

Increased release of neurotransmitters in the intestine, which can stimulate a reduced transit time and emptying of the bowel.

Functional tests

The simplest measure of effects on constipation is to keep a record of bowel movement habits. No further follow-up besides this is needed.

Interactions with drug therapy

No known interactions.

Contraindications

Absolute contraindications include acute myocardial infarction and ongoing asthma attack. Relative contraindications include exercise-induced asthma.

Risks

None. If bleeding from the bowel should occur, the patient should contact a physician.

The gastrointestinal tract and metabolic diseases

Absorption of nutrients from the gastrointestinal tract occurs in the small intestine first. The gastric emptying speed is therefore decisive in metabolic control and blood sugar balance. Absorption of sugar and fat must be counter-regulated by insulin in order to not reach injuriously high levels. In cases of a reduced capacity to release insulin in sufficient amounts (adult onset diabetes) and insulin resistance (overweight, pre-diabetes, adult onset diabetes), the gastric emptying speed can be decisive for sugar control. Already during physiological conditions, cycling at a submaximal level (70% of maximal capacity) can affect the pressure relations in the stomach and increase emptying (13), which increases the absorption of nutrients from the small intestine.

In diabetes, gastrointestinal tract activity and emptying of the stomach have obvious significance for metabolic control, above all through the lack of insulin to keep the blood sugar down. In diabetes, emptying of the stomach can be slow. It has been found that 30 minutes of walking after meals improves gastric emptying and metabolic control in many diabetics (14). One should, however, keep in mind that intensive physical activity can dramatically lower the blood sugar and even lead to hypoglycemia (blood sugar that is so low that it impacts general health) in these individuals.

Other gastrointestinal diseases

Diseases of the gastrointestinal tract often involve catabolic conditions where the patient is not able to take advantage of the nutrients needed to maintain a normal nutritional balance. In such circumstances, it is reasonable to recommend exercise training for the particular individual. There are several conditions where physical activity is considered to exacerbate and even induce symptoms of disease. The following gives a presentation of which diseases this applies to and the underlying causes behind such recommendations.

Gastro-oesophageal reflux

Chest pain from the oesophagus can be induced in connection with exertion. Gastro-oesophageal reflux, that is, inflammation of the oesophagus caused by a backward flow (reflux) of the contents of the stomach, is a common symptom that can arise with motility disturbances in the oesophagus. Gastro-oesophageal reflux often presents in connection with physical activity, particularly with symptoms in the form of "heartburn" (acid reflux), but also with chest pain (12, 13). This applies to running, cycling, strength training and various fighting sports. In the first case, the cause of this is likely constant dislocations of the gastrointestinal tract during the impact of running, which can lead to mechanical leakage. In the second case, increased abdominal pressure likely occurs, which pushes the contents of the stomach up into the oesophagus thus giving reflux symptoms. The symptoms are amplified in physical activity after meals (15–17).

Distinguishing between symptoms that precipitate from the oesophagus and angina pectoris is difficult. A suspicion of coronary insufficiency (insufficient blood flow in the coronary arteries) during physical exertion is very important, because angina pectoris directly affects the heart's vital functions. Here, the attending physician must always keep in mind that chest pain coming from the oesophagus can also occur with coronary insufficiency and that reflux can exacerbate myocardial ischaemia. Patients with known coronary insufficiency have been shown to give a positive Bernstein test with acid in the oesophagus and in certain patients even ECG changes as with myocardial ischaemia (18, 19). It has also been described that gastro-oesophageal reflux is more common during physical exertion in individuals with known coronary insufficiency (20, 21). The clinical importance of symptoms from the oesophagus in connection with exertion lies in the danger zone for incorrect assessment of a clinically significant coronary insufficiency with myocardial ischaemia during exertion. Reflux symptoms can, however, be prevented through temporary drug therapy with an H2-receptor antagonist (ranitidine) (12), or, in more pronounced cases, with a proton pump inhibitor (omeprazole).

Gastrointestinal bleeding

Bleeding from the gastrointestinal tract, usually in the form of occult bleeding, is seen in 8–22 per cent of all marathon runners (22). Usually the source of bleeding is localised to the stomach or more seldomly to the colon. The background to this finding is a

dramatically reduced blood flow to the area that supplies blood to the gastrointestinal tract (splanchnicus). During running, the blood flow to the gastrointestinal tract decreases by 80 per cent and has been considered a local state of shock (23). This affects the perfusion of blood in the mucous lining in particular, since 90 per cent of the blood flow to the gastrointestinal tract during rest goes to the mucous membrane (24). It then ceases to function with a normal exchange of salts and fluid between the intestine and the body's inner environment. An interesting finding is that the source of bleeding in the stomach is usually localised to the mid corpus region where the gastric acid is produced, while the lower antrum is rarely affected. In these cases, gastroscopy reveals a haemorrhagic gastritis. It has been speculated that there is a similar originating mechanism for these membrane injuries as for "stress ulcers", which are seen in intensive care cases with multiple trauma. Exercise-induced gastrointestinal bleeding appears to be related to the degree of exertion. It occurs more frequently in young athletes upon vigourous exertion than at lower levels of exertion (25–28). The bleeding can be prevented through treatment with H2-receptor antagonists (22, 29) or proton pump inhibitors.

Strenuous training often leads to low blood haemoglobin levels. The reason for this is in part a dilution of the blood through the increase in blood volume in athletes, and in part that blood cells are destroyed, something seen primarily in long-distance runners. This has been assumed to be due to trauma to the blood cells in the soles of the feet.

Bleeding from the gastrointestinal tract is thus not an uncommon finding after a strenuous physical exertion. It must in the first place be seen as a transient natural reaction and does not require special investigation if the condition subsides within about a week. In the case of known ulcer disease, however, strenuous physical training, especially long-distance running or marathon races, are not recommended because this can theoretically lead to a bleeding episode, which always involves a significant medical risk.

Medication in the form of non-steroidal anti-inflammatory drugs (NSAIDs) should absolutely be avoided if bleeding occurs, since all drugs of this type (ibuprofen, naproxen, diclofenac, sulindac, ketoprofen, etc.) as well as acetylsalicylic acid increase the risk of bleeding.

Inflammatory bowel disease

The extreme metabolic stress that an individual undergoes when developing inflammatory bowel disease is significant and places demands on increased nutritional supplementation for all of the body's cellular energy processes, healing and immunological defense functions. If the organism is unable to take advantage of these demands, a situation of reduced physical work capacity, increased glycogen and protein breakdown and impaired immune defenses arises (30, 31).

Strenuous exercise and a general inflammatory response demonstrate many similarities and in many cases activate the same biological mediators (32). In the case of cell disintegration of the intestinal lining with biochemical and mechanical stress, disturbances in the gastrointestinal tract's barrier functions occur, which can lead to an increased uptake of bacterial endotoxins and other toxic contaminants. In athletes, one sees a similar increase

in the uptake of endotoxins in the intestine after strenuous exercise (33, 34). Secretion of IgA in the intestine also decreases during physical activity, which can weaken the immune system. (35).

In strenuous exercise, the uptake of endotoxins from bacteria can lead to a classic inflammatory response, with an increase in the number of white blood cells in the blood (leukocytosis) and increased levels of cytokines, such as tumour necrosis factor α (TNFα), interleukin-1 and interleukin-6 in the blood stream (36–38). It has been shown that 80 per cent of runners with endotoxins in the blood have symptoms of nausea, vomiting and diarrhoea, which can be compared to 18 per cent in the control group without endotoxins (32). An interesting observation here is that long-distance runners develop high levels of the protective blood lipid fraction HDL, which can bind endotoxins in the blood stream and thereby serve as protection (39, 40). A new study has also found that the quality of life in Crohn's disease improves if the patients engage in physical activity. Exercise can reduce the disease activity and the psychological stress of the disease. Low intensity exercise gives no deterioration of the symptom picture or activation of the disease and can, from a psychological perspective, be good for certain patient groups with inflammatory bowel disease (41).

Our knowledge thus indicates primarily a negative effect from strenuous exercise for inflammatory conditions in the gastrointestinal tract. This conclusion is based primarily on the fundamental negative metabolic consequences resulting from the combination of inflammation and exercise training. Low intensity training does not exacerbate the condition and can be beneficial from a psychological standpoint.

A special case in this context is the well-known fact that, through travelling to competitions around the world, athletes are often exposed to the risk of gastrointestinal infection. Similarly to the case of inflammatory bowel disease, this means that the body is not able to take advantage of the nutrition absolutely required during the building up phase, making top performance impossible (42).

Stitch pain

The symptom of stitch pain is usually located on the left side (compare "side stitch" or "side ache"). This condition is clearly related to exercise and occurs more often at the beginning of a training period and in intensive training. The condition has no defined cause. Usually it subsides with a successive increase in the amount of exercise and is not a reason to avoid exercise training (12).

Final remarks

Despite lacking "athletic" characteristics, the function of the gastrointestinal tract has decisive importance for how an athletic activity should be planned and carried out. Gastrointestinal tract functions at rest play a role in building up the body and thereby the optimisation of nutritional status leading up to athletic performance. This also applies in disease conditions, where rest is important for achieving the best conditions for healing

and health. Our knowledge about these relations can often be utilised to optimise nutritional conditions in disease, for example, in diabetes. In reasonable amounts, physical activity has a positive effect on many gastrointestinal tract conditions by helping to normalise physiological control.

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