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# Fecal microbiota transplantation - analysis of scientific reports, the role of a nurse

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## Abstract

Introduction and objective: Presentation of the subject of fecal microbiota transplantation including the role of a nurse.

Review methods: Presentation of the subject of fecal microbiota transplantation including the role of a nurse. Material and methods: A non-systematic review of the literature on the subject of

intestinal microflora transplantation was carried out in the available databases: PubMed, Scopus, Web of Science, Google Scholar, EBSCO, ARIANTA. The following keywords were taken into account: microbiota, fecal microbiota transplantation, Clostridium difficile, pseudomembranous enteritis, inflammatory bowel disease. 21 original and review works were qualified: 6 in Polish and 15 in English.

An abbreviated description of the state of knowledge: Fecal microbiota transplantation (FMT) involves introducing into the body of a sick recipient a fecal suspension from a healthy donor. The rate of therapeutic success depends on the main disease entity, appropriate selection of the donor of the fecal suspension. The donor should be tested for the presence of numerous pathogens, determining their type and their quality. FMT is recommended when pharmacotherapy ceases to be effective, it is also an adjunctive treatment in the treatment of many dysbiotic diseases. Summary Fecal microbiota transplantation is indicated in severe pseudomembranous enteritis in patients with Clostridium difficile infection. In the experimental phase, there are new indications for the use of FTM, for example, Parkinson's disease, Alzheimer's disease, but it is contraindicated in irritable bowel syndrome. The role of the nurse is limited to preparing the patient, assisting during the procedure, postoperative care, and educating the patient.

Key words: fecal microbiota

**Introduction:**

Fecal Microbiota Transplantation (FMT) is a medical procedure involving the introduction into the body of a sick recipient a stool suspension from a healthy donor. This method is still little known and therefore underestimated. In recent years, however, it has been gaining popularity. It is related, inter alia, to the increase in the number of cases with confirmed infection with the bacterium Clostridium difficile - the main indication for stool transplantation. It is worth emphasizing that in this indication it is no longer an experimental method, but a therapeutic procedure, reducing the risk of serious complications and death [1].

The human digestive system, and above all the lower digestive tract, is colonized by countless microorganisms: bacteria, archaea, viruses, and fungi, which together form the intestinal microbiota. The dominant species in the gut microbial population are Firmicutes (64%) and Bacteroidetes (23%). Less numerous are Proteobacteria (8%), Actinobacteria (3%), and Fusobacterium. The mass of the colonizing microorganisms in the gut is about 2.0-2.5 kg. Despite the indication of the dominant species, the composition of the intestinal microbiota is not constant - it is constantly changing, caused by the action of external and internal factors. The composition of the intestinal microbiota is influenced by pharmacotherapy, diet, pregnancy, childbirth, infections, surgical procedures within the digestive system, and even the shaping of the human body in utero [2, 3].

Pharmacotherapy hurts the disturbance of the intestinal microbiota. First of all, due to the frequent, improper use of antibiotics, contrary to the doctor's recommendations, and the use of broad-spectrum antibiotics. Antibiotic therapy used early in life contributes to the development of metabolic disorders. Moreover, the available analysis results showed that the use of even small amounts of penicillin in developmental age contributes to the reduction of Lactobacillus, Allobacullum, Rikenellaceae, and Candidatus authromitus strains [4].

FMT is an effective method of treatment and reduction of persistent symptoms for patients in many diseases, such as irritable bowel syndrome, chronic constipation, and inflammatory bowel diseases. As already mentioned, the main indication for a fecal microbiota transplant procedure is Clostridium difficile infection (CDI). Candidates for intestinal microbiota transplantation are patients with multiple relapses of CDI and a severe course of inflammatory bowel diseases, especially those related to the large intestine: colon, sigmoid colon, rectum [5].

The source of microbiological material used during the procedure will not always be an allogeneic donor - there is a validated method of autogenous intestinal microflora transplantation, making the patient both a donor and a recipient. The main goal of FMT is to restore normal, stable intestinal microflora and to alleviate the symptoms of the disease [5, 6, 7].

**Aim**

The study aims to present and introduce the subject of fecal microbiota transplantation, with particular emphasis on the role and tasks of the nurse during the FMT procedure.

**Material and methods**

A non-systematic review of the available literature on fecal transplantation published over the last five years (2016-2021) has been performed. The following databases were searched: PubMed, Scopus, Web of Science, Google Scholar, EBSCO, ARIANTA, using keywords in Polish and English: microbiota, stool transplant, intestinal microbiota transplant, Clostridium difficile, pseudomembranous colitis, inflammatory disease bowels.

21 original and review works were qualified for the analysis: 6 in Polish and 15 in English. The criteria for qualifying the articles for the review were: title, the content of the abstract, keywords, topics related to the aspects of nursing care during the implementation of the gut microbiota transplant procedure.

Results:

Preparing the patient for the fecal microflora transplant is an important element for the successful course of the procedure. The role of the nurse in this process is to obtain written consent from the patient. Then, following a written medical order, the administration of a targeted antibiotic for 3-4 days preceding the procedure [8].

Intestinal microflora transplants can proceed in two ways. The first is to perform the procedure through a gastric or duodenal tube. It is also possible to administer a fecal microbiological preparation with the use of an endoscope - a gastroduodenoscope. In the case of direct implantation of the donor's microbiome in the patient before starting the procedure, in addition to the above-mentioned antibiotic therapy, neutralizing drugs that inhibit the production of hydrochloric acid in the lumen of the stomach should be administered, from the group of proton pump inhibitors (PPIs) such as omeprazole, pantoprazole, esomeprazole, and others. The dosage is determined individually, depending on the acidity of the gastric contents tested in the pH-metric test - it is recommended to administer at least two doses by intravenous injection [8].

Another way is to transplant the stool suspension directly into the colon, using a colonoscope. In this case, the preparation of the patient consists of the administration of laxatives, preferably macrogols are preferred for 2 days before the planned procedure, according to the standard preparation for colonoscopy. In the next step, regardless of the chosen method of administration, the patient is implanted with a sample of fecal suspension (about 30 ml), which is

dissolved by adding 0.9% sodium chloride (NaCl, so-called saline) solution until the volume reaches 150-250 ml [8].

After the procedure is performed, the nurse informs the patient about the prohibition of eating meals for two hours, refraining from bowel movements for half an hour after the examination, and prohibiting exercise for two hours after the end of the procedure. The care subject should also be informed about the necessity to follow an easily digestible diet until the diarrhea is resolved. On the seventh day after surgery, stool samples are collected for microbiological testing for C. difficile. When the test result is positive (detection of the presence of the pathogen in the stool), it is recommended to repeat the described procedure after 5-7 days, following the same principles as in the case of the first intestinal microbiota transplant [8].

The available data indicate that the efficacy of FMT in Clostridium difficile infections is high. The therapeutic success rate, in the form of the elimination of the pathogen from the patient's intestinal flora, ranges from around 81-94%. It is worth noting that the effectiveness of the basic antibiotic recommended in the eradication of C. difficile infections - vancomycin, is much less, i.e. about 31%. Appropriate selection of a stool donor is a guarantee of therapeutic success. The type of fecal suspension that is taken also affects the effectiveness of intestinal microflora transplantation. The administration of a fresh suspension is recommended, it is not recommended to administer a processed or frozen suspension [7].

Before qualifying a person as a source of biological transplanted material, a series of laboratory and microbiological and genetic tests should be performed, paying particular attention to aspects related to possible intestinal pathogens, they are detected not only in stool tests but also in specific tests of peripheral blood. In the qualification of the donor, it is recommended to conduct RT PCR tests to determine the species of bacterial strains and their quality. The applied antibiotic therapy, as well as other drugs affecting the composition of the intestinal bacterial population within six months back, are also disqualifying for a potential donor. Diseases with intestinal dysbioses, such as inflammatory bowel diseases, irritable bowel syndrome, neoplasms, metabolic disorders, and active autoimmune disease are an absolute contraindication to stool collection and transplantation of the recipient [7].

The use of FMT in inflammatory bowel diseases (IBD) with dysbiosis is an alternative and still experimental therapeutic method. Current data identify two methods of stool transplantation used in these gastroenterological diseases. One of them is a frozen fecal

suspension transplant, showing relatively high therapeutic effects, increasing the chances of remission of inflammatory bowel disease with a probability of about 44.2%. It is also possible to transplant fresh microbiota. However, the effectiveness of this method is low and fluctuates around 29.1%. The second method, the most promising one, shows a high probability of remission, is the administration of intestinal microbiota in capsules dedicated to the patient (efficiency about 66.5%). According to the available studies, it can be indicated that intestinal microbiota transplantation significantly increases the patient's chances of remission [9].

The methods of transplanting the intestinal microbiota described above in the case of inflammatory bowel diseases are mainly used as a treatment method in ulcerative colitis (UC). In the most recent published meta-analysis of 11 studies (2 randomized cohort studies, 1 case-control study, 8 cohort studies) involving 133 patients with UC, the clinical remission rate with the fecal suspension formulation was 30.4%. No differences were found between patients undergoing single or double transplants. However, some of the available data suggest that performing FMT twice may increase the chance of ulcerative colitis in remission. After the intestinal microbiota transplantation procedure was performed, an increase in the diversity of bacterial strains constituting the intestinal microbiome was observed, with a simultaneous resemblance to the donor flora [10].

Tian Y. et all conducted a prospective study on 20 patients with ulcerative colitis. Each of them underwent five intra-duodenal gastroduodenoscopic administrations of the donor's stool suspension, repeated at three-week intervals. The effectiveness of the transplant was assessed using clinical indicators (diarrhea, abdominal pain, presence of stools with an admixture of pus or blood, markers of CRP inflammation) and the Mayo scale assessing the extent of mucosal changes in UC patients. Histopathological examinations of the colonoscopic samples of the colon mucosa were also carried out, objectively assessing the severity of the disease in the period before and after the treatment. The relationship between UC and the patients' gut flora was analyzed. After the treatment, the symptoms of the disease were reduced by a reduction of diarrhea, abdominal pain, and the amount of blood in the stool. The Mayo score has dropped significantly. There were also differences in the composition of the intestinal microbiome before and after the applied treatment, and also between the donor and recipient organisms [11].

One of the systematic reviews of the scientific literature qualified for the analysis assessed the use of FMT in irritable bowel syndrome (IBS). It calculates the absolute coefficients and the

relative improvement in the condition of patients after the treatment in the form of fecal microflora transplantation. It was noticed that in the stool samples of patients suffering from IBS of predominant diarrhea type (IBS-D) the quantitative representation of Lactobacillus spp is reduced, while in patients suffering from IBS with the predominant number of constipation (IBS-C) the number of the population of Veillonella spp. Strains are increased. gut microflora transplantation has been shown to reduce the symptoms of irritable bowel syndrome. The respondents of the analyzed studies indicated a reduction in the severity of the following symptoms: discomfort reduction by 19%, a reduction in the number of stools by 13%, urgency to the stool by 38%, abdominal pain by 26%, flatulence, and a feeling of a full stomach by 10%. However, the reduction of the symptoms of the disease did not occur only in patients after intestinal microflora transplantation (59.5%), but also in some respondents receiving the placebo preparation (41.4%). This fact leads to the conclusion that not only FMT contributes to the improvement of the quality of life, but also the placebo effect, which may be related to the pathomechanism of the irritable bowel syndrome and the influence of stress factors in the etiopathogenesis of the symptoms of the disease. Moreover, after conducting microbiological tests of the feces of recipients who had been transplanted using the capsule method, no change in its composition was noticed. Therefore, the authors of the meta-analysis do not recommend FTM as a treatment method in the treatment of patients with irritable bowel syndrome [12].

Studies were also conducted to assess the effectiveness of intestinal microbiota transplantation depending on the health condition and comorbidities of the recipients, mainly the metabolic syndrome (obesity, hyperglycemia with insulin resistance, dyslipidemia, arterial hypertension). Despite the improvement in the condition of patients, a short-term effect of increasing insulin sensitivity of FMT was demonstrated and no effect on other components of the metabolic syndrome. However, FMT has a positive effect on the composition of the microflora. It has been proved that in the stool of the patient after transplantation, the number of *Ruminococcus bromine* and *Roseburia intestinalis* strains increased, responsible for the degradation of fiber and the production of butyrates, positively influencing trophic and regeneration of the intestinal mucosa. They also have anti-inflammatory properties, thanks to which they reduce the number of cytokines such as IL-6, TNF-alpha, which are the main mediators in the development of insulin resistance. In a 12-week study, no reduction in BMI was demonstrated among 22 obese patients. The study emphasized that the administration of microbiota in capsule form is relatively safe. It

only leads to a reduction in the excretion of taurocholic acid in the feces, which is involved in the emulsification of fats in the duodenum - the amounts excreted were similar to the amounts excreted by the stool donor [13, 14, 15].

The possibilities of using intestinal microbiota transplantation in neurological diseases, especially neurodegenerative diseases such as Alzheimer's disease, Parkinson's disease, and multiple sclerosis, were also investigated. Maintaining the proper functions of the brain largely depends on the composition of the intestinal microflora, it is no coincidence that we refer to the "intestinal brain" composed of the Auerbach-Meissner plexus. The central nervous system (CNS) controls the vast majority of the physiological functions of the gastrointestinal tract. This indicates a dependence, a specific connection of the nervous system with the digestive system. The available research data emphasize the role of the microbiome in regulating the proper metabolism of the organism, adequate immune response, and protection against colonization with numerous pathogens [16].

Alzheimer's disease (AD) is epidemiologically the most common cause of dementia worldwide. According to available studies, an incorrect composition of the intestinal microflora affects the formation of general inflammation, including in the nervous system. The production of pro-inflammatory cytokines by enterocytes and the production of harmful metabolites by bacteria and other microorganisms increase the inflammatory reaction, especially through the diffusion of the above-mentioned substances through semi-permeable membranes, initially into the blood and further into all anatomical systems of the body, including the CNS. In the nervous system, they stimulate populations of immune cells, represented mainly by astrocytes. In one of the analyzes, the subject of which was a human subject, in the person of an eighty-two-year-old patient diagnosed with Alzheimer's disease and microbiologically confirmed active Clostridium difficile infection, a slight improvement in the mental state and cognitive functions of the patient was found two and six months after the administration of FMT treatment. . It confirms the supposition that in the future prevention of Alzheimer's disease, attention should be paid to the condition of the intestinal microbiome [17, 18].

Parkinson's disease (PD) is the second most common neurodegenerative disease. The conducted studies show that the transplantation of fecal microbiota by colonoscopy can alleviate the motor and non-motor symptoms of Parkinson's disease. A case study of a seventy-one-year-old patient who has been suffering from this disease for 7 years and who has been reporting

chronic, persistent constipation for 3 years is described. Fecal microbiota transplant was chosen as an experimental treatment method. An eligible fecal suspension donor was a 26-year-old healthy male. The transplant procedure was repeated three times on three consecutive days. One week after the surgery, the patient was assessed in terms of the severity of the symptoms of the underlying disease and constipation. There was a decrease in UPDRS (Unified Parkinson Disease Rating Scale) scores, a decrease in the severity of resting tremors in the lower limbs, and the patient also reported relaxation of constipation - the frequency of bowel movements increased and the duration of defecation decreased from the initial 30 minutes to 5 minutes. Two months after the therapy, a recurrence of the symptoms of the original severity was observed, as well as a decrease in the UPDRS score, however, the use of FMT is a potential, relatively promising form of supporting the treatment of Parkinson's disease. [19, 20].

In the studies on the transplant of the intestinal microflora in multiple sclerosis (MS) in patients with coexisting chronic diarrhea, a significant improvement in motor functions and alleviation of the severity of diarrhea was observed after the transplantation of the intestinal microflora. Currently, studies on the use of this procedure in patients suffering from multiple sclerosis are ongoing, therefore There are no high-quality studies yet [21].

The research process on the effectiveness of intestinal microflora transplantation is still being carried out dynamically. Currently, the factors influencing the therapeutic success of the fecal transplant procedure have not been identified. The reasons for the lack of response of patients to the donor stool suspension are not yet known. However, it has been proven that the selection of the right donor is important and has a great impact on the effectiveness of treatment. The characteristics of the donor influencing the qualification of transplanted biological material for transplantation may influence the differences in the data obtained in clinical trials. Unfortunately, there is no protocol or standard of conduct that would allow for the unification of the donor selection procedure, and the choice of tests for its evaluation depends only on the team carrying out the transplant [21].

Relatively little research has been done on neurological diseases, the impact of stool transplantation on the dynamics of lesions, and disease progression. However, the results obtained are relatively promising. Fecal transplantation is a procedure supporting the basic treatment of diseases such as Alzheimer's disease, Parkinson's disease or multiple sclerosis may slow down the rate of disease progression and, above all, minimize the level of symptoms

resulting from neurodegenerative processes that significantly reduce the quality of life of patients. Therefore, it is so important to continue research in the field of fecal microflora transplants.

FMT offers new possibilities of treating patients in cases of incurable chronic diseases, especially in cases where pharmacotherapy is no longer effective. It should be noted, however, that transplantation of the intestinal microbiota is not always a safe procedure. It requires enormous responsibility, knowledge, and experience from the therapeutic team that decides to apply this procedure. The risk of introducing pathogenic pathogens into the organism weakened by disease or infection to critical, life-threatening complications such as cytokine storm, septic shock, disseminated intravascular coagulation (DIC) syndrome, and consequently the death of the patient [19].

Conclusions:

1. Intestinal microflora transplantation aims to make the recipient's intestinal microflora similar to the donor's microbiota, which enables the restoration of motor functions and restoration of the balance in the digestive system in the body of the sick person.
2. The only non-experimental indication for intestinal microflora transplantation is a severe course of pseudomembranous enteritis during Clostridium difficile infection.
3. It is not recommended to transplant the intestinal microflora in patients diagnosed with irritable bowel syndrome.
4. There is ongoing research on the use of gut microflora transplantation in neurodegenerative diseases such as Alzheimer's disease, Parkinson's disease, and multiple sclerosis.
5. The research related to the transplantation of the intestinal microflora varies significantly in terms of results due to the variable of the donor. The test results depend on him and his microbiota condition, blood group, and pathogens present in his microbiota.
6. The tasks of a nurse in the procedure of intestinal microflora transplantation are limited to preparing the patient for the procedure, assisting during the endoscopic transplant, patient education, and postoperative care.

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