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The Impact of Fecal Microbiota Transplantation on the Intestinal Microecology of Patients with Colorectal Cancer

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Abstract: This study investigated the impact of fecal microbiota transplantation (FMT) on the intestinal microecology of patients with colorectal cancer. The intestinal microbiota structure of patients with colorectal cancer often undergoes significant changes, which are closely related to the occurrence and development of the disease. As a novel therapeutic approach, FMT aims to rebuild intestinal microecological balance and thereby improve clinical symptoms and prognosis of patients with colorectal cancer. This study found that FMT can effectively alter the intestinal microbiota structure of patients with colorectal cancer, increase microbial diversity, reduce intestinal inflammation, and potentially enhance the patient's immune function. However, FMT still faces challenges in clinical application, such as donor selection, ethical issues, and the stability of transplantation effects. Future research needs to further explore optimization strategies for FMT to fully realize its potential in the treatment of colorectal cancer.

Keywords: Fecal microbiota transplantation (FMT); Colorectal cancer; Intestinal microecology; Microbial diversity; Intestinal inflammation; Immune function

1. Introduction

Colorectal cancer, as a widely distributed malignant tumor globally, has increasingly attracted attention regarding its epidemiological characteristics. The high morbidity and mortality rates not only impose heavy physical and psychological burdens on patients, but also pose significant challenges to public health. Understanding the epidemiological characteristics of colorectal cancer is crucial for preventing and controlling its occurrence. Meanwhile, the association between intestinal microbiota and colorectal cancer has gained increasing attention, and the balance of intestinal microecology is considered a critical factor influencing the occurrence of colorectal cancer. Against this backdrop, fecal microbiota transplantation (FMT) technology emerged, aiming to rebuild the intestinal microecology of patients by introducing fecal microbiota from healthy individuals, providing new possibilities for the treatment of colorectal cancer. This article aims to review the epidemiological characteristics of colorectal cancer, the association between intestinal microbiota and colorectal cancer, and the application prospects of FMT technology in intestinal microecological reconstruction, in order to provide new ideas and methods for the prevention and treatment of colorectal cancer.

2. Changes in the Intestinal Microecology of Patients with Colorectal Cancer

The intestinal microecology of patients with colorectal cancer undergoes significant changes, specifically manifesting in reduced diversity and richness of the intestinal microbiota structure as well as changes in specific bacterial populations. Studies have found that the number of beneficial bacteria in the intestine of patients with colorectal cancer is significantly reduced, while the abundance of potentially harmful bacteria increases. In addition, specific bacterial populations such as Fusobacterium and Bacteroides exhibit abnormal proliferation in the intestine of patients with colorectal cancer, and these changes may be closely related to the occurrence and development of colorectal cancer. The changes in intestinal microecology not only affect the local environment of the intestine, but may also participate in the occurrence and development of colorectal cancer by influencing physiological processes such as inflammation, immune response, and metabolism.

3. Principles and Mechanisms of Fecal Microbiota Transplantation (FMT)

3.1 Basic Principles and Operational Procedures of FMT

The basic principle of FMT (fecal microbiota transplantation) is to transplant fecal microbiota from healthy individuals into patients to rebuild their imbalanced intestinal microecology. The operational procedures include: first, rigorously screening healthy donors; then, collecting, processing, and purifying the feces to ensure safety and reduce impurities; finally, transplanting the processed fecal microbiota into patients through oral administration, nasogastric tube, colonoscopy, or enema, thus improving their intestinal microecology and promoting

health. This technique provides a new strategy for the treatment of intestinal diseases.

3.2 Mechanisms of FMT in Reconstructing Intestinal Microecology

FMT plays a crucial role in reconstructing intestinal microecology. By introducing fecal microbiota from healthy donors, it helps restore the balance of intestinal microbiota in patients. This balance restoration not only inhibits the growth of harmful bacteria but also promotes the proliferation of beneficial bacteria, thus enhancing the intestinal immune function. Additionally, FMT can improve the metabolic status of patients by regulating intestinal microbiota metabolites, such as short-chain fatty acids, exerting positive effects on the energy metabolism and material metabolism of the body. These mechanisms work together to provide strong support for intestinal microecological reconstruction.

4. The Impact of FMT on the Intestinal Microecology of Patients with Colorectal Cancer

4.1 Changes in the Gut Microbiota Structure of Colorectal Cancer Patients after FMT

The application of FMT (fecal microbiota transplantation) in colorectal cancer patients has attracted widespread attention. This treatment method aims to positively influence the disease by rebuilding the patient's intestinal microecology. The following describes the changes in the gut microbiota structure of colorectal cancer patients after FMT. From the perspective of diversity, FMT can significantly increase the diversity of the intestinal microbiota of colorectal cancer patients. Diversity is one of the important indicators of the health status of the intestinal microbiota, and higher diversity usually means a more stable intestinal microecology and stronger resistance to external environments and diseases. FMT can also improve the richness of the intestinal microbiota. Richness refers to the number of different types of microorganisms in the intestine. FMT provides patients with more types of microorganisms by introducing the fecal microbiota of healthy donors. These microorganisms participate in processes such as nutrient metabolism and immune response in the intestine, contributing to restoring the normal function of the intestine. In terms of specific microbiota, the number of certain beneficial bacteria in the intestine of colorectal cancer patients will significantly increase after FMT. For example, some bacteria that can produce short-chain fatty acids are restored after FMT, and these short-chain fatty acids are crucial for intestinal health, maintaining the integrity of the intestinal barrier, promoting immune response, and inhibiting the growth of harmful bacteria. At the same time, some potentially harmful bacteria may decrease after FMT, reducing their damage to the intestine. FMT can significantly improve the structure of the intestinal microbiota of colorectal cancer patients, including increasing diversity and richness and restoring the number of specific microbiota. These changes help restore normal intestinal function and provide new ideas and methods for the treatment of colorectal cancer.

4.2 The Improvement Effect of FMT on the Intestinal Microecology of Colorectal Cancer Patients

FMT has demonstrated significant effects on improving the intestinal microecology of colorectal cancer patients. FMT helps reduce intestinal inflammation in colorectal cancer patients. Inflammation is one of the important factors in the occurrence and development of colorectal cancer, and FMT can adjust the flora structure in the patient's intestine by introducing the fecal microbiota of healthy donors, reducing the number of harmful bacteria and increasing the abundance of beneficial bacteria, thus reducing intestinal inflammation. This improvement not only helps alleviate patients' symptoms but also creates a more favorable environment for the treatment of colorectal cancer. FMT can enhance the immune function of colorectal cancer patients. There is a close relationship between the intestinal microbiota and the immune system. FMT can promote the activation and proliferation of immune cells and improve the immune response ability of the body by improving the intestinal microecology. This enhanced immune function helps inhibit the growth and spread of tumor cells, thus improving the prognosis of patients.

FMT can also restore the metabolism of colorectal cancer patients to normal. The intestinal microbiota plays an important role in the metabolism of nutrients, and FMT can restore the normal metabolic process in the patient's intestine by introducing the fecal microbiota of healthy donors. This helps improve the patient's nutritional status, enhances their quality of life, and may provide support for the patient to receive other treatments. It is worth noting that the improvement effect of FMT on the intestinal microecology of colorectal cancer patients is not achieved overnight and requires a certain period of time and continuous treatment. At the same time, the therapeutic effect of FMT is also affected by various factors, such as donor selection, fecal processing methods, and transplantation methods. In FMT treatment, it is necessary to comprehensively consider the patient's specific situation and treatment plan to achieve the best therapeutic effect. The improvement effect of FMT on the intestinal microecology of colorectal cancer patients is multifaceted, including reducing inflammation, enhancing immune function, and restoring normal metabolism. This treatment method provides new treatment options for colorectal cancer patients and is expected to bring better prognosis and quality of life to patients.

5. Conclusion and Prospect

With the deepening of research on intestinal microecology, FMT technology has shown significant effects on the intestinal microecology of colorectal cancer patients and potential value in the treatment of colorectal cancer. By introducing the fecal microbiota of healthy donors,

FMT can rebuild the imbalanced intestinal microecology of patients, thus reducing intestinal inflammation, enhancing immune function, and helping restore normal metabolism. These changes not only bring relief to patients' symptoms but also provide new ideas and methods for the treatment of colorectal cancer. Looking forward, FMT technology has broad development prospects in the treatment of colorectal cancer and other intestinal diseases. With the continuous maturity of technology and in-depth research, FMT is expected to become an important means of intestinal disease treatment. At the same time, with the further understanding of the relationship between intestinal microecology and human health, FMT technology may also play an important role in the treatment of other diseases, such as metabolic diseases like obesity and diabetes, as well as neuropsychiatric diseases. As an important component of human health, the role of intestinal microecology

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