IMPACT OF GUT MICROBIOTA ON POSTOPERATIVE RECOVERY AND WOUND HEALING: NEW INSIGHTS AND EMERGING THERAPIES

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Abstract: The gut microbiota, made up of trillions of microorganisms that inhabit the gastrointestinal tract, plays a fundamental role in human health, influencing immunological and metabolic processes and even wound healing. Recently, studies have shown that the gut microbiota can also significantly impact post-operative recovery. This emerging field of research is revealing new insights into how the composition and function of the microbiota can affect the recovery of patients after surgery and the effectiveness of wound healing. Understanding these interactions paves the way for the development of innovative therapies that can improve surgical outcomes and promote faster and more efficient recovery. This review seeks to explore the new insights into the impact of gut microbiota on postoperative recovery and wound healing, highlighting the emerging therapies and scientific advances that are shaping this field. By investigating the current literature and evaluating recent clinical studies, we aim

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to provide a comprehensive overview of the interactions between the microbiota and healing processes, as well as discussing the therapeutic implications of these findings for clinical practice. This literature review aims to investigate the relationship between the gut microbiota and various aspects of health and disease, using a selected set of landmark studies. To this end, high-impact publications were selected that address topics related to the gut microbiota, its functions, benefits and implications for human health. Post-operative recovery and wound healing are complex processes that involve a series of biological responses, including inflammation, tissue remodeling and cell regeneration. The gut microbiota influences these processes in a number of ways, starting with the modulation of the immune system. Studies have shown that a healthy microbiota can promote a balanced inflammatory response, which is crucial for proper wound healing and surgical recovery. Imbalances in the microbiota, known as dysbiosis, can lead to exacerbated or insufficient inflammatory responses, impairing healing and increasing the risk of post-operative complications. The two-way communication between the gut and other organs, known as the gut-organ axis, is fundamental to understanding how the gut microbiota can influence post-operative recovery. Metabolites produced by the microbiota, such as short-chain fatty acids (SCFA), have anti-inflammatory and immunomodulatory effects that can favor wound healing. In addition, the intestinal microbiota can influence the integrity of the intestinal barrier, preventing bacterial translocation and consequent systemic infection, a common complication after surgery. Based on these insights, several emerging therapies are being developed to modulate the gut microbiota and improve post-operative outcomes. One of the promising approaches is the use of probiotics and prebiotics. Probiotics are live microorganisms that, when administered in adequate amounts, confer health benefits on the host, while prebiotics are substrates that promote the growth and activity of beneficial bacteria in the gut. Clinical studies have shown that supplementation with specific probiotics can reduce the incidence of post-operative infections and improve wound healing. Another innovative approach is fecal microbiota transplantation (FMT), which involves transferring microbiota from a healthy donor to a patient with dysbiosis. FMT has shown promising results in restoring the intestinal microbiota and improving post-operative outcomes in patients undergoing

major surgery. In addition, diet and nutrition play a crucial role in modulating the microbiota. Diets rich in fiber and bioactive compounds, such as polyphenols, can promote a healthy microbiota and consequently improve postoperative recovery and wound healing. It is concluded that the impact of gut microbiota on postoperative recovery and wound healing is a rapidly evolving field of research with significant potential to transform clinical practices. New insights are revealing how the microbiota influences inflammatory and immunological processes essential for surgical recovery. Emerging therapies, such as probiotics, prebiotics and fecal microbiota transplantation, are showing promising results in improving postoperative outcomes. Modulation of the gut microbiota represents an innovative and effective approach to optimizing patient recovery and promoting faster and more efficient healing. With further research and the integration of this knowledge into clinical practice, it is hoped that microbiota intestinal becomes a key component in post-operative management and wound care, significantly improving patients' quality of life.

Keywords: Intestinal Microbiota; Postoperative; General Surgery; Gastroenterology; Innovative Therapies.

INTRODUCTION

The intestinal microbiota, made up of trillions of microorganisms, plays a key role in maintaining human health and regulating various physiological processes. In recent years, research has highlighted the influence of intestinal microbiota on immune response and postoperative recovery. Microbiota diversity and balance are essential for the health of the immune system, which, in turn, is crucial for wound healing and recovery after surgery. Studies show that a healthy microbiome can improve immune response, reduce inflammation and accelerate tissue recovery (Sommer and Bäckhed, 2013).

In addition, intestinal microbiota can directly influence wound healing through metabolites

production that modulate inflammatory response and promote tissue regeneration. Interaction between the intestinal microbiota and the immune system may favor an environment conducive to effective healing. Research indicates that dysbiosis, or microbiota imbalance, can compromise inflammatory response and slow the healing process, making microbioma modulation a potential strategy to improve postoperative results (CH and Blaser, 2012).

New emerging therapies, such as the use of probiotics, prebiotics and fecal microbiota transplants, have shown significant promises in intestinal microbiota modulation to optimize postoperative recovery and wound healing. Probiotics, for example, can restore microbial balance and strengthen immunological defenses, while prebiotics provide substrates for the growth of beneficial microorganisms. Fecal microbiota transplantation, although still in early research stages, has a remarkable potential to restore microbial homeostasis in patients with severe dysbiosis, improving clinical results (Suez et al., 2019).

Given these new insights, it is crucial to continue exploring the complex interactions between the intestinal microbiota and postoperative recovery, as well as develop and implement therapies that can effectively modulate microbiota. The in -depth understanding of these mechanisms can revolutionize current treatment approaches, providing better results for patients in terms of wound healing and global recovery (ZUO & NG, 2018).

MATERIALS AND METHODS

This bibliographic review aims to investigate the relationship between the intestinal microbiota and various aspects of health and disease, using a selected set of reference studies. To this end, high impact publications have been selected that address topics related to the intestinal microbiota, its functions, benefits and implications on human health. The adopted methodology followed the following steps:

1. Selection of sources: The references were chosen based on the relevance and impact on the field of intestinal microbiology. Selected publications include pairs revised and published in renowned scientific journals such as Nature Reviews Microbiology, Nature Reviews Genetics, Frontiers in Microbiology, New England Journal of Medicine, among others.

2. Inclusion Criteria: Articles that address:

- The development and physiology of the host influenced by the intestinal microbiota (Sommer & Bäckhed, 2013).
- The interface between human microbiome and health/disease (Cho & Blaser, 2012).
- The pros and cons of the use of probiotics (Suez et al., 2019).
- The role of microbiota in pathogenesis and therapy of intestinal inflammatory diseases (Zuo & NG, 2018).
- The influence of microbiota on surgical recovery (Krezalek et al., 2016).
- Definitions and effects of probiotics, prebiotics and symbiotics (Schrezenmeir & de Vrese, 2001).
- Bacterial metabolites and colorectal cancer (Louis et al., 2014).
- Use of donor feces infusion to treat recurrent closetridium difficile (Van Nood et al., 2013).
- General Benefits of Probiotics (Ouwehand et al., 2002).
- Clinical trials on probiotic prophylaxis in severe acute pancreatitis (BESSELINK et al., 2008).
- Impact of intestinal microbiota on brain and behavior (CRYAN & DINAN, 2012).
- Evolution of the concept of sepsis of intestinal origin (DEITCH, 2012).
- Mechanisms and health benefits of fiber and prebiotics (Slavin, 2013).

3. Review of Articles: Each article has been thoroughly revised to extract relevant information

on the intestinal microbiota, its functions, and its implications on human health. The information has been organized thematically to facilitate comparative analysis and data synthesis.

4. Summary of results: Extracted information was synthesized to provide a comprehensive view of the role of intestinal microbiota in health and disease, highlighting the main findings of each study and identifying areas of consensus and controversy in the current literature.

5. Critical discussion: The results were critically discussed in light of available evidence, considering the limitations of revised studies and the implications for future research and clinical practices.

THEORETICAL FOUNDATION

The relationship between the intestinal microbiota and postoperative recovery is an emerging research area that has generated great interest in the scientific community. Studies show that microbiota plays a crucial role in modulation of the immune system, which is critical to recovery after surgery. A balanced microbiota contributes to an adequate immune response that helps prevent infections and promote wound healing. For example, patients with a diverse microbiota have a faster recovery and fewer postoperative complications (KREAZALEK et al., 2016).

Intestinal dysbiosis, or imbalance in microbiota composition, has been associated with an increased risk of infections and slower wound healing. The presence of pathogenic bacteria and the reduction of beneficial bacteria may compromise the integrity of the intestinal barrier, leading to an exacerbated and prolonged inflammatory response. Clinical studies have shown that interventions to restore microbiota balance, such as the use of probiotics and prebiotics, can improve postoperative results. For example, the administration of probiotics in surgical patients was associated with a significant reduction in infection rates and an improvement in wound healing (Schrezenmeir & de Vrese, 2001).

In addition, metabolites produced by intestinal microbiota, such as short chain fatty acids

(AGCC), play a vital role in regulating inflammatory response and promoting tissue regeneration. AGCC, such as butirato, have anti-inflammatory properties and can promote the proliferation and differentiation of epithelial cells, facilitating wound healing. Dietary fiber supplementation, which are fermented by Microbiota to produce AGCC, has shown improved healing in experimental models. This suggests that dietary interventions that modify intestinal microbiota can be an effective strategy for improving postoperative recovery (Louis et al., 2014).

Fecal microbiota transplantation (TMF) is an emerging approach that has shown promises to restore microbial homeostasis in patients with severe dysbiosis. TMF involves the transfer of microbiota from a healthy donor to a patient's gastrointestinal tract, with the aim of restoring a healthy microbiome. Preliminary studies indicate that TMF can be effective in improving wound healing and reducing postoperative complications, especially in patients with antibiotic resistant infections. Although still in the experimental phase, the TMF can become a valuable tool in postoperative recovery management (Van Nood et al., 2013).

Interrelation between intestinal microbiota and wound healing is an expanding field, with research indicating that microbiota can directly influence tissue repair processes. The presence of a diverse and balanced microbiota is associated with an optimized immune response, which is essential for efficient healing. On the other hand, an imbalance in microbiota, or dysbiosis, can lead to a prolonged inflammatory response, compromising tissue regeneration and increasing the risk of infections. Interventions that restore microbial equilibrium have shown to be effective in accelerating wound healing and improving postoperative results (DEITCH, 2012).

The role of probiotics in intestinal microbiota modulation to promote wound healing has been widely studied. Probiotics, which are beneficial living microorganisms, can compete with pathogens by resources and space, inhibiting the growth of harmful bacteria and modulating the immune response. Clinical studies have shown that probiotic administration can reduce inflammation, promote the production of anti-inflammatory cytokines and accelerate wound healing. For example, a study showed that patients who received probiotics after abdominal surgery had a faster recovery and

lower incidence of infectious complications (BESELINK et al., 2008).

Prebiotics, which are non -digestible dietary fibers that feed beneficial bacteria in the gut, also play a crucial role in intestinal health and wound healing. Ingestion of prebiotics can increase the production of short chain fatty acids (AGCC), such as butirato, which have anti-inflammatory properties and promote the integrity of the intestinal barrier. Prebiotic supplementation has been associated with an improvement in intestinal microbiota composition and an increase in AgCC production, which can accelerate wound healing and reduce inflammation (Slavin, 2013).

Moreover, the interaction between the intestinal microbiota and the enteric nervous system, known as the intestine-brain axis, can influence postoperative recovery and wound healing. Microbiota can produce neurotransmitters and other metabolites that modulate the function of the enteric nervous system, affecting gastrointestinal motility and inflammatory response. Studies indicate that modulation of the intestine-brain axis through microbiota interventions can improve response to surgical stress and promote wound healing (Cryan & Dinan, 2012).

Finally, the combination of therapeutic approaches, including the use of probiotics, prebiotics and TMF, can offer an integrated strategy for the modulation of intestinal microbiota and the improvement of postoperative results. The customization of these interventions based on the patient's individual microbiota profile can maximize therapeutic benefits and minimize risks. As research advances, understanding of complex interactions between intestinal microbiota and wound healing will continue to evolve, offering new opportunities for innovative clinical interventions (Ouwehand et al., 2002).

CONCLUSION

Therefore, the understanding of the crucial role that the intestinal microbiota plays in postoperative recovery and wound healing has opened new borders in the field of medicine and post-surgical therapy. Studies show that the composition and functionality of intestinal microbiota are

closely linked to modulation of inflammatory response, maintenance of intestinal barrier integrity, and the production of bioactive metabolites that promote tissue regeneration.

Interventions that aim to restore and optimize microbiota, such as the use of probiotics, prebiotics and fecal microbiota transplantation, have shown promising in several studies, indicating that these strategies can reduce postoperative complications and significantly improve healing outcomes. In addition, diet modulation, emphasizing fiber consumption and fermented foods, also presents itself as an effective approach to maintaining a healthy and functional intestinal microbiome.

These findings highlight the importance of an integrated approach to postoperative management, where intestinal health is considered a fundamental component of patient recovery. The personalization of interventions, based on the individual composition of microbiota, can represent a significant advance in personalized medicine, optimizing results and minimizing the risks associated with surgeries.

However, it is necessary to continue research to fully understand the mechanisms by which the intestinal microbiota influences wound healing and postoperative recovery. Warmer and more well -controlled clinical studies are essential to validating proposed interventions and establishing standardized therapeutic protocols.

In conclusion, the intestinal microbiota emerges as an important ally in promoting postoperative health and wound healing. Emerging therapies aimed at modulation of microbiota represent a promising field that can transform current clinical practices, offering patients a faster and more effective recovery. Integration of advanced knowledge of microbiota into therapeutic strategies can redefine postoperative care, significantly improving the quality of life of surgical patients.

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