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Rectal adenocarcinoma: clinical evaluation and treatment through robotic surgery

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LITERATURE REVIEW

RESUMO

O adenocarcinoma retal é uma neoplasia maligna que se desenvolve nas células glandulares do reto. Sua avaliação clínica e tratamento têm sido objetos de considerável interesse, especialmente com o avanço da cirurgia robótica. A introdução do robô na cirurgia colo-retal proporcionou vantagens significativas, como melhor visualização, precisão e controle dos movimentos, resultando em potenciais benefícios para os pacientes. No entanto, a literatura sobre a eficácia e os resultados da cirurgia robótica no tratamento do adenocarcinoma retal é vasta e variada. Objetivo: examinar e sintetizar as evidências disponíveis sobre a avaliação clínica e o tratamento do adenocarcinoma retal por meio da cirurgia robótica, com foco nos últimos 10 anos. Metodologia: A metodologia seguiu as diretrizes do checklist PRISMA. Utilizamos as bases de dados PubMed, Scielo e Web of Science para identificar artigos relevantes publicados nos últimos 10 anos. Os descritores utilizados foram "adenocarcinoma retal", "cirurgia robótica", "avaliação clínica", "tratamento" e "resultados". Os critérios de inclusão foram estudos que avaliaram a cirurgia robótica no tratamento do adenocarcinoma retal, publicados em inglês ou português. Os critérios de exclusão foram estudos não relacionados ao tema, estudos sem acesso ao texto completo e estudos com dados duplicados. Resultados: Os resultados revelaram uma tendência crescente no uso da cirurgia robótica para o tratamento do adenocarcinoma retal. Os principais tópicos abordados incluíram resultados oncológicos, complicações pós-operatórias, qualidade de vida pós-tratamento e comparações com outras abordagens cirúrgicas. Conclusão: A revisão destaca a crescente evidência em apoio à eficácia e segurança da cirurgia robótica no tratamento do adenocarcinoma retal. No entanto, são necessários estudos adicionais para uma compreensão mais aprofundada de sua utilidade clínica e seu impacto a longo prazo nos resultados dos pacientes.

Palavras-chave: "adenocarcinoma retal", "cirurgia robótica", "avaliação clínica", "tratamento" e "resultados".

ABSTRACT

Rectal adenocarcinoma is a malignant neoplasm that develops in the glandular cells of the rectum. Its clinical evaluation and treatment have been objects of considerable interest, especially with the advancement of robotic surgery. The introduction of the robot in colorectal surgery has provided significant advantages, such as better visualization, precision and control of movements, resulting in potential benefits for patients. However, the literature on the effectiveness and outcomes of robotic surgery in the treatment of rectal adenocarcinoma is vast and varied. Objective: to examine and synthesize the available evidence on the clinical assessment and treatment of rectal adenocarcinoma using robotic surgery, focusing on the last 10 years. Methodology: The methodology followed the PRISMA checklist guidelines. We used the PubMed, Scielo and Web of Science databases to identify relevant articles published in the last 10 years. The descriptors used were "rectal adenocarcinoma", "robotic surgery", "clinical evaluation", "treatment" and "results". The inclusion criteria were studies that evaluated robotic surgery in the treatment of rectal adenocarcinoma, published in English or Portuguese. The exclusion criteria were studies unrelated to the topic, studies without access to the full text and studies with duplicate data. Results: The results revealed an increasing trend in the use of robotic surgery for the treatment of rectal adenocarcinoma. Key topics covered included oncological outcomes, postoperative complications, post-treatment quality of life, and comparisons with other surgical approaches. Conclusion: The review highlights the growing evidence supporting the efficacy and safety of robotic surgery in the treatment of rectal adenocarcinoma. However, additional studies are needed to further understand its clinical utility and its long-term impact on patient outcomes.

Keywords: "rectal adenocarcinoma", "robotic surgery", "clinical evaluation", "treatment" and "results".

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INTRODUCTION

Rectal adenocarcinoma represents a significant concern in the field of oncology due to its increasing incidence and the challenges associated with its treatment. Given this, robotic surgery emerges as a promising therapeutic approach to address this condition. Robotic surgery, initially developed to overcome some limitations of laparoscopic surgery, has been increasingly used in the management of rectal adenocarcinoma, offering improved precision and dexterity to the surgeon. Using a robotic platform, the surgical procedure becomes more controlled and less invasive, allowing for more delicate tissue manipulation, especially in difficult-to-access areas such as the rectum.

Furthermore, the adoption of robotic surgery in the treatment of rectal adenocarcinoma raises interest in the medical community due to its potential impacts on oncological outcomes. Recent studies have been dedicated to evaluating the effectiveness of this approach in terms of long-term results, including survival rates, disease control and incidence of tumor recurrence. The precision and three-dimensional vision offered by robotic surgery can contribute to more precise resection margins and a lower rate of intraoperative complications, crucial factors in determining the prognosis of patients with rectal adenocarcinoma.

Thus, the increasing adoption of robotic surgery and the renewed interest in exploring its oncological outcomes provide a solid basis for the investigation and continued development of this therapeutic modality in the context of rectal adenocarcinoma.

Treatment of rectal adenocarcinoma is not only limited to oncological efficacy and surgical precision, but also to patients' postoperative quality of life. In this sense, recent investigations have focused on postoperative complications associated with robotic surgery, aiming to better understand the challenges and limitations of this approach. Complications such as bleeding, fistulas or intestinal dysfunction can significantly impact the recovery and quality of life of patients after the surgical procedure, and it is therefore of clinical interest to assess their incidence and severity.

At the same time, the quality of life of patients after treatment for rectal adenocarcinoma is a fundamental aspect to be considered. Studies have explored the physical, emotional and social effects of robotic surgery in this context, comparing them with other therapeutic modalities. Issues such as sexual function, fecal continence and

return to daily activities are important aspects to be evaluated to determine the overall impact of robotic surgery on patients' quality of life.

Furthermore, the comparison between robotic surgery and other surgical approaches for the treatment of rectal adenocarcinoma has been the subject of interest in the literature. Comparative studies investigate not only oncological results, but also aspects such as recovery time, hospital stay and cost-effectiveness of different treatment modalities. This comparative analysis is crucial to guide clinical decision making and to identify best practices in the management of rectal adenocarcinoma.

Thus, the comprehensive evaluation of robotic surgery in the context of rectal adenocarcinoma goes beyond efficacy and oncological outcomes, also addressing postoperative complications, post-treatment quality of life and comparison with other surgical approaches. This holistic approach is essential to provide valuable insights into the clinical utility and overall impact of this therapeutic modality.

The aim of this systematic literature review is to thoroughly examine the most recent studies published in the last 10 years on the application of robotic surgery in the context of the treatment of rectal adenocarcinoma. We aim to evaluate and synthesize the available evidence related to the effectiveness of robotic surgery in terms of oncological outcomes, postoperative complications and quality of life of patients post-treatment. Furthermore, we sought to compare robotic surgery with other therapeutic modalities, such as laparoscopic surgery and the conventional approach, in order to identify possible advantages and disadvantages of each technique. This systematic review aims to provide a comprehensive and up-to-date analysis of the state of the art of robotic surgery in the treatment of rectal adenocarcinoma, contributing to clinical decision-making and the continued advancement of medical practice in this area.

METHODOLOGY

The methodology adopted in this systematic review followed the guidelines of the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist. To search for relevant articles, the PubMed, Scielo and Web of Science databases were used. The descriptors used were "rectal adenocarcinoma", "robotic surgery", "clinical evaluation", "treatment" and "results". For inclusion in this systematic review, studies published in the last 10 years that investigated the use of robotic surgery in the treatment of rectal adenocarcinoma. Only studies available in full text and written

in English or Portuguese were included. Furthermore, studies that presented relevant data on oncological results, postoperative complications or patients' quality of life were considered.

For exclusion, studies that did not specifically address the treatment of rectal adenocarcinoma or did not use robotic surgery as a therapeutic modality were discarded. Studies with small sample sizes, isolated case reports or those that were not available in full text were excluded. Furthermore, duplicate studies or those that presented redundant data were eliminated.

RESULTS

15 articles were selected. Robotic surgery represents a significant advance in the therapeutic approach to rectal adenocarcinoma. Currently, robotic systems offer a sophisticated technological platform that allows surgeons to perform procedures with greater precision and dexterity. With the use of robotic arms and an intuitive control interface, surgeons can execute complex movements with millimeter precision, enabling delicate manipulation of rectal tissues. Furthermore, the three-dimensional vision provided by robotic systems offers better visualization of the surgical field, allowing for a more precise identification of anatomical structures and a more complete resection of the tumor.

These advances in robotic surgery have revolutionized the treatment of rectal adenocarcinoma, providing a less invasive and more precise alternative compared to traditional techniques. With the continuous evolution of technology, new functionalities are being incorporated into robotic systems, such as the integration of magnetic resonance images and computed tomography during the surgical procedure, which helps guide and plan the surgery. These technological innovations are further expanding the possibilities of robotic surgery in the treatment of rectal adenocarcinoma, providing better results for patients and promoting faster and less painful recovery.

The effectiveness of robotic surgery in the treatment of rectal adenocarcinoma is a topic of considerable interest in the medical community. Recent studies have investigated the oncological results of this approach, evaluating the rate of complete tumor resection, the incidence of compromised surgical margins and long-term survival rates. The results of these studies indicate that robotic surgery is capable of achieving

results comparable to those of traditional techniques in terms of local disease control and overall patient survival.

Furthermore, robotic surgery offers some additional advantages that can positively influence oncological outcomes, such as the ability to perform more precise dissections and better preserve surrounding tissues. The millimetric precision of the movements performed by the robotic arms minimizes the risk of injury to adjacent structures, which can be especially relevant in surgeries involving the rectum, an anatomically complex region that is difficult to access. Therefore, robotic surgery emerges as a viable and effective option in the treatment of rectal adenocarcinoma, offering comparable and potentially superior oncological results to conventional techniques.

Despite technological advances and improvements in surgical technique, robotic surgery for the treatment of rectal adenocarcinoma is not free from postoperative complications. It is essential to understand and evaluate these complications to ensure an appropriate approach to the postoperative management of patients. Among the most common complications are bleeding, fistulas and intestinal dysfunction. Bleeding can occur due to tissue manipulation during the surgical procedure, and adequate control is essential to avoid additional complications and ensure the patient's hemodynamic stability. Fistulas, in turn, represent an abnormal communication between the rectum and other adjacent structures, such as the bladder or vagina, and can result in infections and abscesses. Intestinal dysfunction can manifest itself as persistent diarrhea, constipation or fecal incontinence, significantly affecting the patient's quality of life after surgery.

The analysis and management of postoperative complications are an integral part of the perioperative care of patients undergoing robotic surgery for the treatment of rectal adenocarcinoma. Early identification and adequate treatment of these complications are essential to minimize the negative impact on patients' recovery and quality of life. Furthermore, preventive strategies, such as optimizing surgical technique, appropriate patient selection and adopting specific perioperative measures, can help reduce the incidence and severity of postoperative complications, thus ensuring better clinical and functional results.

Assessment of patients' quality of life after robotic surgery for the treatment of rectal adenocarcinoma is a fundamental aspect to be considered when evaluating the effectiveness and global impact of this therapeutic approach. Patients' quality of life can be influenced by a variety of factors, including physical, emotional and social aspects. In the context of rectal adenocarcinoma, changes in intestinal function, sexual dysfunction,

body concerns and social stigma can significantly affect patients' quality of life after surgery.

Studies have shown that robotic surgery can offer significant benefits in terms of quality of life compared to conventional surgical techniques. The precision and delicacy of movements performed by robotic arms can result in lower rates of intestinal dysfunction and postoperative fecal incontinence, thus providing an improvement in patients' quality of life. Furthermore, the faster recovery and less postoperative pain associated with robotic surgery may contribute to faster reintegration into daily activities and better psychosocial adaptation of patients over time. Therefore, assessing patients' quality of life after robotic surgery is essential to understand the true benefits of this therapeutic approach and to guide clinical decision-making in the management of rectal adenocarcinoma.

The comparison between robotic surgery and other surgical techniques, such as conventional laparoscopy and the open approach, is an object of interest in current medical literature. This comparative analysis aims to identify the advantages and disadvantages of each therapeutic modality, providing relevant data to guide the choice of the best approach for the treatment of rectal adenocarcinoma. Compared to laparoscopic surgery, robotic surgery offers some potential advantages, such as greater precision in movements and better three-dimensional visualization of the surgical field. This can result in more precise tumor resection and a lower incidence of postoperative complications, such as bleeding and damage to adjacent tissues. Additionally, robotic surgery can be more easily performed on patients with complex anatomy or obesity due to its greater flexibility and reach of surgical instruments.

However, it is important to also consider the limitations and challenges associated with robotic surgery, including the higher cost of the procedure and the learning curve required to master the technique. Compared to the open approach, both laparoscopic surgery and robotic surgery are generally associated with faster recovery, shorter hospital stays, and less postoperative pain. However, the choice between these surgical techniques must take into account the specific characteristics of each patient, such as age, comorbidities and tumor stage, as well as the surgeon's experience and skill. Therefore, comparison between robotic surgery and other surgical techniques is essential to provide valuable insights into the best therapeutic approach for the treatment of rectal adenocarcinoma, taking into account not only clinical results but also economic and operational aspects.

Analysis of the costs associated with robotic surgery for the treatment of rectal adenocarcinoma is an important aspect to be considered in clinical decision making. Although robotic surgery can offer advantages in terms of precision and postoperative recovery, its initial cost is generally higher compared to other surgical techniques such as conventional laparoscopy or the open approach. This is mainly due to the investment required in purchasing and maintaining robotic equipment, as well as the costs associated with training surgeons and medical staff. However, it is important to also consider the potential long-term benefits of robotic surgery, such as lower rates of postoperative complications and faster recovery, which may result in additional savings in terms of hospital costs and follow-up care.

In addition to the direct costs of robotic surgery, it is also crucial to evaluate patients' access to this therapeutic modality. Not all hospitals and medical centers have access to robotic systems due to their high initial cost and the need for specialized training. This may limit the availability of robotic surgery to certain populations, especially in rural or low-income areas. Therefore, it is important to consider strategies to increase access to robotic surgery, such as collaboration between medical institutions, sharing resources, and developing training and capacity-building programs for surgeons in regions with limited access to this technology.

Adequate training of surgeons is a fundamental aspect to ensure the safety and effectiveness of robotic surgery in the treatment of rectal adenocarcinoma. Due to the complexity of the robotic system and the need for specific technical skills, an extensive training period is required for surgeons to acquire proficiency in using robotic technology. This includes not only mastering the technical skills required to operate the robotic console, but also understanding the basic principles of robotic surgery and the ability to make appropriate clinical decisions during the surgical procedure.

It is important to note that the learning curve for robotic surgery can be steep, especially for surgeons with little or no prior experience with minimally invasive techniques. However, with proper training and supervision from experienced surgeons, most surgeons can acquire the skills necessary to perform robotic procedures safely and effectively. In addition to initial training, it is also important to maintain continuing education and participate in retraining programs to ensure that surgeons remain up to date with the latest techniques and advances in robotic surgery. Therefore, investment in the training and professional development of surgeons is crucial to maximize the benefits of robotic surgery in the treatment of rectal adenocarcinoma and ensure positive clinical results for patients.

Technological innovations have played a crucial role in the continued evolution of robotic surgery in the treatment of rectal adenocarcinoma. Currently, new technologies and techniques are being developed to further improve the precision and effectiveness of robotic procedures. One of these innovations is the integration of magnetic resonance imaging and computed tomography during the surgical procedure, allowing better visualization and guidance for the surgeon during tumor resection. Furthermore, more compact and versatile robotic systems are being developed, which can be easily adapted to different types of surgery and patient anatomy.

Another area of technological innovation in robotic surgery is the development of more advanced and sophisticated surgical instruments. These instruments can offer greater precision and dexterity to surgeons, allowing for more delicate tissue manipulation and more complete tumor resection. Additionally, new augmented and virtual reality techniques are being explored, which can assist surgeons in navigating and planning the surgical procedure. With these constantly evolving technological innovations, robotic surgery is expected to continue to play a key role in the treatment of rectal adenocarcinoma, offering increasingly better outcomes for patients.

Personalizing treatment based on individual patient and tumor characteristics is a growing trend in oncology, and this also applies to the treatment of rectal adenocarcinoma through robotic surgery. Each patient is unique, with different risk factors, comorbidities and preferences, and it is important to take these aspects into account when planning treatment. Furthermore, the characteristics of the tumor itself, such as size, location and degree of aggressiveness, can influence the choice of the most appropriate surgical approach.

Customizing treatment also involves selecting the most appropriate surgical technique based on the surgeon's skills and experience, as well as the resources available at the medical center. For some patients, robotic surgery may be the best option due to its advantages in terms of precision and postoperative recovery, while for others, conventional surgical techniques may be more appropriate. Therefore, personalization of treatment is essential to ensure that each patient receives the most appropriate and effective care for their specific case of rectal adenocarcinoma, resulting in better clinical outcomes and quality of life.

The future prospects of robotic surgery in the treatment of rectal adenocarcinoma are promising, with continuous technological advances and developments in the area. It is expected that robotic technology will continue to evolve, becoming more accessible and versatile, which will enable greater adoption of robotic surgery in different clinical

settings. Additionally, new surgical techniques and approaches are being explored, such as artificial intelligence-assisted surgery and fully robotic surgery, which may offer additional benefits in terms of precision and safety.

In the field of personalized medicine, robotic surgery is expected to play an increasingly important role in adapting treatment to the individual characteristics of each patient and tumor. This includes identifying predictive biomarkers of treatment response and optimizing therapeutic strategies based on this information. Furthermore, integration of robotic surgery with other therapeutic modalities, such as neoadjuvant and adjuvant therapy, may lead to more effective and personalized multimodal approaches for the treatment of rectal adenocarcinoma. Overall, the future prospects for robotic surgery in this context are exciting, with the potential to further improve clinical outcomes and quality of life for patients.

CONCLUSION

Robotic surgery in the treatment of rectal adenocarcinoma represented a significant advance in clinical practice, offering precision, dexterity and potential benefits in terms of oncological outcomes and patients' quality of life. Recent studies have highlighted the effectiveness of robotic surgery in tumor resection and reducing postoperative complications, contributing to a faster and less painful recovery. Furthermore, robotic technology has allowed greater personalization of treatment, taking into account the individual characteristics of each patient and tumor.

Comparison with other surgical techniques, such as conventional laparoscopy and the open approach, revealed potential advantages of robotic surgery in terms of precision and postoperative recovery. However, it is important to consider the costs associated with robotic surgery and ensure equitable access to this therapeutic modality. The future perspectives of robotic surgery in the treatment of rectal adenocarcinoma are promising, with continuous technological advances and developments in the area, aiming to further improve clinical results and patients' quality of life. In summary, robotic surgery emerges as a valuable and effective therapeutic option in the management of rectal adenocarcinoma, providing tangible benefits to patients and medical practice.

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