

## ADVANCES AND CHALLENGES IN THE RESULTS AND COMPLICATIONS OF ROBOTIC SURGERY IN RENAL SURGERY: AN INTEGRATIVE REVIEW

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**Abstract:** Robotic surgery has gained prominence in the area of urology, particularly in renal surgery. In this study, we carried out an integrative review to evaluate the results and complications of the use of robotics in renal surgeries, based on a selection of articles published between 2010 and 2023. We used an integrative review approach, including searching the PubMed and Scopus, with descriptors related to robotic kidney surgery, resulting in a selection of 10 articles. These studies were analyzed regarding their results, complications and methods used. The studies included in this review demonstrated that robotic kidney surgery has been shown to be an effective and safe technique for treating complex kidney tumors, regardless of size. Analysis of complications revealed that the incidence of perioperative complications, such as excessive bleeding and injury to adjacent organs, was generally low. Furthermore, oncological results, such as negative surgical margins, were consistently satisfactory. Based on the integrative review of selected studies, we concluded that robotic renal surgery is a viable and safe approach for the treatment of renal tumors, including complex cases. The favorable results and low complication rates suggest that this technique may be a valuable option for patients with surgical indications. However, additional studies are needed to evaluate long-term oncological and functional outcomes.

**Keywords:** robotic surgical procedures, intraoperative complications, nephrectomy, renal neoplasms, evaluation of health care outcomes.

## INTRODUCTION

Kidney surgery, over the years, has undergone significant advances that have shaped its therapeutic scenario. Among these advances, the introduction of robotic surgery stands out, a modality that has revolutionized

the approach to several urological conditions, including kidney tumors. Villani et al. (2020) and George et al. (2020).

Robotic surgery is characterized by the use of robotic-assisted surgical systems, which allow surgeons to perform complex procedures with greater precision and less invasiveness Villani et al. (2020) and George et al. (2020). In the context of renal surgery, the application of this technology has been the subject of rigorous study and evaluation, focusing on clinical results and associated complications Cacciamani et al. (2020), Gallo et al. (2020) and Wong et al. (2020).

In this integrative review, we will seek to analyze the results and complications of robotic surgery in the treatment of kidney tumors, using an approach based on solid scientific evidence Meng et al. (2019) and Sivaraman et al. (2019). To achieve this objective, we drew on a series of recent studies that address the topic, providing valuable insights into the efficacy and safety of this surgical modality Greco et al. (2019), Raza et al. (2019) and Lee et al. (2019).

Among the central questions to be explored are the rates of negative surgical margins, which indicate the oncological effectiveness of robotic surgery Villani et al. (2020) and the incidence of intra- and postoperative complications Cacciamani et al. (2020), Gallo et al. (2020) and Wong et al. (2020). Additionally, we will examine the influence of this surgical approach on the patient's kidney function, a critical aspect in the treatment of kidney tumors.

This study aims to contribute to a better understanding of the benefits and limitations of robotic surgery in renal surgery, as well as highlight areas that require additional research. By gathering and analyzing the latest findings from the scientific literature, we hope to provide valuable information that assists healthcare professionals in making evidence-

informed clinical decisions and continually improving the care provided to patients with kidney tumors.

Throughout this article, we will review the main studies with an emphasis on outcomes and complications, to offer a comprehensive and up-to-date overview of the state of the art of this surgical approach.

## **METHODOLOGY**

The conduct of this integrative review followed a systematic process of selecting relevant studies. A comprehensive search was performed in the academic databases PubMed and Scopus. The searches were conducted using the descriptors: robotic surgical procedures, intraoperative complications, nephrectomy, renal neoplasms, evaluation of results in health care, with the aim of finding studies published between the years 2010 and 2023.

The inclusion criteria for the studies were previously defined and included: studies that investigated the use of robotics in renal surgery, studies that reported surgical results and/or complications, studies published between 2010 and 2023, and studies in English and Portuguese. Studies that were not available in full text, studies in languages not accessible for review, duplicate studies and studies that did not meet the inclusion criteria were excluded.

After the initial search, the titles and abstracts of the articles were independently reviewed by two reviewers, who determined the relevance of each study in relation to the scope of the integrative review. Articles considered irrelevant were excluded at this stage.

The studies that met the inclusion criteria after reviewing the titles and abstracts underwent a complete reading of the texts to ensure that they complied with the established criteria.

Data extraction was performed to collect relevant information from the selected studies. The following items were recorded: author(s) and year of publication, objective of the study, methodology used, main results related to the use of robotics in renal surgery, reported surgical complications, oncological and functional outcomes.

Data extraction was conducted independently by two reviewers, and any discrepancies were resolved through consensus.

The results of the included studies were qualitatively analyzed. The main findings related to the results and complications of robotic renal surgery were summarized and critically discussed.

## RESULTS

This analysis focused on providing a detailed understanding of the outcomes and complications associated with robot-assisted kidney surgery, contributing to an up-to-date overview of the clinical and scientific implications of this innovative technology. These studies have provided valuable insights into outcomes and complications associated with this surgical modality.

Villani et al. (2020) performed a comprehensive meta-analysis of robotic surgery in patients with T1b and T1a complex renal tumors. The results indicated that robotic surgery resulted in comparable outcomes, in terms of surgical margins and complications, to other surgical approaches.

George et al. (2020) conducted a meta-analysis that compared laparoscopic-assisted robotic surgery with open and laparoscopic surgery in complex kidney tumors. They concluded that robotic surgery had advantages, such as shorter hospital stays and less intraoperative bleeding.

Cacciamani et al. (2020) carried out a multicenter study that analyzed complications,

oncological and functional outcomes after performing robot-assisted radical nephrectomies in patients with renal cell carcinoma. Results showed that complication rates were acceptable, and surgical margins were generally negative.

Gallo et al. (2020) conducted a systematic review and meta-analysis of robot-assisted radical nephrectomies for renal cell carcinoma. They reported favorable results, highlighting minimal conversion rates to open surgery and low incidence of serious complications.

Wong et al. (2020) performed a meta-analysis of robot-assisted partial nephrectomies in complex renal tumors. Results indicated that robotic surgery resulted in less bleeding, shorter hospital stays, and faster recovery compared to open or laparoscopic approaches.

Meng et al. (2019) performed a comprehensive review of current progress in robot-assisted partial renal surgery. They highlighted technological innovations and advances in surgical technique, highlighting the growing adoption of this modality.

Sivaraman et al. (2019) discussed the current state of robotic partial renal surgery, emphasizing its relevance in preserving renal function and minimizing complications.

Greco et al. (2019) provided an overview of the current status of robotic-assisted partial renal surgery, highlighting the benefits of this minimally invasive approach.

Raza et al. (2019) performed a systematic review and meta-analysis that examined the role of robotics in partial nephrectomies. The results suggested that robotic surgery has significant advantages over open surgery in terms of bleeding, recovery and hospital stay.

Lee et al. (2019) conducted a meta-analysis that compared robotic partial nephrectomy with open partial nephrectomy in patients with renal cell carcinoma. They concluded that robotic surgery resulted in less bleeding

and shorter hospital stays.

Taken together, the studies analyzed in this integrative review suggest that robot-assisted renal surgery is a safe and effective approach for treating complex renal tumors. Although complications can occur, their rates are generally low compared to traditional surgical approaches.

Furthermore, robotic surgery offers advantages, such as less intraoperative bleeding, faster recovery and reduced hospital stay. However, more follow-up studies are needed to evaluate the long-term outcomes and quality of life of patients undergoing this surgical modality.

## DISCUSSION

The comprehensive analysis of the studies selected in this integrative review highlights important findings related to results and complications associated with this surgical modality.

The effectiveness of robotic surgery in the management of complex kidney tumors has been highlighted in several studies. Villani et al. (2020) and George et al. (2020) demonstrated that robotic surgery is comparable in terms of surgical margins and complications when compared to conventional approaches such as open and laparoscopic surgery. This reinforces the position of robotic surgery as a viable alternative for challenging clinical cases.

Furthermore, the safety of robotic surgery in renal surgery is evidenced by the low incidence of surgical complications, as observed in studies by Cacciamani et al. (2020), Gallo et al. (2020), Meng and Brand (2019), Sivaraman and Noronha (2019), Greco et al. (2019) and Raza et al. (2019). Although complications could occur, they were generally infrequent and manageable, ensuring patients had a less traumatic recovery and reducing the risk of serious complications.

Regarding oncological results, the studies

reviewed indicate that robotic surgery remains effective in the treatment of renal cell carcinoma. Villani et al. (2020) observed negative surgical margin rates that meet expectations. These results are crucial, as preserving kidney function and obtaining satisfactory oncological results are essential goals in the treatment of kidney cancer.

In addition to the main results, it is important to highlight the additional benefits of robotic surgery in renal surgery, including less intraoperative bleeding, reduced hospital stay and faster recovery, as observed in studies by Wong et al. (2020) and Lee et al. (2019). These benefits can significantly improve patients' quality of life and reduce costs associated with hospitalization.

Looking to the future, it is essential to consider the future prospects of robotic surgery in renal surgery. The field continues to evolve with the development of advanced technologies and innovative techniques. Additional studies are needed to evaluate long-term outcomes, including functional outcomes and patients' quality of life. Furthermore, widespread implementation of this technology requires logistical and financial considerations.

In summary, the discussion highlights the relevance of the results found in this integrative review, highlighting the effectiveness, safety and benefits of robotic surgery in renal surgery. The need for additional research and practical considerations for implementing this approach into clinical practice is recognized. This discussion provides a comprehensive overview of the current state of robotic surgery in renal surgery and its implications.



## FINAL CONSIDERATIONS

Robotics have played an increasing role in urological surgery, in particular renal surgery, and this review sought to provide up-to-date insights into its impact.

Our analyzes revealed an encouraging scenario regarding the use of robotics in renal surgery. The selected studies consistently highlighted that robotic kidney surgery is an effective and safe technique for treating a variety of conditions, including complex kidney tumors. The oncological results obtained were, for the most part, satisfactory, with negative surgical margin rates that met expectations. This suggests that the robotic approach is a viable alternative to open and laparoscopic surgery in terms of oncological outcomes.

Furthermore, the review pointed to the relative low incidence of surgical complications associated with robotic kidney surgery. Although complications may occur, such as excessive bleeding or injury to adjacent organs, these events were generally infrequent and manageable. The reviewed literature highlights the safety of the robotic approach, providing patients with a faster and less painful recovery.

It is important to highlight that although the results are promising, research in the area

of robotic kidney surgery continues to evolve. Further studies are needed to further evaluate long-term outcomes, including functional outcomes, quality of life, and costs associated with this technique.

This integrative review contributes to the current understanding of robotics in renal surgery, highlighting its advantages and positive results in terms of efficacy and safety. The data compiled in this study could be valuable to clinicians, patients, and healthcare policymakers, helping to guide clinical decisions and future strategies in kidney surgery.

Finally, it is critical that new investigations continue to track advances in robotic technology and expand our knowledge about long-term outcomes. We hope that this review will join the growing literature on robotic kidney surgery, providing a clear and up-to-date overview for the medical and scientific community.

These final considerations summarize the findings and impact of the evidence presented in their integrative review. Remember to customize the final considerations according to the main results of your review and highlight the relevance of your work to the medical and scientific community.

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