

**The impact of robotic surgery on postoperative recovery in a patient with prostate cancer: a systematic literature review**

O impacto da cirurgia robótica na recuperação pós-operatória de um paciente com câncer de próstata: uma revisão sistemática da literatura

El impacto de la cirugía robótica en la recuperación postoperatoria en un paciente con cáncer de próstata: una revisión sistemática de la literatura

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[pau\\_2195@hotmail.es](mailto:pau_2195@hotmail.es)**ARTICLE HISTORY****Received:** 27-01-2024**Revised Version:** 27-04-2024**Accepted:** 16-05-2024**Published:** 22-05-2024**Copyright:** © 2024 by the authors**License:** CC BY-NC-ND 4.0**Manuscript type:** Article**ARTICLE INFORMATION****Science-Matrix Classification (Domain):**

Health Sciences

**Main topic:**

Robotic surgery and prostate cancer

**Main practical implications:**

The study highlights the practical benefits of robotic surgery for prostate cancer, including reduced complications, shorter hospital stays, and improved urinary and sexual function outcomes. These findings inform medical decision-making and suggest the potential for broader accessibility to advanced surgical techniques globally.

**Originality/value:**

The study's originality lies in its focus on advanced robotic techniques such as nerve-sparing prostatectomy and its implications for preserving urinary and sexual function, alongside minimizing complications and reducing hospital stays. Additionally, the article explores future directions in robotic surgery, including emerging technologies like telesurgery and telementoring, offering a glimpse into the evolving landscape of prostate cancer treatment. Overall, the research highlights the pivotal role of robotic surgery in enhancing patient recovery and underscores the need for continued advancements in surgical techniques and postoperative care to optimize outcomes for prostate cancer patients.

**ABSTRACT**

Prostate cancer has become one of the most prevalent diseases globally, which affects millions of men, and is estimated to go up to 288.3 thousand patients in the U.S. in 2023. Therefore, its diagnosis and management process need innovations and continuous improvements to reduce morbidity and mortality rates. The advancement of robotic surgery, defined by its minimally invasive method, has changed the game. It is superior to open surgery practice, with fewer complications after the operation time, quicker recovery, and improved lifestyle. This systematic review rigorously and systematically analyzes studies of this kind and addresses the various operative outcomes, including wound complications, surgical site infections, and urinary and sexual functions. This systematic review will be explorative, aiming to establish the benefits of robotic surgery in terms of postoperative outcomes. We intend to contribute to the cardio-thoracic surgical literature by providing a comprehensive analysis of how this type of surgery affects the postoperative recovery of patients with prostate cancer, giving recommendations for future clinical care and research in this field.

**Keywords:** Prostate Cancer, Robotic surgery, Latest Advancements, Post-Operative Outcomes.**RESUMO**

O câncer de próstata se tornou uma das doenças mais prevalentes em todo o mundo, afetando milhões de homens, e estima-se que em 2023 haverá 288,3 mil pacientes nos EUA. Portanto, seu processo de diagnóstico e gerenciamento precisa de inovações e melhorias contínuas para reduzir as taxas de morbidade e mortalidade. O avanço da cirurgia robótica, definida por seu método minimamente invasivo, mudou o jogo. Ela é superior à prática da cirurgia aberta, com menos complicações após o tempo de operação, recuperação mais rápida e melhor estilo de vida. Esta revisão sistemática analisa rigorosa e sistematicamente estudos desse tipo e aborda os vários resultados operacionais, incluindo complicações da ferida, infecções do local da cirurgia e funções urinária e sexual. Essa revisão sistemática será exploratória, com o objetivo de estabelecer os benefícios da cirurgia robótica em termos de resultados pós-operatórios. Pretendemos contribuir para a literatura cirúrgica cardiorácica fornecendo uma análise abrangente de como esse tipo de cirurgia afeta a recuperação pós-operatória de pacientes com câncer de próstata, fornecendo recomendações para futuros cuidados clínicos e pesquisas nesse campo.

**Palavras-chave:** Câncer de próstata, cirurgia robótica, últimos avanços, resultados pós-operatórios.**RESUMEN**

El cáncer de próstata se ha convertido en una de las enfermedades más prevalentes a nivel mundial, que afecta a millones de hombres, y se estima que llegará a 288,3 mil pacientes en EE.UU. en 2023. Por lo tanto, su diagnóstico y proceso de tratamiento necesitan innovaciones y mejoras continuas para reducir las tasas de morbilidad y mortalidad. El avance de la cirugía robótica, definida por su método mínimamente invasivo, ha cambiado las reglas del juego. Es superior a la práctica de la cirugía abierta, con menos complicaciones después del tiempo de operación, recuperación más rápida y mejor estilo de vida. Esta revisión sistemática analiza de forma rigurosa y sistemática los estudios de este tipo y aborda los diversos resultados operatorios, incluidas las complicaciones de la herida, las infecciones del sitio quirúrgico y las funciones urinaria y sexual. Esta revisión sistemática será exploratoria, con el objetivo de establecer los beneficios de la cirugía robótica en cuanto a los resultados postoperatorios. Pretendemos contribuir a la literatura quirúrgica cardio-torácica proporcionando un análisis exhaustivo de cómo este tipo de cirugía afecta a la recuperación postoperatoria de los pacientes con cáncer de próstata, dando recomendaciones para la futura atención clínica y la investigación en este campo.

**Palabras clave:** Cáncer de próstata, Cirugía robótica, Últimos avances, Resultados postoperatorios.

## INTRODUCTION

Prostate cancer is the cancer of prostate glands, which is a small, walnut-shaped gland in men that makes fluid to nourish and transport sperm (Prostate Cancer - Symptoms and Causes - Mayo Clinic, 2022). Prostate cancer is one of the more frequent in men above 50 and black people, and families with a family history of cancer are more at risk of developing this condition. Mohamed, 2024 with other evidence, confirmed that prostate cancer usually grows slowly and initially remains confined to the prostate gland, where it may not cause serious harm (Mohamed, 2024). While some types of prostate cancer grow slowly and may need minimal or no treatment, other types are aggressive and can spread quickly. Several factors increase the risk of developing prostate cancer, including age, family history, ethnicity (with Black men having a higher risk), and genetic mutations (Hurwitz., 2021).

Lifestyle factors such as diet, physical activity, alcohol, obesity, and smoking may be seen to influence the development of disease (Benítez, Ayala & Rueda, 2022). Usually, like other cancers, this type does not represent symptoms in its early stages (Wilson., 2019). With time, as the disease progresses, symptoms may include difficulty urinating, blood in the urine or semen, erectile dysfunction, pain in the hips, back, or chest, and weakness or numbness in the legs or feet (Prostate et al. and Symptoms, 2023). According to the recent statistics in 2023 data, it was revealed that Prostate cancer is the most common cancer among men globally, except for skin cancer. In the United States alone, an estimated 288,300 men were diagnosed with prostate cancer in 2023. Findings revealed some interesting information: Its incidence rates had dropped from 2007 to 2014 due to changes in screening guidelines, but they have since increased. Recent advancements in screening and treatment have contributed to a decline in the death rate and, with a 5-year relative survival rate of 97% in the U.S. (Prostate Cancer - Statistics, 2023). However, these survival rates vary based on factors such as cancer stage, grade, age, and overall health status of patients with prostate cancer.

Most standard diagnosis involves a combination of medical history evaluation, physical examination, prostate-specific antigen (PSA) blood test, and imaging studies such as ultrasound, MRI, or biopsy, just like other cancers, but early detection through regular screening is essential for timely intervention and improved prognosis (Haj-Mirzaian,2024) so early signs such as urinary changes, nocturia, erectile dysfunctioning, pain, lymph nodes, or weight loss or swellings should not be ignored. Treatment options for prostate cancer vary and depend on stage and disease aggressiveness, and standard treatment includes active surveillance, surgery (such as radical prostatectomy), radiation therapy, hormone therapy, chemotherapy, immunotherapy, or targeted therapy (Varaprasad, 2023). Robotic surgery has transformed the treatment landscape for prostate cancer; however, a clear understanding of its specific influence on postoperative recovery in patients remains an unexplored gap in the literature (Guni., 2024).

This systematic review aims to contribute to the discussion of robotic surgery techniques in the context of prostate cancer, hopefully identifying the main trends in the literature and portraying the state of the art to assist in the emergence of new research agendas.

## METHODS

We decided that a comprehensive literature search was conducted across multiple databases, including PubMed, Scopus, Web of Science, and the Cochrane Library. The search will cover studies published up to April 2024. Primary Keywords were Robotic Surgery, Prostate Cancer, and Postoperative Recovery. Moreover, secondary keywords were Wound Complications, Quality of Life, Urinary Function, Sexual Function, post-operative outcomes, etc. We decided to Combine MeSH Terms with Boolean Operators and Used AND to combine different concepts, ensuring that the retrieved articles contain information on all aspects of the query. Our main MesH term was ("Robotics"[MeSH] OR "Robotic Surgical Procedures"[MeSH]) AND ("Prostatic Neoplasms"[MeSH] OR "Prostate Cancer") AND ("Postoperative Period"[MeSH] OR "Postoperative Recovery").

We also Expanded the Search with Secondary Keywords while OR to include various terms within the same concept, broadening the search to capture more relevant studies, for example, ("Surgical Wound Infection"[MeSH] OR "Wound Complications") OR ("Quality of Life"[MeSH]) OR ("Urinary Bladder, Neurogenic"[MeSH] OR "Urinary Function") OR ("Sexual Dysfunction, Physiological"[MeSH] OR "Sexual Function") were needed; we Used NOT to exclude terms that might lead to irrelevant results.

### Inclusion and Exclusion Criteria

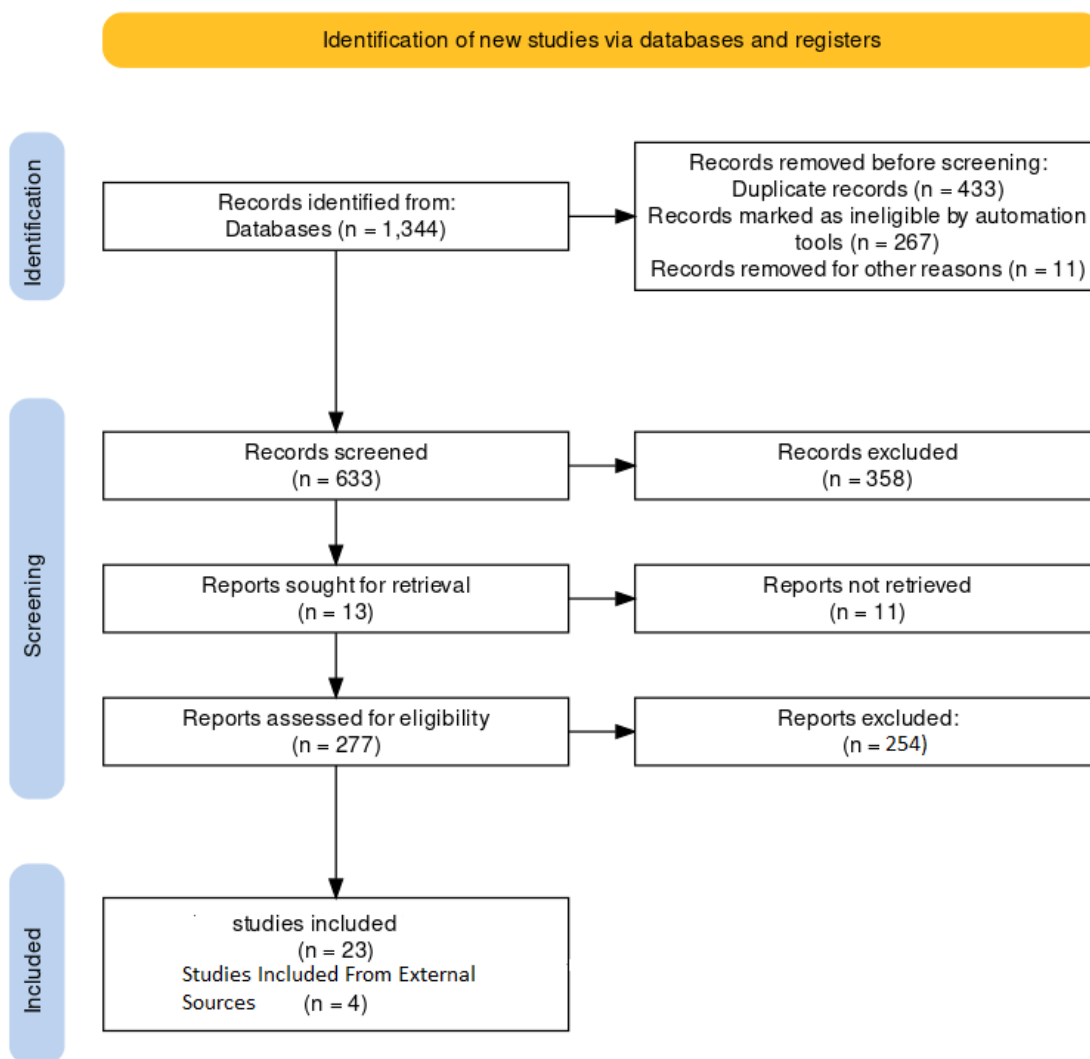
We decided to use studies that evaluate the impact of robotic surgery on postoperative recovery in prostate cancer patients, and studies that provide comparative data between robotic surgery and traditional open or laparoscopic

approaches were also included. This paper is based on a review of previous randomized controlled trials, cohort studies, and case-control studies. Most of the journals published that report on postoperative complications, recovery times, and quality of life outcomes, and data from only English literature was extracted. We excluded those papers that do not specifically address robotic surgery in the treatment of prostate cancer. This paper does not contain case reports, editorials, reviews, unpublished data, or grey literature. We promptly excluded studies without clear outcomes related to postoperative recovery.

**Data Extraction**

After applying filters such as year, language, human objects, and study types, we captured titles, and after including relevant studies, we accessed studies. After deciding which studies we needed, we extracted study citations, year of publication, study design, number of participants, age of participants, details of the surgical procedure, outcome measures (complications, recovery time, quality of life), and main findings while also writing reason behind the selection of each study.

**Figure 1.** Flow diagram for PRISMA literature review



Source: own elaboration (2024)

**RESULTS AND DISCUSSION**

In this systematic review, we identified 1,344 records through database searches, including PubMed and Scopus. We removed 433 duplicates and excluded 267 by automation, plus 11 for other reasons. After screening 633 records and assessing 277 reports, we included 23 from a database search and manually included 4 new papers. Here are the PRISMA guidelines for a comprehensive review. The following Table 1 systematically summarizes the main literature collected.

**Table 1.** Main results of the literature retrieved

Author	Participants/ No of studies included	Purpose	Method Design and Limitations	Hierarchical Level	Findings and Summary	Applicability to our research
<b>Su X et al., 2023</b>	The study analyzed data from 9 studies involving a total of 2063 prostate cancer patients undergoing robotic surgery.	The meta-analysis aimed to critically evaluate the role of robotic surgery in reducing postoperative wound complications in prostate cancer patients. It compared robotic surgery's outcomes with traditional open and laparoscopic approaches.	This meta-analysis followed PRISMA guidelines, reviewing studies published up to April 2023 from databases like PubMed, Scopus, Web of Science, and the Cochrane Library. It included randomized controlled trials, cohort studies, and case-control studies comparing robotic surgery with open or laparoscopic procedures for prostate cancer.	This study is a meta-analysis, which is high in the hierarchy of evidence Level I.	Robotic surgery demonstrated a significantly lower incidence of wound complications, including reduced rates of wound infection and wound dehiscence, compared to traditional methods, as indicated by standardized mean differences (SMDs) of 0.49, 0.26, and 0.23, respectively, with corresponding 95% confidence intervals (C.I.s) and heterogeneity indices reflecting substantial improvements.	It supports the reduction in postoperative complications, including infection and dehiscence. High heterogeneity among studies (84% for wound complications, 94% for infection rates, and 70% for dehiscence events) warrants cautious interpretation, calling for targeted research to optimize robotic surgery's benefits.
<b>(Osmonov et al., 2018)</b>	285 participants were included in this study	The study aims to compare the incidence and management of surgical site infections (SSIs) following robot-assisted laparoscopic radical prostatectomy (RALP) and retropubic radical prostatectomy (RRP), defining SSIs as infections near surgical incisions within 30 days of the procedure, categorized as superficial, deep, or organ/space.	The study reviewed 285 patients over four years, with 187 undergoing RRP and 98 undergoing RALP. It evaluated the frequency, types, and management of SSI complications, using Centers for Disease Control and Prevention (CDC) criteria to classify the SSIs into superficial incisional, deep incisional, and organ/space infections.	Retrospective Cohort Study Level 3 Evidence	A significant difference was found in SSI rates between the RALP (2%) and RRP (14.4%) groups, indicating a lower risk associated with robotic surgery. RALP patients experienced only organ/space SSIs, whereas RRP patients developed all types of SSIs. Management and SSIs diagnosed in RALP patients resolved more rapidly than those in RRP patients, highlighting a lower incidence and an easier management process with robotic surgery.	This paper was selected for its discovery of fewer surgical site infections (SSIs) with robot-assisted laparoscopic radical prostatectomy (RALP) backs the aim of assessing robotic surgery's impact on postoperative recovery in prostate cancer patients. Despite longer operations, RALP notably reduces SSIs and shorter infection treatments, likely due to its minimally invasive technique.
<b>Hyun-Ju Seo., 2016</b>	Sixty-one studies are included.	To systematically update evidence on the clinical efficacy and safety of Robot-Assisted Radical Prostatectomy versus Retropubic Radical Prostatectomy in patients with prostate cancer.	Systematic review and meta-analysis of non-randomized studies (prospective and retrospective cohort studies) from January 1980 to August 2013. Significant limitations include the lack of randomized controlled trials and	Non-randomized studies provide a lower level of evidence than randomized controlled trials, reflecting a moderate level of evidence quality in the hierarchy of evidence.	RARP is associated with a lower risk of complications, reduced urinary incontinence, and improved potency rates compared to RRP. Oncologic outcomes, such as positive margin and biochemical recurrence rates, were comparable between the two procedures. However, these findings should be interpreted cautiously due to the non-randomized nature of the studies and heterogeneity.	We aimed to evaluate data on post-operative outcomes between robotic and open surgery for prostate cancer so decided to include. It supports the notion that robotic surgery may offer advantages in reduced complications and improved functional outcomes, which are crucial aspects of post-operative recovery.
<b>Anna Lantz., 2021</b>	The study involved 4003 patients from 14 Swedish centres between 2008 and 2011. It is a single study, not a compilation of multiple studies.	The study aimed to evaluate the functional and oncological outcomes eight years after undergoing either robot-assisted laparoscopic prostatectomy (RALP) or open retropubic radical prostatectomy (RRP) for localized prostate cancer.	This was a prospective, controlled, nonrandomized trial. Data for functional outcomes were collected through validated patient questionnaires administered preoperatively, at 12, 24 months, and eight years post-surgery. The main limitation is the nonrandomized design of the trial.	The study is a controlled, prospective clinical trial, placing it at a higher level of evidence within observational studies, though below randomized controlled trials due to its nonrandomized design.	Eight years post-surgery, urinary incontinence rates did not significantly differ between RALP and RRP groups (27% vs 29%). Erectile dysfunction was lower in the RALP group (66% vs 70%). Prostate cancer-specific mortality (PCSM) was significantly lower in the RALP group, particularly noticeable in patients with high D'Amico risk. The RALP group had lower rates of positive surgical margins, biochemical recurrence, and PCSM than the RRP group.	We selected this because the findings support the long-term oncological safety and potential functional benefits of robot-assisted laparoscopic prostatectomy compared to the open approach.
<b>Patel., 2008</b>	The study involved 1500 consecutive cases of robot-assisted laparoscopic radical prostatectomy performed by a single surgeon.	Analyze perioperative and postoperative outcomes and assess the procedure's feasibility, safety, and efficacy.	Prospective data collection with functional outcome assessment using self-administered questionnaires. Limitations include the need for long-term follow-up data.	Observational Study, Level III	The mean operation time was 105 minutes, and 97% of patients were discharged on postoperative day 1. The complication rate was 4.3%, and the positive margin rate was 9.3%, varying by cancer stage.	It provides us with perioperative and postoperative outcomes, and the feasibility of robot-assisted prostatectomy is valuable for shaping future research and clinical practice.
<b>(Yasui et al., 2014)</b>	Three hundred consecutive patients with clinically localized prostate cancer underwent RALP with a posterior dissection approach to the seminal vesicle between May 2011 and November 2013.	To analyze the perioperative outcomes of robot-assisted laparoscopic radical prostatectomies (RALPs) performed at the center.	From May 2011 to November 2013, 300 patients underwent RALP at Nagoya City University Hospital, following standardized protocols.	Retrospective study.	Post-RALP outcomes: Median operative time was 220 min, with robotic surgery lasting 160 min. Median blood loss was 200 mL, some requiring transfusions. Median catheterization and hospital stay were 7 and 11 days, respectively—positive margins: 29.7%, decreasing over time for pT2. Seven cases experienced PSA recurrence. Complications in 9 cases included bladder perforations and hematomas. Urinary continence: 57.8% ≤1 pad at three months, rising to 82.4% at six months. Additionally, 76.9% with unilateral nerve-sparing achieved sufficient erectile function.	Evaluation of outcomes focusing on postoperative urethral catheterization, TNM staging, surgical margin status, urinary continence, and PSA elevation recurrence in patients undergoing RALP.

Source: own elaboration (2024)

The latest era has revolutionized robotic surgery processes, such as the advancement of nerve-sparing robotic prostatectomy, which is a novel surgical technique that focuses on preserving the nerve fibers and blood vessels that are critical for erectile function and urinary continence among patients with prostate cancer. It is a robotic-assisted surgical system that aims to provide surgeons with enhanced precision, flexibility, and control compared to traditional surgical

methods. Department of Urology suggests the advanced technique of nerve-sparing robotic prostatectomy offers a safer, minimally invasive method for removing the prostate gland in clinically localized prostate cancer patients, preserving vital nerve structures linked to penile erections. Other benefits include smaller incisions, less pain, blood loss, and shorter hospital stays compared to open surgery, but these may not suit all cases (UF., 2024). Maruo et al. (2024) suggested that Nerve-sparing robot-assisted radical prostatectomy aims to prevent urinary incontinence and erectile dysfunction, so numerous urologists have switched to this advanced technique to preserve both functions while ensuring effective cancer control (Maruo et al., 2024). According to research, nerve-sparing robotic prostatectomy has proved successful as following nerve-sparing prostatectomy, around 40-50% of men recover their urinary and erectile function to the level they had before the treatment within a year. This percentage increases to 30-60% after two years among those patients, but the success of the procedure depends on the surgeon's expertise and the extent of nerve preservation during surgery (Erectile Dysfunction After Prostate Cancer, 2019). The precision of these instruments allows for meticulous dissection and suturing, leading to smaller incisions that ultimately reduce postoperative pain and discomfort during the surgery. The advent of these technologies has reduced patients' and surgeons' trauma and provided more reliability with fewer errors, resulting in decreased inflammation and faster healing processes (Esperto et al., 2023). Research by Fairag et al. (2024) suggested that the pivotal advantage of robotic surgery lies in its contribution to faster recovery times, reduced hospital stays and that most patients can resume normal activities sooner. However, they are prescribed 3-4 weeks rest maximum for Strenuous physical activities. This reduces healthcare costs and diminishes the risk of hospital-acquired infections, one of the most common concerns in postoperative care. Robotic surgeries enhance robotic arms' dexterity, facilitating delicate maneuvers in confined spaces of the pelvic region, reducing tissue trauma, and, thus, promoting quicker recovery (Fairag et al., 2024). Its improved visualization during surgery allows for superior nerve sparing, directly enhancing postoperative urinary and sexual function, which is a major concern among prostate cancer survivors because about 85% of people report difficulties with erection after radical prostatectomy, Emanu et al. (2016) suggested. However, after robotic-assisted laparoscopic surgery, people can have sex again after one month of their surgery. Its imaging capabilities inherent in robotic systems aid in the early identification and management of potential complications, further safeguarding patient outcomes (Du et al., 2018).

(Reddy et al., 2023) Research has reported that the ergonomic design of robotic systems has reduced surgeon fatigue and decreased the likelihood of surgical errors, which is paramount for ensuring patient safety. Moreover, the lower rates of postoperative complications such as infections, wound dehiscence, and adhesions show the enhanced safety profile of robotic surgery, and this safety has provided reduced reliance on opioid medications due to lower postoperative pain. Da Vinci® Surgical System is famous for robot-assisted surgery, which shows a 78-94% success rate; this approach allows surgeons to perform complex procedures with enhanced vision, control, and accuracy (Schwaibold et al., 2018). Miniaturized robotic instruments are inserted with small incisions, and the prostate is easily removed, even from surrounding tissues, with exceptional precision. This method starkly contrasts the traditional radical retropubic prostatectomy, where surgeons used to make substantial abdominal incisions. Da Vinci provides a magnified, three-dimensional view of the prostate and its surrounding structures (e.g., nerves, blood vessels, muscles) and reduces the risk of damaging adjacent tissues. Surgeon operates from a computer console, manipulating instruments that offer a greater range of motion than the human hand. There is no need to insert hands into the patient's body cavity directly. In terms of error, possible risks and side effects, such as bleeding, infection, and adjacent tissue or organ damage, align closely with those of traditional surgical methods, including urinary incontinence and erectile dysfunction. However, the incidence of these side effects is comparable to open surgical approaches, with the possibility of improvement over time, especially when nerve-sparing techniques are employed to preserve sexual function (Robotic Prostatectomy, 2023).

Osmonov et al. (2018) in his study demonstrated that comparing robot-assisted laparoscopic radical prostatectomy (RALP) and retropubic radical prostatectomy (RRP), RALP patients experienced longer operative times (mean 331.3 vs. 269.5 minutes), but benefited from shorter catheterization (mean 9.2 vs. 12.6 days) and hospitalization times (mean 9.7 vs. 13.5 days), indicating a faster recovery process. Despite the longer surgery duration, RALP was associated with a significantly lower rate of surgical site infections (SSIs) (2% for RALP vs. 14.4% for RRP), with SSIs developing later but resolving more quickly in RALP patients. This suggests that while RALP involves more time in surgery, it offers the benefits of shorter recovery times and lower infection rates, aligning with patient-centered care objectives by potentially reducing the impact on post-operative recovery and overall patient well-being. These findings highlight RALP's advantages in minimizing hospital stay and postoperative complications and enhancing patient recovery experiences. Patel et al. (2008), in their robot-assisted surgery for prostate cancer research, demonstrated that the overall complication rate was 4.3%, with no mortalities recorded. The positive margin rate (PMR) was reported to be 9.3% overall. However, when broken down by cancer stage, the rate was lower for less advanced cancers (4% for pT2) and higher for more advanced stages (34% for T3 and 40% for T4). Patel et al. (2008) highlighted the importance of considering the risk of complications and positive margins when evaluating the outcomes of robot-assisted laparoscopic radical prostatectomy procedures (Patel et al., 2008).

According to research by Yasui et al., (2014), the study observed prostate-specific antigen recurrence in 5 cases of pT3 and 2 cases of pT2 after robotic surgery. Nine out of 300 cases encountered intraoperative or immediate postoperative



complications. At the same time, three posterior bladder perforations were immediately sutured during laparoscopy, and four patients required allogeneic blood transfusions due to postoperative hematomas. Urinary continence was assessed in 199 patients for over six months, with 57.8% using a maximum of 1 pad per 24 h at three months postoperatively, increasing to 82.4% at six months. Moreover, 76.9% of patients who underwent unilateral nerve-sparing achieved sufficient erectile function for sexual intercourse, with or without augmentation, using phosphodiesterase five inhibitors. These findings underscore the importance of evaluating postoperative outcomes and complications to refine surgical techniques and enhance patient care in robot-assisted laparoscopic prostatectomy. Seo et al., 2016 suggested that RARP is associated with fewer overall complications, including lower risks of organ injury and pulmonary embolism and reduced rates of bladder neck contracture. Global RARP procedures showed a longer average operating time of 32.27 minutes than open surgeries. However, short-term hospital stays made it a better alternative for patients, hence a faster recovery process. RARP is a functional method, and in 12 months post-surgery, the rate of urinary incontinence and good sperm motility were recorded. Relating to oncological results, the positive surgical margins and biochemical recurrence rates are on the same level for RARP and RRP, providing evidence of equal effectiveness in malignancy control. Despite this, the review stresses that the quality of the included studies is moderate, emphasizing that which evidence speaks more for its validity needs further randomized controlled trials.

Lantz et al. (2021), both in the continuation of the LANTZ study (LAPPRO trial) with eight-year follow-up and in the comparison of RALP with RRP- open retropubic radical prostatectomy -obtained that in higher-risk tumors, RALP showed significantly lower prostate cancer-specific mortality (PCSM). There was, however, a difficulty in conclusively asserting the effect of surgical technique on mortality due to the study needing to be randomized and the remaining confounding factors that may affect the results. However, the findings may imply that RALP is oncologically safe. The silencing disappearance of the early erectile function benefits for RALP was demonstrated by the end of year eight. At the same time, most long-term continence rates between these groups were not significantly different. As such, this study, being a prospective one with a large sample size that enrolled both academic and non-academic patients, does reveal that both RALP and ORP have satisfactory results in preventing the chances of PCSM and then ORP could outperform RALP in the recovery of erectile function in the beginning. Regardless of the shortcomings in the non-randomized design and a potential selection bias in it, the discipline of the systematic follow-up over a very long period and the absolute specificity of the obtained data make robot-assisted techniques a cutting-edge, one of the top surgical tools in modern prostate cancer treatment.

### **Future Directions**

Robotic surgery for prostate cancer is approaching a revolutionary benchmark with the advance of new robotic platforms such as telesurgery, and telementoring. The conclusive enrollment of numerous robotic devices currently wrapping up through the FDA, completely ending the robotic surgery monopoly by the DaVinci® system, indicates an entirely new era where many competitors will be available, giving potential for cost reduction as well. This further implies that residents in less developed regions and with low economic resources could acquire modern surgical procedures around the world. The telemeaning and telementoring give the direction to another road that possibly cures the cancer of the prostate from the surgical point of view and even more. Through the facilities of 5G networks and other communication technologies, astronauts can now undergo remote surgeries; thus, the border of highly sophisticated treatments is no longer the geographical one. This would open up new avenues of communication and training for highly skilled surgeons, enabling them to reach those with quality care in remote areas. However, this highly advanced model of the forthcoming surgery has its difficulties. Ethical issues such as overly dehumanizing patient care, the potential distance of surgeons from their patients, and large extra hardware installation costs are valid and give reason for reflection. Promoting the need that both economic robotics surgeries and the latest updated surgery technology must be available to all, the authors propose a model that is a combination of the models of the latest robots that are affordable, telesurgery with global reach, as well as the telementoring with its collaborative features. The entirety of telementoring enhances the role of robotic surgery by expressing new learning content and components and making it more accessible, ultimately worsening the range of robotic surgery's impact. With real-time guidance and mentorship from experienced surgeons to their less experienced counterparts, telementoring can elevate surgical skills and foster a collaborative spirit across distances.

## **CONCLUSIONS**

This review concludes that robotic surgery for prostate cancer causes fewer complications after the operation and reduces hospital stays. The advantage of this procedure is that it is a complete finish. Some of them are reduced risk of surgical wound complications and surgical site infections, early clinical effects, and better outcomes of urinary and sexual function after the surgery. Beyond highlighting the technical benefits of robotic surgery, for instance, less invasiveness and precise operations, the implications of this research are about ensuring that current prostate cancer survivors preserve their quality of life. The robotic system offers advanced visualization, exactness, and control, among other things, which make

nerve-sparing procedures quite possible, a feature associated with excellent postoperative functional results. Furthermore, reduced staff fatigue while performing surgical procedures and lower injury rate lead to more secure treatment and less likely risk of complications that contribute to lower healthcare costs resulting from shortened hospital stays and reduced postoperative care needs. As robot surgery develops and advances, a prostate cancer treatment path with an effective outcome via robotic surgery technology gives us a convenient medical solution. While it is evident that the recovery process may differ from one patient to another, studies for further optimizations of the surgical approaches and postoperative care should be a priority with the aim of each patient's needs. In the end, all of these data give arguments for using robotics during prostate cancer surgery by highlighting its important role in facilitating the patient's recovery during and after the procedure.

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**Contribution of each author to the manuscript:**

Task	% of contribution of each author				
	A1	A2	A3	A4	A5
A. theoretical and conceptual foundations and problematization:	30%	25%	15%	15%	15%
B. data research and statistical analysis:	30%	25%	15%	15%	15%
C. elaboration of figures and tables:	30%	25%	15%	15%	15%
D. drafting, reviewing and writing of the text:	30%	25%	15%	15%	15%
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