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REVIEW ARTICLE

Postoperative nursing in robot-assisted urologic surgery: Are there any platform-based differences?

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Abstract

Many robotic platforms are currently available for urologic surgery, each with its technical characteristics. It can be hypothesised that these characteristics might affect postoperative nursing, as they affect several aspects of surgery. They could, therefore, impact the surgical outcomes and wound characteristics, involving aspects of postoperative care such as mobilization, nutrition and length of stay. Although data are available on surgical technique aspects and intraoperative nursing, studies have yet to offer insights and considerations about the potential effect of having different robotic platforms on postoperative nursing care. We aimed to verify whether the technical features of the available robots could impact postoperative nursing. We conducted an integrative review on PubMed, CINAHL and Scopus, using Medical Subject Headings (MeSH) and free-text terms; wildcards and boolean operators were also used. Studies of any design were included. Fifteen papers were retrieved; the key themes emerging from the literature regard trocar setup, technical characteristics of the robots (e.g. single or multiple ports), pneumoperitoneum and Trendelenburg degree. According to the literature, none of these characteristics produce differences in postoperative nursing. The fundamental concepts of postoperative care in surgical inpatients stay the same no matter the robotic platform used. Having competing platforms able to ensure reduced complications without impacting postoperative nursing allows health care facilities to adopt the newest technologies without the need for differentiated nursing protocols. This is an advantage in times of global nursing shortage as it avoids the need for additional platform-based nursing training.

KEYWORDS
advanced nursing practice, bladder cancer, nursing research, prostate cancer, renal cancer, surgical nursing

What is currently known on this topic

- Robotic surgery is widely used in urology; each available robot has different characteristics, such as single or multiple port access.
- Many papers exist on the role of nurses in the robotic operating theatre. However, no studies have investigated whether any differences in postoperative care might arise from the specific characteristics of the robot chosen for surgery.

What this paper adds

- There is no difference in postoperative nursing of patients operated with the available robotic platforms.
- Scant information exists about the favourable outcomes related to low-pressure pneumoperitoneum and accurate choice of intraoperative patient position.
- Several platforms have been introduced in recent years, with different characteristics from those on the market for longer. Studies are needed to elucidate the potential impact of their technical features on postoperative nursing.

1 | INTRODUCTION

In the early 20th century, robotic surgery was introduced to overcome some limitations of endoscopic surgeries. The DaVinci robotic system was the first approved by the FDA (Food and Drug Administration), providing a three-dimensional view of the operative field and applying specified instruments that mimic the movements and agility of the human hand.[1] The robot mimics movements of a human's wrist, hands and fingers plus excludes the essential human hand tremors to obtain better results than traditional laparoscopic surgeries. The robotic instruments provide seven degrees of freedom, allowing a finer dissection and more delicate suturing, and are equipped with a force feedback system (like those found in videogame controllers), which provides tactile sensation to the operator. This feedback, augmented by high-resolution three-dimensional visions, compensates for the loss of tactile stimulation.[1] The current generation of one of the most widespread surgical robots, DaVinci, has been widely advertised and adopted by surgeons and hospitals. Eight hundred seventy-seven thousand different types of robotic-assisted laparoscopic surgeries (RALS) have been performed worldwide.[2] After the DaVinci system, other robotic platforms have been recently introduced, such as the Hugo platform, which is now supported by literature on prostatectomy performed with that platform.[2] Several platforms, such as the Versius robot, are emerging and being approved in many countries worldwide, as highlighted by recent reviews.[3,4]

Introducing and developing these new and complex surgical technologies has created additional responsibilities for surgical nurses. The study by Schuessler et al.[5] pointed out the need for deep comprehension and knowledge of the robots, as well as the ability to troubleshoot problems with equipment and awareness of the potential threats to patient safety. The data from this study suggested that effective teamwork and communication of the surgical team during RALS is crucial for efficient surgery and optimal patient outcomes. An extensive review of 281 papers[6] concluded that nursing professionals should be constantly up to date, considering the fugacity of technological evolution. According to these authors, developing new competencies, team building and patient safety regarding robotic surgery are among the main challenges observed in the reviewed articles. The role of nurses in the operating theatre is well described in the literature and includes assurance of available instruments, team organization and patient safety. The challenge of intraoperative nursing is related to the familiarity with robotic technology, as nurses need to know how to connect, calibrate and set up properly and be familiar with the instruments of each type of surgery. The patient-side surgeon assists the non-sterile operative surgeon by exchanging sterile instruments, retracting patient tissues and manipulating non-robotic sterile instruments to help the procedure. Familiarity with removing the patient cart from the sterile field is required if the surgeon aborts the robotic procedure.[7] Each of the robots currently available on the market (DaVinci®, Versius®, Hugo-RAS®, Senhance®, Revo-I®, Avatera® and Hinotori®) all have different characteristics such as single or multiple port access, independent arms versus armtray, presence/absence of foot-controlled functions, and different wrist rotation angles. It can be hypothesised that these characteristics might affect postoperative nursing, as they affect several aspects of surgery. They could, therefore, impact the surgical outcomes and wound characteristics, involving aspects of postoperative care such as mobilization, nutrition and length of stay; this hypothesis still needs to be verified. Nursing during the hospital stay is related to vital signs monitoring, early mobilization,[8] nutrition,[9] administering therapies and fluids, wound dressing,[10] infection prevention,[11] management of drainages and catheters and patient education in view of discharge. A recent systematic review[12] confirms that postoperative care for prostatectomy includes 'routine nursing, intraoperative posture management, robotic nursing and enhanced recovery nursing'. The same considerations can be applied to radical cystectomy and nephrectomy.

Although data are available on surgical technique aspects and intraoperative nursing, no studies offer insights and considerations about the potential effect of having different robotic platforms on postoperative nursing care.

2 | AIM OF THE STUDY

This review aims to summarize the evidence regarding the effects on postoperative nursing care of the different characteristics offered by the robotic surgical platforms currently approved for human use in urology.

3 | METHODS

3.1 | Design

We conducted an integrative review, which allows the combination of different study designs to provide an overview of the existing evidence on a topic. The methodology suggested by Whittemore and Knafl[13] was followed, which includes problem identification with the relevant research question(s), literature search, data evaluation, data analysis and presentation. We sought to answer the following research question: 'Are there any differences in postoperative nursing care of patients undergoing robot-assisted urological surgery that can be attributed to platform-specific characteristics?'. Patients undergoing radical prostatectomy, radical cystectomy or nephrectomy (either partial or radical) were considered. A PICO study design was applied to the review: Population (Adult patients undergoing robot-assisted surgery for urological diseases), Intervention (Operations performed with any of the robots approved for Urology), Comparison (Between the robotic platforms) and Outcome (Postoperative Nursing).

3.2 | Literature search

The search was conducted in PubMed, CINAHL and Scopus, using Medical Subject Headings (MeSH) and free-text terms; wildcards and boolean operators were also used. Studies of any design published since the approval of the robots currently used for urological surgery in adults, until July 31, 2024, reporting the characteristics of the robots (either directly, i.e. technical papers, or indirectly, i.e. describing operations that made use of specific technical characteristics) and providing information with potential impact on postoperative nursing (i.e. trocar setup, pneumoperitoneum and Trendelenburg). We excluded studies presenting technical aspects unrelated to postoperative nursing (i.e. usability of the machines by surgeons), concerned education of scrub nurses through robotic simulators and reported findings regarding non-urological surgery. Literature comparing their technical characteristics was considered to guide the identification of postoperative nursing issues potentially related to the characteristics of the robots. Given the lack of studies dedicated to postoperative nursing care in this specific field, three surgical textbooks with references,[14–16] the Core Curriculum for Urologic Nursing published by an international association[17] and a textbook on nursing[18] in robotic surgery were retrieved from the University library and consulted to snowball additional references. The European bladder,[19] prostate[20] and kidney cancer[21] guidelines were also consulted. Finally, a search on Google Scholar was performed.

According to the literature,[13] as most studies had different designs and settings, it was not advisable to calculate quality scores. Therefore, for data evaluation, we considered the design and sample size according to the objectives of the retrieved papers. For data analysis, the papers were tabulated and categorized according to the topic and nature of the studies (i.e. surgical technique papers) to achieve data reduction as suggested by the methodology.[13] The keywords used for data integration were nursing, postoperative and *complications*.

4 | RESULTS

Table 1 reports the search strings, presented using Pubmed syntax; the syntax has been adapted to the other databases, maintaining the keywords.

Fifty-six papers were retrieved (23 from Pubmed, 12 from CINAHL, 21 from Scopus). Fifteen were duplicates; twenty-six were discarded according to the exclusion criteria described above (12 from Pubmed, four from CINAHL). The final search included the 15 original studies[22–36] reported in Table 2.

4.1 | Technical features and intraoperative factors potentially related to postoperative nursing

Before looking for specific papers on nursing, we deemed it useful to analyse the technical features of the robots that could impact the patient's condition immediately after surgery and, therefore, on

TABLE 1 Search strings.

Robot* urology* 'postoperative nursing'
Robot* urology* 'postoperative complications' nurs*
Nursing after ('robot-assisted' OR 'robotic-assisted') urology (prostatectomy OR cystectomy OR nephrectomy)
((DaVinci OR Versius OR Hugo-RAS OR Senhance OR Revo-I OR Avatera OR Hinotori)) AND (nurs*[Title/Abstract])
((("postoperative nursing"[Title/Abstract]) AND (robot-assisted[Title/Abstract])) AND (urology[Title/Abstract])) AND ((prostatectomy[Title/Abstract] OR nephrectomy[Title/Abstract] OR cystectomy[Title/Abstract]))

TABLE 2 Papers included in this review.

Study	Design	Sample	Findings
Yilin 2022	Prospective observational	65 patients undergoing RARP, 3-month follow-up	The incidence of post-operative LUTS at 3 months after surgery is similar to that of pre-operation. BMI is a predictor of LUTS
Gezginci 2015	Retrospective	534 patients undergoing RARP	Patients with previous operations, comorbidities and high ASA score are at risk of neuromuscular complications during RALP. Lower BMI and having an implant also lead to higher postoperative pain
Wang 2018	RCT	70 patients undergoing RARP	Continuing nursing care intervention had significant beneficial effects on urinary functions and quality of life in patients with prostate cancer after RARP
Brassetti 2023	Narrative review	NA	Technical features of DaVInci®, Senhance®, Revo-I®, Versius®, Avatera®, Hinotori® and Hugo™ RAS are presented
Farinha 2022	Narrative review	NA	Technical features of Senhance®, Revo-I®, and Versius® are presented
Salkowski 2023	Narrative review	NA	Technical features of Senhance®, Versius® and Versius® are presented
Alip 2022	Narrative review	NA	Technical features of da Vinci®, Avatera®, Hinotori®, Revo-i®, Senhance®, Versius® and Surgenius® are presented
Bakanoglu 2023	Narrative review	NA	The authors discuss postoperative education programs for radical cystectomy with orthotopic neobladder
Shah 2011	Prospective study	30 consecutive patients undergoing RARC	A 3-day postoperative pathway to discharge is presented, that includes no nasogastric tube, ambulation on postoperative day 0, clear liquids on day 1, then regular diet on passing flatus
Kocaçal 2020	Cross-sectional	54 patients undergoing RARP	The most common nursing diagnoses concerned 'risk management', 'elimination management', 'coping assistance', 'tissue perfusion management' and 'self-care facilitation'
Alhusseinawi 2023	RCT	98 patients undergoing RARP	RARP performed at low pneumoperitoneum pressure improves postoperative rpain, physical comfort and emotional state, compared to the standard pressure
Huang 2018[35]	Non-randomized pilot study	74 patients undergoing kidney surgery in two different positions	Low back pain and contralateral shoulder pain can be reduced by proper preoperative of the patients' position
Kaouk 2022	Retrospective	9 patients undergoing single-port transvesical partial prostatectomy for cancer	Postoperative complications were reported, with incidence and types comparable to those reported in the European guidelines[14]
Shukla 2021	Retrospective	12 patients undergoing single-port RARP	No complications were found after surgery
Rocco 2023	Case report	1 patient undergoing RARC	The first case of intracorporeal cystectomy with neobladder, performed with the HUGO™ RAS system, reporting trocar angles and intraoperative setup

Abbreviations: BMI, body mass index; LUTS, lower urinary tract symptoms; NA, not applicable; RARC, robot-assisted radical cystectomy; RARP, robot-assisted radical prostatectomy.

postoperative nursing during a hospital stay. Table 3 summarizes such characteristics.[31–34,37] The features strictly related to the surgeon (i.e. type of controllers, number of instruments used before discard) were omitted.

Another surgical system was found in the literature, called Surgenius®, but the article citing this robot[28] reported that commercialisation had not started yet. As can be seen from Table 3, all surgical systems have little differences in terms of instrument diameter; a difference might be expected between single- and multi-port platforms. However, the introduction of single-port robots is very recent; the literature reports preliminary experiences with radical prostatectomies[34] and renal surgery[35] without pointing out data that could be used to draw nursing consideration. As regards the intraoperative factors that can impact postoperative nursing, pain after surgery is related (other than to the incisions) to the pneumoperitoneum and the positions (i.e. extreme Trendelenburg) required by some operations. However, in the analysed literature, an intraperitoneal carbon dioxide pressure of 12 mmHg was deemed 'standard' for prostatectomy, and some author[32] even suggested 7 mmHg; the pressure does not differ much in the other types of urologic surgery considered in this review, and most of all, no distinction was found in the literature about the pressure required to operate with the different platforms. The patient's position on the operating table for robot-assisted urological surgery varies from supine to Trendelenburg, 90° lateral and 60° lateral without distinctions related to the surgical platform in the retrieved literature.[18]

TABLE 3 Characteristics of the robots potentially related to nursing aspects.

Model	Single port	Camera diameter (mm)	Instrument diameter (mm)	Instrument DoF	Multiquadrant surgery
DaVinci Xi	No	8	8	7	Yes
DaVinci SP	Yes	12	6	7	No
Versius	No	10	5	7	Yes
Dexter	No				Yes
Hugo-RAS	No	11	8	7	Yes
Senhance	No	10	10	7	Yes
			5	6	
			3	6	
Revo-I	No	10	7.4	7	No
Avatera Y	No	10	5	7	No
Hinotori Y	No	NA	NA	NA	No

Note: All marks are property of their respective owner(s).
Abbreviation: DoF, degrees of freedom; NA, not applicable.

4.2 | Radical cystectomy

The literature[19] points out patients' frailty as a paramount nursing issue across the whole hospital stay, as people undergoing demolitive surgery for bladder cancer are often aged and present with comorbidities. The literature offers insights about urinary diversions,[38] sometimes required in muscle-invasive bladder cancer when it is impossible to prepare a neobladder.[39] Immunonutrition, defined as the use of specific nutritional substrates called «immunonutrients» and having the ability to modulate mechanisms involved in several immune and inflammatory pathways, has been studied as an important intervention to foster prompt recovery after surgery.[40] Some authors[36] have reported the details of intraoperative setup with a recently introduced platform (HUGO™ RAS), including trocar angles and Trendelenburg; according to reference textbooks,[18] none of these characteristics seem to impact postoperative nursing.

4.3 | Radical prostatectomy

No evidence was found about the differences in postoperative nursing care of patients undergoing robot-assisted prostatectomy based on the different platforms. A paper regarding nursing diagnoses and NIC (Nursing Intervention Classification) intervention in patients undergoing radical prostatectomy was found,[31] which did not make any distinction based on the surgical machinery. The European guidelines[20] and other literature report a span of side effects related to pain, continence[41] and erection (these latter two are not considered during hospital stay) without making distinctions between different surgical platforms.

4.4 | Kidney surgery

No evidence was found about differences in the incidence of postoperative complications, potentially impacting nursing care, between different platforms. A meta-analysis[42] published in 2021 compared two surgical techniques for partial nephrectomy, finding shorter lengths of stay in patients operated with the retroperitoneal technique than those undergoing transperitoneal surgery. The mean difference was 0.5 days (95% CI [95% CI 0.25–0.77], $p = 0.0001$), which does not significantly impact postoperative nursing.

5 | CONCLUSION

The topics proposed by the available literature about postoperative nursing care are described in specialistic urologic nursing textbooks.[17,18] Such sources do not suggest changes in postoperative nursing principles based on the robotic platform adopted or the choice between traditional laparoscopy or robot-assisted surgery. Since the inception of the literature in Pubmed about urologic robotic surgery in 2006, an overwhelming amount of literature in other journals has investigated the postoperative outcomes of robotic surgery, with many authors reporting on the effects and advantages of robotic techniques. However, little has changed in the nursing care of inpatients undergoing the most common urologic operations.

Short-term and long-term outcomes of robotic surgery in urology have remained the same for nursing practice, as they are related to the anatomical nature of the operation instead of specific technologies.

The pathways of patients undergoing minimally invasive surgery share some common principles regarding the reduction of preoperative and postoperative fasting, reprise of nutrition and bowel function, and anticipated mobilization. These principles all aim for early discharge from the hospital and faster recovery. To this purpose, there is no difference in postoperative nursing of patients operated with the different robotic platforms currently available: the principles found in the literature, in scientific textbooks and the guidelines are the same, regardless of the type of robot used.

This conclusion has some important practical advantages for major robotic centres: intraoperative nursing with different platforms requires long training, as each platform has specific technical characteristics and uses dedicated equipment. This poses the need for stable nursing staff and a long training period; experiencing the same situation in postoperative care would be an important organizational difficulty, given the worldwide shortage of nurses. The literature included in this review allows us to conclude that the fundamental concepts of postoperative care in surgical inpatients stay the same no matter the robotic platform used. This enables the preparation of nursing protocols that can be used regardless of the technological advancements and choices of the health care facility.

As a final consideration, the surgical robot market is rapidly developing, as new platforms are being introduced and improved in a few years. For this reason, several platforms, which differ from those with a long history, have been recently introduced; studies are needed to elucidate the potential impact of their technical features on postoperative nursing.

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The authors declare no conflict of interest.

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