



Current status, evolution, and future perspectives in robotic platform systems for prostate cancer treatment: a narrative review

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Background and Objective: Robotic surgery has contributed greatly to the shift from traditional surgery to minimally invasive surgery. Urology is the major field of application of robotic surgery. Several urological procedures, especially radical prostatectomy, benefit from the use of robotic surgery.

Methods: Non-systematic research of the literature was performed using “Robot-assisted radical prostatectomy” and “Robotic platforms” as keywords to understand the actual situation and the future perspectives of this technology in prostate cancer treatment.

Key Content and Findings: The robotic platform landscape is constantly evolving. DaVinci has always been the mainstay in this field, particularly after the advent of the new single port platforms. New platforms are emerging, providing an alternative option to the well-known DaVinci system. Since in literature, few studies compare the use of different robotic platforms, their application in urological procedures is not yet widely used, for both oncological and non-oncological procedures. Furthermore, artificial intelligence begins to play a role in this landscape and could be useful for future developments. So further studies are warranted to give a full comprehension of the whole scenario.

Conclusions: This review aims to analyze the current state of the use of robotic platforms in urology, particularly in radical prostatectomy, and to understand the evolution.

Keywords: Radical prostatectomy; robot-assisted radical prostatectomy (RARP); robotic platforms; DaVinci systems

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Introduction

The advent of robot-assisted surgery has brought a revolutionary transformation in various surgical fields, especially in urology. Integrating robotic systems into urological procedures has been the leading step in embracing this technology. This innovation marks a significant shift toward minimally invasive surgery, offering

a range of advantages that were once beyond imagination (1).

The dexterity offered by robotic systems further elevates their effectiveness in urologic procedures. The robotic arms can replicate the natural movements of the human hand in a better way, with tremor reduction, enabling precise and controlled actions, particularly in confined spaces (2). So this heightened dexterity proves crucial in procedures where

fine motor skills are paramount, such as suturing and tissue manipulation (2).

As reported by the American Cancer Society, rates of incidence of prostate cancer showed an increase of 3 % annually from 2014 to 2019 (3). At the same time, prostate cancer is linked to higher rates of survival (nearly 97%) than other tumors (3). An earlier diagnosis, accurate screening programs, and the availability of more effective treatments lead to an improved prognosis for prostate cancer (4). Radical prostatectomy is one of the first-line treatments in patients with localized prostate cancer, alongside radiotherapy and active surveillance in selected patients (4). Particularly robot-assisted radical prostatectomy (RARP) has become the gold standard for radical prostatectomy wherever a robotic system is available, mostly for the benefits of its minimally invasive nature (5).

Partial nephrectomy, nephrectomy and cystectomy are increasingly performed with the use of robotic platforms showing how robotic systems have become integral in the urological procedures (1). The impact of robot-assisted surgery on urological outcomes is substantial. Research has indicated reduced blood loss, lower complication rates, and quicker patient recovery than traditional open surgeries (2). From the late 1980s, before the DaVinci® Era in the 2000s, ancestor platforms such as Probot® and PUMA 560 were described to outline historical perspective (6). Thus, new robotic competitors of Intuitive Surgical such as Senhance®, Revo-I®, Versius®, Avatera®, Hinotori®, and Hugo™ RAS were illustrated (6). Although DaVinci® had a high level of competitiveness, and for many years represented the most plausible option for robotic procedures, several modern platforms are emerging in the surgical market (6). Growing competition through unique features of the new robotic technologies might extend application fields, improve diffusion, and increase cost-effectiveness procedures (6). However, despite several new robotic platforms being released, currently the available studies that analyzed comparisons among those are limited.

This review aims to comprehend the current status, the evolving landscape of this transformative technology, and the future perspectives in robotic platform systems. We present this article in accordance with the Narrative Review reporting checklist (available at <https://cco.amegroups.com/article/view/10.21037/cco-24-47/rc>).

Methods

We performed non-systematic research of the literature in

January 2024 and updated it in March of the same year. The literature research was performed on PubMed (MEDLINE) and Web of Science using “Robot-assisted radical prostatectomy” and “Robotic platforms” as keywords. All the authors agreed on the main articles collected for each topic and a narrative review of the literature was performed.

Robotic platforms: the origins, the present and the future

Early robotic platforms and the actual situation

The first inclusion of robotics into surgical procedures goes back over 50 years (6). However, their practical implementation arose nearly the late 1980s. In urological fields, the first applications of robotic systems were used for trans-urethral resection of the prostate with the PUMA 560 (6). Since this platform was initially designed for neurosurgical biopsies, it led to the development of the PROBOT system (6).

Unfortunately PROBOT system itself presented several limits in trans-urethral resection prostate, such as difficult haemostasis of the prostatic fossa at the end of the procedure and because of the poor accuracy of three-dimensional reconstructions of the enlarged gland (6). So its use was addressed to other surgeries (orthopedic prosthetic surgery) and this guided to creation of ROBODOC, the first robot approved by the Food and Drugs Administration (FDA) (7).

However, neither the PROBOT platform nor ROBODOC was fit for urological procedures. So the Automated Endoscopic System for Optimal Positioning (AESOP) was designed to perform surgeries in a laparoscopic environment (2). The AESOP can be described as the early version of the current DaVinci system (2). *Figure 1* represents a schematic timeline with the main platforms with their year of approval.

In the year 2000, the DaVinci system obtained FDA approval for general laparoscopic procedures, obtaining the title of the first surgical robot employed in operations within the United States (6). The Vattikuti Institute of Detroit recorded the Vattikuti Institute prostatectomy, eventually recognized as the robotic-assisted prostatectomy, showcasing favorable outcomes (8). The first model of DaVinci consisted of three components: a patient cart, a surgeon console, a platform and an image system. The system's robotic arms were connected to the patient cart miming the movement of a human wrist. In 2002, DaVinci

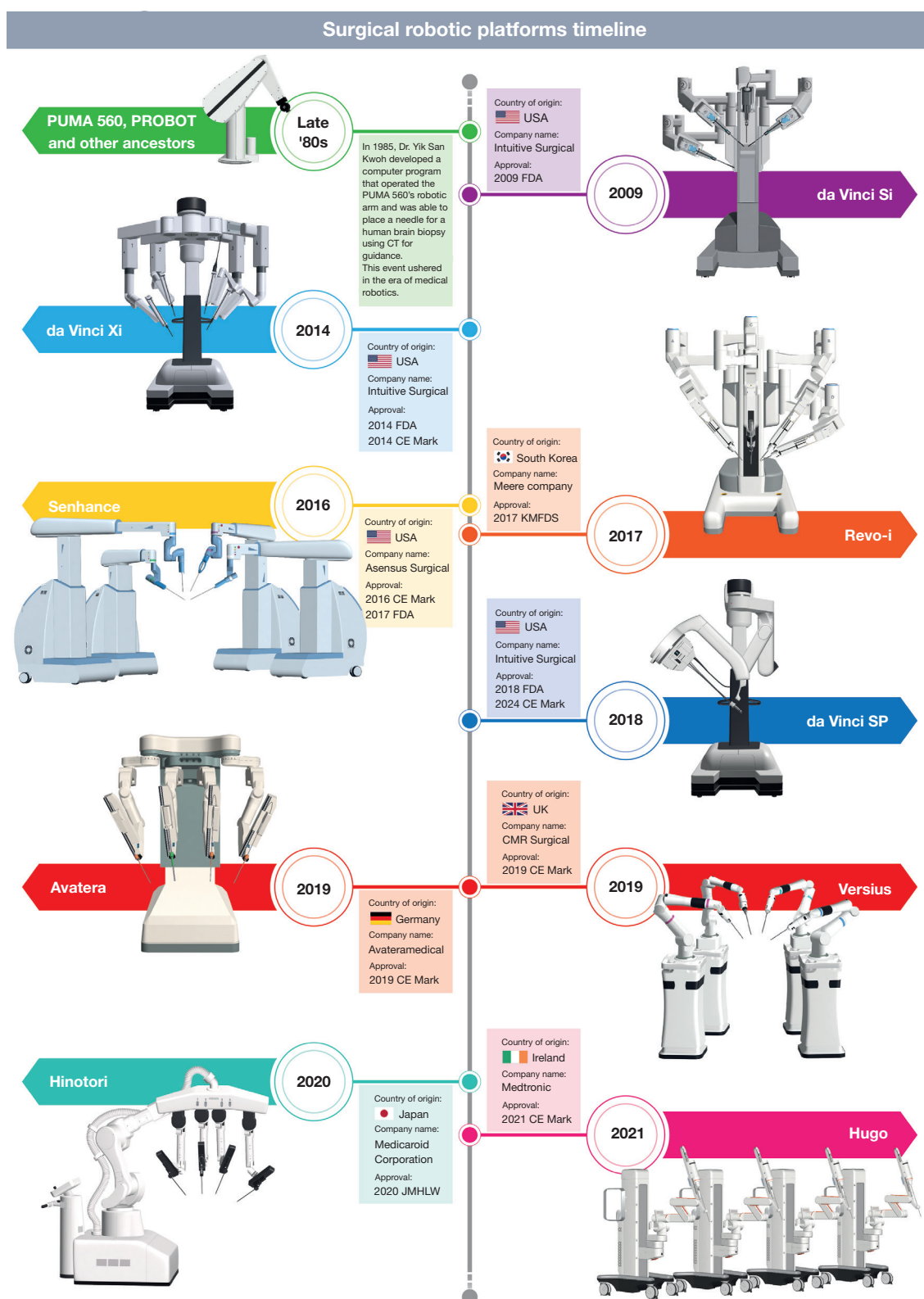


Figure 1 Main robotic platforms and their date of approval. FDA, Food and Drug Administration; KMFDs, Korea Ministry of Food and Drug Safety; JMHLW, Ministry of Health, Labour and Welfare of Japan; CE, Conformity European.

system released a new four-arm version with better control and exposure of anatomical structures. This platform allowed a decrease of tremors and provided a fine control for delicate maneuvers (5).

The DaVinci system can be recognized as well as the dominator of the scene, for this reason in the last years there was a dynamic fight by the other companies to give a reasonable competitor in the hands of the surgeons. In 2006, with the DaVinci S, a better perioperative view spread out thanks to a 3D camera with high resolution, added with a simplified configuration thanks to the touch screen display (9).

In 2009, the DaVinci SI gave the chance to have a second console surgery. Furthermore, this one benefited from fluorescence imaging by utilizing the Firefly technology, which enhanced the execution of the surgical procedure (9). In 2014, with the DaVinci Xi, a significant advancement was made in visualization technology, providing a 3D-HD view, and maximum mobility and flexibility during the surgical intervention (10). Its structure allows attachment from any angle and enables access to any quadrant of the patient. The four arms offer freedom of movement, improved access to the patient, and a reduction in external collisions (10,11). As a recent innovation, in June 2018, the FDA approved the DaVinci single port (SP) robotic platform for urological surgery (12). So in this scenario mostly occupied by DaVinci platforms, the new platforms of other robotic competitors deserve attention. The main competitors and their features are summarized in *Table 1*.

The Senhance® robotic system (Asensus Surgical, Durham, NC, USA), initially introduced in 2012 under the name TELELAP Alf-X, received approval in the United States in 2017. Comprising an open console and four separate modular robotic arms, the system allowed the use of standard laparoscopic trocars for introducing robotic instruments enabling a quick conversion to conventional laparoscopy in emergencies (6). Most instruments within the system have diameters ranging from 3 to 5 mm and are reusable. The system incorporates eye-tracking camera control and haptic feedback to enhance the surgeon's ability to perceive pressure and tension thresholds (6). Robotic docking time has been reported to vary between 3 to 10 minutes. The most frequently reported procedure for urology has been radical prostatectomy. Kulis *et al.* reported a study comparing extraperitoneal Senhance-assisted radical prostatectomies with the standard laparoscopic technique and found no differences in operative time, blood loss, positive surgical margins (PSMs), length of stay, or catheterization (14). Lin *et al.* enrolled 63 patients

who underwent radical prostatectomy with Senhance robotic platforms and compared with other 63 radical prostatectomies performed with DaVinci Xi (15). Blood loss, positive margin rates and other short-term post-operative data are analyzed as outcomes (15). Their result highlighted similar outcomes between the two groups, with less cost-effective for the Senhance group (15). While much of the literature on this system focuses on general surgery, colorectal surgery, and gynecology, various studies have explored its application in a broad spectrum of urologic procedures (16,17).

The Revo-I platform developed in Korea, obtained approval for human use after being safely used in several surgeries (partial nephrectomy, cholecystectomies, and Fallopian tube surgery) in preclinical studies in animal models (18-20). The use of this platform on human subjects is described by Chang *et al.* where it is used for radical prostatectomy in patients with localized prostate cancer (21). Revo-I is similar to the DaVinci (surgical console, patient cart with four arms and a high-definition vision cart) but has several technical problems. First of all the robot's arms are not sensitive enough to recognize instruments and one has to insert instruments repetitively to overcome this limitation (21). Second of all the scissors cut tissue less easily than the DaVinci, so this results in the need to prepare more scissors for the operating table (21). Moreover, the robot sometimes interrupts the operation if the speed of the surgeon's hand movements exceeds the safety speed chosen by the platform leading to a reduction in the surgeon's performance (21). Eventually, the size of the robot's arms is larger than DaVinci's and determines more precautions during use to minimize the risk of internal or external collusion (21). Engineers highlighted these limitations and solutions need to be found and designed for future versions (21). Alip *et al.* compared a Revo-I system arm with a DaVinci arm enrolling 33 patients for arm. A shorter hospitalization was reported for the Revo-I group (22).

The Versius surgical system is the new robotic platform designated to assist surgeons in performing various surgical procedures. Thomas *et al.* described successfully performing prostate and kidney surgeries on both cadavers and porcine models (23). This platform has surgical arms that simulate the shoulder, elbow and wrist joint mounted on a mobile cart. The surgeon interacts with the platform via a joystick and visual feedback on the surgeon console. The console's head-up display relays the three-dimensional video from the endoscopic camera together with a display overlay (6). The open console allows better communication

Table 1 Main robotic platforms and their main features (6,13)

Platform	Features	Visual	Console	Interface	Number of carts	Number of arms and trocars
DaVinci Si	Chance to have a second console surgery; firefly technology; tremor filtration	3D	Closed	Master-slave finger loops	1 cart	4 arms, 4 trocars
DaVinci Xi	Better visualizations technology than previous models; increase mobility and flexibility; tremor filtration	3D-HD	Closed	Master-slave finger loops	1 cart	4 arms, 4 trocars
DaVinci SP	Smaller overall field of view; increase coordination between the instruments and the camera; tremor filtration	3D-HD	Closed	Master-slave finger loops	1 cart	4 arms, 1 trocar
Senhance	Chance to use standard laparoscopic trocar; haptic feedback; eye sensing control	3D-HD	Opened	AR/VR controllers	4 carts	4 arms, 4 trocars
Revo-I	Multiuse instruments; with seven degrees of freedom	3D-HD	Closed	Master-slave finger loops	1 cart	4 arms, 4 trocars
Versius	Open console without pedal control; instruments with seven degrees of freedom	3D-HD	Opened	Controllers	4 carts	4 arms, 4 trocars
Avatera	Open console	3D-HD	Opened	Master-slave finger loops	1 cart	3 arms plus 1 for endoscopic instruments, 4 trocars
Hinotori	Instruments with eight degrees of freedom	3D-HD	Semi-closed	Master-slave finger loops	1 cart	4 arms, 4 trocars
Hugo	Pedal switch for camera, energetic source, additional arm; six articulation for increase freedom of movement	3D-HD, glasses for head-tracking	Opened	Pistol grip manipulator	4 carts	3–4 independent arms, 4 trocars

AR, augmented reality; VR, virtual reality; 3D, three dimensional; HD, high-definition.

between the surgeon and the team, enhancing practice and teaching (24). These promising results support the progression of the new system to further phases of development and exploration in clinical studies of renal and prostate surgery as per the IDEAL-D framework (25). To validate the use of Versius platforms performing radical prostatectomy, De Maria *et al.* reported their experience with a group of 18 patients. They recorded the median durations for setup, console, operation, and total surgery, as well as for bilateral pelvic lymphadenectomy (26). Particularly the patients exhibited promising recovery outcomes, including a high rate of continence at two months post-operation (26). This study highlighted how the Versius system could be safe, feasible and reproducible in performing RARP, toward its potential clinical adoption (26).

Also, Dibitetto *et al.* reported their experience of 53 patients underwent extraperitoneal RARP performed with this platform. They showed the safety, the effectiveness and also the versatility of this innovative system (27).

Avatera is a new platform, developed in Germany and approved in Europe in 2019 for minimally invasive laparoscopic surgery in urology and gynecology and its first utilization in clinical practice was in 2022 (28). The platform consists of three arms for single-use instruments and an additional arm for the endoscope (28). The console is open and equipped with 3D and full HD vision. The instruments are about 3–5 mm and with seven degrees of freedom (28). Since it's a relatively new platform, there is a lack of long-term studies to support its use. However, it would seem that it could become widespread thanks to the possibility of

Table 2 Comparison between the Hugo and DaVinci platform performing robot-assisted radical prostatectomy (33,35)

Similar oncological and functional outcomes
Similar intra-operative time
Better flexibility in arms movements for Hugo
Larger workspace for assistants for Hugo
Faster docking process for DaVinci

reducing costs in the long term (29). Avateramedical Group has been in clinical use at various European hospitals since spring 2022 and successfully used in nearly one hundred procedures. Adding to this, the Group, announces in the 10th of October 2023, that the competent local country in Erfurt opened insolvency proceedings on the operative subsidiaries for the restructuring of the companies. The situation is still being resolved and they said to be optimistic to find new investors to cooperation with them.

Hinotori was developed in Japan and approved in 2020. Tezuka production approved this name inspired by a manga written by Osamu Tezuka, who also had a medical license, agreeing with the concept of Medicaroid's robot: "a robot to serve and support humans rather than to replace humans" (30). The Hinotori surgical robot system consists of three components: the surgeon's control cabin, the operating unit, and the vision unit. The arms of the Operating Unit are designed to be as compact as human arms, which contributes to smoother operation because it reduces interference between arms or between an arm and an assistant (28). Hinata *et al.* performed radical prostatectomy using Hinotori platform. Their results showed that the procedure was safe and feasible (31). However further studies are required to confirm these data.

The Hugo Robot-Assisted Surgery (RAS) system developed by Medtronic in Minneapolis received approval in Europe for urologic and gynecologic surgical procedures after its first use in a clinical case in 2021 in Chile (28).

The platform consists of three or four arms for robotic surgery (28). Open console streamlines surgical team communication and maximizes your comfort while offering: 3D HD vision with specific glasses for head tracking technology; easy grip controllers to control instruments at a variety of scale; adjustability to each surgeon's preferences (28). Platform can benefit of task simulator enabling surgeons to learn and practice improving instrument and camera control, electrosurgery application, needle driving and suturing, movement and efficiency (28).

The Hugo RAS system could be applied in the field of minimally invasive urological surgery (32). Several studies have been published about the utilization of Hugo platform in urological procedures, such as nephrectomy and prostatectomy. Ragavan *et al.* performed three radical prostatectomy and showed absence of intra-operative and post-operative complications (33). Bravi *et al.* analyzed data from 542 patients undergoing prostatectomy RARP and lymphadenectomy at OLV (Belgium) hospital between 2021 and 2023 (34). All procedures were performed by six surgeons using DaVinci or Hugo, following no preference regarding platform use.

The aim of the study was to evaluate the perioperative and postoperative outcomes of patients undergoing RARP with both robotic platforms (34). The authors showed no difference in surgical and functional outcome between the robots (34). The two platforms were able to achieve similar outcome, suggesting that the introduction of Hugo RAS system is safe and allows for optimal outcomes after radical prostatectomy (34,35). The Hugo system, with its simple three arms configuration offers an easy docking process (36). Particularly, Prata *et al.* reported their experience which described off-clamp partial nephrectomy robot-assisted (RAPN) performed with Hugo RAS system. Their results showed feasible and safe practice with this simplified three-instrument configuration, with peri-operative outcomes similar to other robotic platforms (37).

Interestingly the Hugo RAS system was employed also for benign procedures such as pyeloplasties and simple radical prostatectomy (38,39). Particularly Rebuffo *et al.* reported their experience showing promising results for using Hugo RAS system (38). However further studies with longer follow-up are required to confirm its application in non-oncological procedures.

The Hugo RAS robot was largely compared to the DaVinci platforms in performing RARP, as is summarized *Table 2*.

However, there is no doubt that robotic technology costs are higher than other approaches. Further studies, like the one by He *et al.*, compared outcomes, including economic costs, between robotic-assisted and laparoscopic-assisted surgery (40). For individual patients economic costs are influenced by diagnosis and examination costs and at the same time, by operation cost, nursing cost, medical material cost, and drug cost (40). In the work of He *et al.*, the operation and nursing costs were found to be significantly lower in the robot-assisted surgery group than in the laparoscopic-assisted, while the medical material cost,

total hospitalization cost, and personal expenses were found to be higher in the robot-assisted group (40). According to these results the robot-assisted operation cannot completely replace the conventional laparoscopic operation in the short term in term of costs (40). However, some improvement could lead to break down these differences.

The advent of SP

Among the traditional and well-standardized multi-port approach, there is the use of new SP robotic platforms. The SP system consists of a single trocar that houses a flexible camera and three bi-articulated arms (41). Each arm corresponds to an instrument and occupies a position along the “clock” (3, 6, 9, and 12 o’clock). Every instrument is interchangeable and can move within the trocar independently of the others (42). Furthermore, the “clock” may be rotated to change the instrument deployment without requiring any exchange by the bedside assistant (42). Indeed the flexible camera is the most notable advancement from the prior multiport systems, but also the most distal point of articulation of the arms is located more proximally along the instrument than standard multi-port instruments (42). All these changes lead to a different geometry from the multiport systems. First of all, there is a smaller overall field of view (42). Second of all the ability to throw suture at a full 90°, such as the 6 o’clock stitch of the vesicourethral anastomosis in a radical prostatectomy, is limited by the more proximal distal point of articulation location (42). In the end multiple angulation points and the single point of entry reduce the lateral strength and range of motion of an instrument compared to the multi-port platform (42). As compensation of the smaller working area in the SP system, there is an increased coordination between the instruments and the camera (42). This is allowed by the presence of the “Navigator”. This new tool is a visual overlay for the surgeon that monitors the relative position of each instrument and camera in real time (42). Moreover, the surgeon can find the optimal position of the camera and the instruments during each surgical step thanks to the “Cobra mode” feature (42). Thanks to this increased coordination the surgeon can bypass the problem of a smaller field of work.

Over the past decade, single-site robotic prostatectomy has not been widely adopted (12). However, a few years ago (June 2018) the FDA approved the DaVinci SP system for urological procedures (12). With this recent approval, there has been a renewed interest in single site robotic-assisted prostatectomy and the comparison between this and the

multiport one. Several studies have been published on this topic. Lai *et al.* summarized the literature regarding patient outcomes for single site robotic-assisted prostatectomy and evaluate its role in surgical treatment of prostate cancer with the aim of investigating the feasibility and safety of SP platform performing radical prostatectomy (12). They considered several outcomes, such as operative times, estimated blood loss (mL), and hospital length of stay (days), but also the presence of intra-operative conversion to open surgery and intraoperative and postoperative complications (12). Their results highlighted that hospital stay, operative times and estimated blood loss are in line with previously published robotic prostatectomy series (12). According to this single-port techniques appear to represent a new alternative approach for performing minimally invasive radical prostatectomy (12). On the other hand among the potential advantages of this approach, there are a lower number of surgical sites, but also a better cosmesis and reduced pain (12). Although these parameters reflected a subjective opinion.

The group of Moschovas *et al.* published their work in which they compared multi-port *vs.* SP system in patients who underwent radical prostatectomy. In order to minimize influence of different pre-operative features on the outcomes in exam they enrolled patients with same pre-operative characteristics (41). Their evidences underlined the absence of a clinically significant difference between the two groups regarding post operative pain (41). Moreover, they noticed limits of the use of SP in patients with higher BMI or previous abdominal surgery. This finds explanation in the need of extra trocars for a laparoscopic approach for performing an adhesion lysis (41). Also this means a longer operative time for the SP group without demonstration of clinically significant differences (41).

The group of Dobbs *et al.* reported their single centre experience of the use of SP not only for radical prostatectomies but also for other procedures, such as nephrectomies and partial nephrectomies (42). They analyzed the post operative outcomes and reported their results. Among their 45 cases reported there were two cases with major complications which needed reoperation. These patients underwent a SP nephrectomy and a SP vaginoplasty (42). This rate of complication finds an explanation both in the heterogeneity of the cases reported as well as the initial phase of the learning curve of surgeons (42).

Recently Franco *et al.*, in their work, collected the evidences and the outcomes of SP radical prostatectomy (43). As for the multiport systems they described different

approaches for the SP system with the transperitoneal at first place (43). This one is the most familiar for multi-port radical prostatectomies, so it was the one initially preferred for the SP system, too (43). Extraperitoneal approach in multi-port systems has always been described with a limited work of space (43). But SP can overcome this problem and can allow the use of this approach (43). Few studies have compared these two different approaches in SP radical prostatectomies. The works of Kaouk *et al.* and Abou Zeinab *et al.* investigate the differences between SP transperitoneal *vs.* SP extraperitoneal radical prostatectomy (44,45). For Kaouk *et al.*, the extraperitoneal approach has some advantages such as a shorter hospital stay and a decreased need for postoperative narcotics (44). Zeinab *et al.* confirmed this finding with a little difference about the operative time, which is found to be longer than the transperitoneal (45). However, the extraperitoneal approach is connected to a major absorption of CO₂ than transperitoneal, which can cause hypercapnia in rare cases (45). The group of Kaouk *et al.* also described an early experience for SP transvesical radical prostatectomy (44). In these approaches, many benefits can be described. First of all, the bladder could not be stressed by unnecessary dissection or mobilization (44). Second of all the bowel could remain untouchable (44). At the end, there is no need for Trendelenburg position and the absorption of CO₂ is minimum (43). However, there could be some limits to the use of this approach such as bladder diseases (43).

The aim of preserving as far as possible urinary continence justifies the widespread of another approach: the Retzius sparing approach. Galfano *et al.* introduced this technique in 2010 (46). This is focused on preserving the natural pelvic anatomy and the structures implicated in urinary continence such as the detrusor apron and the striated sphincter (46). Balasubramanian *et al.* described a Retzius Sparing SP radical prostatectomy (47). Compared to the SP transperitoneal and SP extraperitoneal, the Retzius-sparing SP radical prostatectomy seems to have similar peri- and post-operative outcomes (47). Several studies have investigated the rate of urinary continence after radical prostatectomy with Retzius sparing approach. The group of Egan *et al.* enrolled 70 patients and they observed continence a 12 months in the 95% of their cohort (48). However, this approach has its limitations such as an intrinsic difficulty when the prostate is large or a higher possibility of PSMs for anterior tumors (43). In a randomized control trial Menon *et al.* compared the Retzius sparing arm with an anterior radical prostatectomy arm.

Their results confirmed a higher rate of urinary continence in the Retzius sparing arm (at 6 months 96% *vs.* 74%) (49). On the another hand they observed quite the opposite about the rate of PSMs (49). Particularly in the Retzius sparing arm PSM rate was 25%, while in the anterior arm was about 13% (49). However, the need of a long-term follow-up is required in order to consolidate the promising outcomes about urinary continence of this approach.

Lately a new technique was proposed: the “Hood Sparing” technique. Wagaskar *et al.* wanted to emulate the Retzius sparing approach with the hopeful aim to reduce the incidence of PSM (50). They proposed an anterior approach when the preserved anterior tissue following prostate removal has a “hood” appearance. The preserved tissue includes detrusor apron, endopelvic fascia, and puboprostatic ligaments in order to guarantee support to the membranous urethra, external sphincter, and vesicourethral anastomosis (50). Their series included 300 patients and the rate of continence was 83% at 1 month (50). Shimmura *et al.* adopted this technique and reported similar results with a rate of 69.1% of urinary continence at 1 month (51). While the rates of PSM were respectively 6% for Wagaskar and 16% for Shimmura (50,51). However, the lack of randomized controlled trials did not allow to obtain an accurate evolution of the efficacy of these two new approaches.

Li *et al.* described a full comparison including the different approaches in SP radical prostatectomy (52). In terms of peri e post-operative outcomes the results did not have significant differences, but they highlighted that in patients of the SP groups the hospital stay was shorter and the use of post-operative narcotics was lower (52). Moreover, cosmetic advantage was classified as major advantage (52). While the costs of the prostatectomy itself was similar between MP and SP system, the shorter hospital stay of the SP group could reduce the burden of this expensive surgery (43), as reported by Lenfant *et al.* in their single centre experience (53). Since currently most of all the series published are single centre experiences randomized trials with long-term follow-up monitoring the learning curves of surgeons required (12).

All the relevant papers using are summarized in *Table 3*.

The role of artificial intelligence (AI) and future perspectives

Lately, AI has gained popularity across several fields, including surgery. Surgery is one of the medical specialties which generates very large datasets that can be processed in

Table 3 Main relevant papers

Author	Title	Year	Specialty	Number of patients	Platform	Intervention	Conclusions
Kulis <i>et al.</i> (14)	Comparison of extraperitoneal laparoscopic and extraperitoneal Senhance radical prostatectomy	2022	Urology	168	Senhance	RARP	Senhance robot-assisted RP is safe, feasible and offers comparable functional and oncological outcomes to laparoscopy
Chang <i>et al.</i> (21)	Retzius-sparing robot-assisted radical prostatectomy using the Revo-I robotic surgical system: surgical technique and results of the first human trial	2018	Urology	17	Revo-I	RARP	Good peri-operative, early oncological and continence outcomes in patient underwent RARP with Revo-I
Alip <i>et al.</i> (22)	Comparing Revo-I and Da Vinci in Retzius-Sparing Robot-Assisted Radical Prostatectomy: A Preliminary Propensity Score Analysis of Outcomes	2022	Urology	33	Revo-I	RARP	Revo-I robot-assisted radical prostatectomy had equivalent short-term oncologic outcomes with the DaVinci standard
Lin <i>et al.</i> (15)	Comparison of senhance and da vinci robotic radical prostatectomy: short-term outcomes, learning curve, and cost analysis	2024	Urology	63	Senhance	RARP	Senhance system may serve as a safe and effective alternative for robotic RP, with a more affordable price as its biggest advantage
De Maria <i>et al.</i> (26)	Versius robotic surgical system: case series of 18 robot-assisted radical prostatectomies	2023	Urology	18	Versius	RARP	Performing RARP using the Versius system is feasible, safe, and easily reproducible
Dibitetto <i>et al.</i> (27)	Extraperitoneal robot assisted laparoscopic prostatectomy with Versius system: single centre experience	2024	Urology	53	Versius	RARP	Show the safety, the effectiveness and also the versatility of this innovative system
Hinata <i>et al.</i> (31)	Hinotori Surgical Robot System, a novel robot-assisted surgical platform: Preclinical and clinical evaluation	2022	Urology	30	Hinotori	RARP	The safety of the newly developed Hinotori surgical system was shown in the present preclinical and clinical studies
Ragavan <i>et al.</i> (33)	Robot-Assisted Laparoscopic Radical Prostatectomy Utilizing Hugo RAS Platform: Initial Experience	2023	Urology	34	Hugo-RAS	RARP	Hugo RAS platform is a safe robotic system for pelvic procedures such as radical prostatectomy, provides comparable results with existing robotic systems, and is a good addition to the existing arsenal of surgical robots

Table 3 (continued)

Table 3 (continued)

Author	Title	Year	Specialty	Number of patients	Platform	Intervention	Conclusions
Bravi <i>et al.</i> (34)	Robot-assisted Radical Prostatectomy Performed with Different Robotic Platforms: First Comparative Evidence Between Da Vinci and HUGO Robot-assisted Surgery Robots	2024	Urology	542	Hugo-RAS	RARP	Among patients receiving RARP with DaVinci or Hugo RAS surgical platforms no differences were found in surgical and functional outcomes between the robots
Moschovas <i>et al.</i> (41)	Comparison between intra- and postoperative outcomes of the da Vinci SP and da Vinci Xi robotic platforms in patients undergoing radical prostatectomy	2023	Urology	1,857	SP	RARP	Similar clinical outcomes between SP and multiport
Li <i>et al.</i> (52)	Perioperative and Oncologic Outcomes of Single-Port vs. Multiport Robot-Assisted Radical Prostatectomy	2022	Urology	1,239	SP	RARP	SP-RARP is associated with a shorter hospital stay and catheterization time, and the need for postoperative pain medication is lower compared to MP-RARP, with comparable perioperative, functional, and oncologic outcomes

RARP, robot-assisted radical prostatectomy; RP, radical prostatectomy; SP, single port; MP, multi-port; RAS, robot-assisted surgery.

detail and depth by AI (54).

Firstly the application of AI in urologic surgery was used for evaluating possible outcomes in patients who are going to undergo surgery robot-assisted, especially RARP (54). In 2018, AI was used to evaluate surgical performance during radical prostatectomy. A machine learning algorithm was employed in order to predict the length of hospital stay. So Hung *et al.* with this algorithm achieved a rate of accuracy of 88.5% (55). From this initial experience AI started to be employed in evaluating clinical outcomes and objectively assessing surgical experience. Schuler *et al.* applied a machine learning algorithm generated from robotic objective performance indicators, video-based surgical gestures, and model-based force sensors to a group of 35 urologists (56). Their aim was to predict surgeon caseload and expertise in nerve-sparing radical prostatectomy robot-assisted (56). Their rate of accuracy in predicting surgeon experience was notably about 96% (56).

On the other hand, AI could be useful for judging surgeons and for helping with training and optimizing their formation. Machines can develop a human-like understanding of various aspects of images and videos with the help of computer vision, which is a field of AI (57).

Through computer vision, machines can learn information from visual data in a way that resembles human learning. Assigning specific informative labels to different aspects of a video is known as video labeling. This process is utilized in machine learning and for the development of computer vision, where machines can make use of these labels (57). Every surgeon could improve his surgical skills thanks to different tools during the traineeship. Pieces of evidence support the utilization of video-based educational interventions in the education of surgeons (57).

Since the use of robotic platforms is increasingly growing in the surgical, especially urological, field, the presence of similar growth in the training standard is required. The training programs aim to provide generic and specialty-related skills, which include both laparoscopic skills and comprehension of the hardware and software of robotic systems (58). Intuitive surgical has its online training program for their surgical systems, the DaVinci technology training pathway (58). American centres planned the robotic training network (RTN) to improve robotic skills of the surgeons (58). However, long-term studies about how any of these programs could lead to better surgical outcomes are missing.

Particularly The European Association of Urology (EAU) Robotic Urology Section (ERUS) proposed the ‘Robotic Curriculum’ (RC) as a comprehensive training framework that addresses all aspects of a robust training program, validated to train surgeons to perform RARP (59). This training program involves key steps being performed *in vivo* under supervision (59).

Indeed, as data from The European Association of Urology showed, surgeons with limited robotic experience could improve their skills thanks to this 12-week structured training program including simulation-based training and mentored training in the operating room. Moreover, surgeons learn how to perform robot-assisted radical prostatectomy with a better confidence of every surgical step (59). However, there is a lack of long-term evidence to support its validity.

Furthermore, the arrangement of a video dataset in a cloud storage network and its division into the various steps of the procedure can serve research purposes and enhance the efficiency of post-operative review of a surgeon’s performance (57). Since video labeling could be so helpful, Cheikh Youssef *et al.* In their work investigated how a novice student, with anatomical knowledge, could perform video labelling of radical prostatectomy (57). They recorded 25 RARP performed with Da Vinci Si HD dual console system and with the transperitoneal approach (57). Videos were segmented and principal operative steps, previously defined by a review of literature, were highlighted. After adequate instructions about video-labeling novice student could be able to access the video, previously randomly chosen among all (57). Their results showed an average of over 90% accuracy in the time stamping and video labelling of the procedural steps. It was shown that a beginner student could be trained to accurately label and segment surgical videos in a short period of time (57). However, the accuracy was not the same for all the steps, with a lower accuracy for the bladder neck transection passage (57).

Eventually, AI could develop algorithms that can enhance robotic platforms. Surgeons could benefit from the capability of the robotic real-time recognize different situations and adapt in real time (60).

Conclusions

Robotic surgery dominates most of all urological procedures, especially radical prostatectomy. This surgery underwent several modifications and updates in the last decades, with the widespread of different approaches. In this

scenario, DaVinci system is the pillar platform, but not the only one. With the advent of new platforms, the choice of the most feasible system became harder and harder. In this article we tried to give a point of view on the current status of robotic platforms systems for prostate cancer treatment. However, this work has several limits. First of all, this is a non-systematic review. Furthermore, it is mainly based on retrospective studies. In the field of mini-invasively urologic procedures robotic platforms have increasingly employed for different kinds of surgery, such as nephrectomy, cystectomy and prostatectomy.

Eventually, our work is focused on radical prostatectomy, which we are aware is a small piece of the field of use.

In addition to this, a clear comparison between all of the systems could be necessary. The feedback of the surgeons and the clinical outcomes have a pivotal role in the categorization of all the new entries. So further studies, randomized controlled trials, are warranted to allow a responsible choice of one platform instead one another. Moreover, the future of robotic surgery is deeply connected with the advent of AI. AI could be helpful both for evaluating possible outcomes and improving the surgical procedures, but could contribute to the formation and training of surgeons. However, further studies are warranted to find the perfect way to exploit all the possible benefits.

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Footnote

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References

1. Franco A, Ditunno F, Manfredi C, et al. Robot-assisted Surgery in the Field of Urology: The Most Pioneering Approaches 2015-2023. *Res Rep Urol* 2023;15:453-70.
2. Mjaess G, Orecchia L, Albisinni S. New robotic platforms for prostate surgery: the future is now. *Prostate Cancer Prostatic Dis* 2023;26:519-20.
3. Siegel RL, Miller KD, Wagle NS, et al. Cancer statistics, 2023. *CA Cancer J Clin* 2023;73:17-48.
4. Marchioni M, Primiceri G, Castellan P, et al. Conservative management of urinary incontinence following robot-assisted radical prostatectomy. *Minerva Urol Nefrol* 2020;72:555-62.
5. Coughlin GD, Yaxley JW, Chambers SK, et al. Robot-assisted laparoscopic prostatectomy versus open radical retropubic prostatectomy: 24-month outcomes from a randomised controlled study. *Lancet Oncol* 2018;19:1051-60.
6. Brasseti A, Ragusa A, Tedesco F, et al. Robotic Surgery in Urology: History from PROBOT(®) to HUGO(TM). *Sensors (Basel)* 2023;23:7104.
7. Paul HA, Bargar WL, Mittlestadt B, et al. Development of a surgical robot for cementless total hip arthroplasty. *Clin Orthop Relat Res* 1992;(285):57-66.
8. Tewari A, Menon M. Vattikuti Institute prostatectomy: surgical technique and current results. *Curr Urol Rep* 2003;4:119-23.
9. Hellan M, Spinoglio G, Pigazzi A, et al. The influence of fluorescence imaging on the location of bowel transection during robotic left-sided colorectal surgery. *Surg Endosc* 2014;28:1695-702.
10. Freschi C, Ferrari V, Melfi F, et al. Technical review of the da Vinci surgical telemanipulator. *Int J Med Robot* 2013;9:396-406.
11. Gosrisirikul C, Don Chang K, Raheem AA, et al. New era of robotic surgical systems. *Asian J Endosc Surg* 2018;11:291-9.
12. Lai A, Dobbs RW, Talamini S, et al. Single port robotic radical prostatectomy: a systematic review. *Transl Androl Urol* 2020;9:898-905.
13. Peters BS, Armijo PR, Krause C, et al. Review of emerging surgical robotic technology. *Surg Endosc* 2018;32:1636-55.
14. Kulis T, Hudolin T, Penezic L, et al. Comparison of extraperitoneal laparoscopic and extraperitoneal Senhance radical prostatectomy. *Int J Med Robot* 2022;18:e2344.
15. Lin YC, Yuan LH, Tseng CS, et al. Comparison of senhance and da vinci robotic radical prostatectomy: short-term outcomes, learning curve, and cost analysis. *Prostate Cancer Prostatic Dis* 2024;27:116-21.
16. Melling N, Barr J, Schmitz R, et al. Robotic cholecystectomy: first experience with the new Senhance robotic system. *J Robot Surg* 2019;13:495-500.
17. McKechnie T, Khamar J, Daniel R, et al. The Senhance Surgical System in Colorectal Surgery: A Systematic Review. *J Robot Surg* 2023;17:325-34.
18. Kim DK, Park DW, Rha KH. Robot-assisted Partial Nephrectomy with the REVO-I Robot Platform in Porcine Models. *Eur Urol* 2016;69:541-2.
19. Lim JH, Lee WJ, Park DW, et al. Robotic cholecystectomy using Revo-i Model MSR-5000, the newly developed Korean robotic surgical system: a preclinical study. *Surg Endosc* 2017;31:3391-7.
20. Abdel Raheem A, Troya IS, Kim DK, et al. Robot-assisted Fallopian tube transection and anastomosis using the new REVO-I robotic surgical system: feasibility in a chronic porcine model. *BJU Int* 2016;118:604-9.
21. Chang KD, Abdel Raheem A, Choi YD, et al. Retzius-sparing robot-assisted radical prostatectomy using the Revo-i robotic surgical system: surgical technique and results of the first human trial. *BJU Int* 2018;122:441-8.
22. Alip S, Koukourikis P, Han WK, et al. Comparing Revo-i and da Vinci in Retzius-Sparing Robot-Assisted Radical Prostatectomy: A Preliminary Propensity Score Analysis of

- Outcomes. *J Endourol* 2022;36:104-10.
23. Thomas BC, Slack M, Hussain M, et al. Preclinical Evaluation of the Versius Surgical System, a New Robot-assisted Surgical Device for Use in Minimal Access Renal and Prostate Surgery. *Eur Urol Focus* 2021;7:444-52.
 24. Hares L, Roberts P, Marshall K, et al. Using end-user feedback to optimize the design of the Versius Surgical System, a new robot-assisted device for use in minimal access surgery. *BMJ Surg Interv Health Technol* 2019;1:e000019.
 25. Sedrakyan A, Campbell B, Merino JG, et al. IDEAL-D: a rational framework for evaluating and regulating the use of medical devices. *BMJ* 2016;353:i2372.
 26. De Maria M, Meneghetti I, Mosillo L, et al. Versius robotic surgical system: case series of 18 robot-assisted radical prostatectomies. *BJU Int* 2024;133:197-205.
 27. Dibitetto F, Fede Spicchiale C, Castellucci R, et al. Extraperitoneal robot assisted laparoscopic prostatectomy with Versius system: single centre experience. *Prostate Cancer Prostatic Dis* 2024;27:323-6.
 28. Salkowski M, Checcucci E, Chow AK, et al. New multiport robotic surgical systems: a comprehensive literature review of clinical outcomes in urology. *Ther Adv Urol* 2023;15:17562872231177781.
 29. Liatsikos E, Tsaturyan A, Kyriazis I, et al. Market potentials of robotic systems in medical science: analysis of the Avatera robotic system. *World J Urol* 2022;40:283-9.
 30. Medicaroid's hinotori Surgical Robot System approved in Japan. [Cited 27 March 2024]. Available online: <http://surgrob.blogspot.com/2020/08/medicaroids-hinotori-surgical-robot.html>
 31. Hinata N, Yamaguchi R, Kusuhara Y, et al. Hinotori Surgical Robot System, a novel robot-assisted surgical platform: Preclinical and clinical evaluation. *Int J Urol* 2022;29:1213-20.
 32. Prata F, Ragusa A, Anceschi U, et al. Three-arms off-clamp robot-assisted partial nephrectomy with the new Hugo robot-assisted surgery system. *BJU Int* 2024;133:48-52.
 33. Ragavan N, Bharathkumar S, Chirravur P, et al. Robot-Assisted Laparoscopic Radical Prostatectomy Utilizing Hugo RAS Platform: Initial Experience. *J Endourol* 2023;37:147-50.
 34. Bravi CA, Balestrazzi E, De Loof M, et al. Robot-assisted Radical Prostatectomy Performed with Different Robotic Platforms: First Comparative Evidence Between Da Vinci and HUGO Robot-assisted Surgery Robots. *Eur Urol Focus* 2024;10:107-14.
 35. Balestrazzi E, Paciotti M, Piro A, et al. Comparative analysis of robot-assisted simple prostatectomy: the HUGO™ RAS system versus the DaVinci® Xi system. *Prostate Cancer Prostatic Dis* 2024;27:122-8.
 36. Prata F, Ragusa A, Civitella A, et al. Robot-assisted partial nephrectomy using the novel Hugo™ RAS system: Feasibility, setting and perioperative outcomes of the first off-clamp series. *Urologia* 2024;91:372-8.
 37. Prata F, Raso G, Ragusa A, et al. Robot-Assisted Renal Surgery with the New Hugo Ras System: Trocar Placement and Docking Settings. *J Pers Med* 2023;13:1372.
 38. Rebuffo S, Ticonosco M, Ruvolo CC, et al. Robot-Assisted Pyeloplasty with HUGO™ Robotic System: Initial Experience and Optimal Surgical Set-Up at a Tertiary Referral Robotic Center. *J Endourol* 2024;38:323-30.
 39. Piro A, Piramide F, Balestrazzi E, et al. Initial Experience of Robot-Assisted Simple Prostatectomy with Hugo Robot-Assisted Surgery System: Step-by-Step Description of Two Different Techniques. *J Endourol* 2023;37:1021-7.
 40. He S, Weng Y, Jiang Y. Robot-assisted radical resection in prostate cancer comparative assessment with conventional laparoscopic prostatectomy: a retrospective comparative cohort study with single-center experience. *Transl Androl Urol* 2022;11:1729-34.
 41. Moschovas MC, Loy D, Patel E, et al. Comparison between intra- and postoperative outcomes of the da Vinci SP and da Vinci Xi robotic platforms in patients undergoing radical prostatectomy. *J Robot Surg* 2023;17:1341-7.
 42. Dobbs RW, Halgrimson WR, Talamini S, et al. Single-port robotic surgery: the next generation of minimally invasive urology. *World J Urol* 2020;38:897-905.
 43. Franco A, Pellegrino AA, De Nunzio C, et al. Single-Port Robot-Assisted Radical Prostatectomy: Where Do We Stand? *Curr Oncol* 2023;30:4301-10.
 44. Kaouk J, Aminsharifi A, Wilson CA, et al. Extraperitoneal versus Transperitoneal Single Port Robotic Radical Prostatectomy: A Comparative Analysis of Perioperative Outcomes. *J Urol* 2020;203:1135-40.
 45. Abou Zeinab M, Beksac AT, Ferguson E, et al. Single-port Extraperitoneal and Transperitoneal Radical Prostatectomy: A Multi-Institutional Propensity-Score Matched Study. *Urology* 2023;171:140-5.
 46. Galfano A, Ascione A, Grimaldi S, et al. A new anatomic approach for robot-assisted laparoscopic prostatectomy: a feasibility study for completely intrafascial surgery. *Eur Urol* 2010;58:457-61.

47. Balasubramanian S, Shiang A, Vetter JM, et al. Comparison of Three Approaches to Single-Port Robot-Assisted Radical Prostatectomy: Our Institution's Initial Experience. *J Endourol* 2022;36:1551-8.
48. Egan J, Marhamati S, Carvalho FLF, et al. Retzius-sparing Robot-assisted Radical Prostatectomy Leads to Durable Improvement in Urinary Function and Quality of Life Versus Standard Robot-assisted Radical Prostatectomy Without Compromise on Oncologic Efficacy: Single-surgeon Series and Step-by-step Guide. *Eur Urol* 2021;79:839-57.
49. Menon M, Dalela D, Jamil M, et al. Functional Recovery, Oncologic Outcomes and Postoperative Complications after Robot-Assisted Radical Prostatectomy: An Evidence-Based Analysis Comparing the Retzius Sparing and Standard Approaches. *J Urol* 2018;199:1210-7.
50. Wagaskar VG, Mittal A, Sobotka S, et al. Hood Technique for Robotic Radical Prostatectomy-Preserving Periurethral Anatomical Structures in the Space of Retzius and Sparing the Pouch of Douglas, Enabling Early Return of Continence Without Compromising Surgical Margin Rates. *Eur Urol* 2021;80:213-21.
51. Shimmura H, Banno T, Nakamura K, et al. A single-center retrospective comparative analysis of urinary continence in robotic prostatectomy with a combination of umbilical ligament preservation and Hood technique. *Int J Urol* 2023;30:889-95.
52. Li K, Yu X, Yang X, et al. Perioperative and Oncologic Outcomes of Single-Port vs Multiport Robot-Assisted Radical Prostatectomy: A Meta-Analysis. *J Endourol* 2022;36:83-98.
53. Lenfant L, Sawczyn G, Kim S, et al. Single-institution Cost Comparison: Single-port Versus Multiport Robotic Prostatectomy. *Eur Urol Focus* 2021;7:532-6.
54. Moglia A, Georgiou K, Georgiou E, et al. A systematic review on artificial intelligence in robot-assisted surgery. *Int J Surg* 2021;95:106151.
55. Hung AJ, Chen J, Che Z, et al. Utilizing Machine Learning and Automated Performance Metrics to Evaluate Robot-Assisted Radical Prostatectomy Performance and Predict Outcomes. *J Endourol* 2018;32:438-44.
56. Schuler N, Shepard L, Saxton A, et al. Predicting Surgical Experience After Robotic Nerve-sparing Radical Prostatectomy Simulation Using a Machine Learning-based Multimodal Analysis of Objective Performance Metrics. *Urol Pract* 2023;10:447-55.
57. Cheikh Youssef S, Hachach-Haram N, Aydin A, et al. Video labelling robot-assisted radical prostatectomy and the role of artificial intelligence (AI): training a novice. *J Robot Surg* 2023;17:695-701.
58. Sinha A, West A, Vasdev N, et al. Current practises and the future of robotic surgical training. *Surgeon* 2023;21:314-22.
59. Volpe A, Ahmed K, Dasgupta P, et al. Pilot Validation Study of the European Association of Urology Robotic Training Curriculum. *Eur Urol* 2015;68:292-9.
60. De Backer P, Van Praet C, Simoens J, et al. Improving Augmented Reality Through Deep Learning: Real-time Instrument Delineation in Robotic Renal Surgery. *Eur Urol* 2023;84:86-91.

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