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Review

# SENHANCE ROBOTIC RADICAL PROSTATECTOMY

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ABSTRACT: Since its introduction 20 years ago, robotic radical prostatectomy has become a standard of care in the treatment of localized prostate cancer in many Centers. Until recently, they have all been performed by the only available robotic platform. Senhance is a novel robotic platform that was approved for clinical use. The term Senhance was used to systematically search PubMed and Scopus databases for relevant articles that were afterward filtered for appropriate designs and data reports. There were two reports that met all of the criteria and were included in the review. Both studies were designed as prospective case series with a total of 234 patients where the data including operative data and oncological outcomes were reported. The average operative time ranged between 180 and 195 min, with estimated blood loss between 250 and 300 mL. There was 3 Clavien - Dindo grade III, and 1 Clavien - DIndo grade IV complication reported. One of the studies compared it with laparoscopy, but no significant difference in operative time and blood loss was found. Both studies concluded that the Senhance is a feasible and safe robotic platform for radical prostatectomy.

Key words: *Senhance; Robotic prostatectomy: Prostate cancer*

## Introduction

Prostate cancer is the second most common malignant neoplasm in the world among men, with the incidence slightly lower than lung cancer (1). Its mortality rate is noticeably lower when compared to other cancers such as lung, colorectal and liver cancers because of its biological behavior, early diagnosis and effective treatment options (1). Radical prostatectomy (RP) is the optimal treatment option for many patients with localized prostate cancer. The first robotic radical prostatectomy (RRP) was performed twenty years ago, marking a new era of minimally invasive surgery in urology (2). Robotic surgery offers all the benefits of minimally invasive surgery providing non-inferior oncological outcomes when compared to open surgery. On the other hand, in the hands of an experienced surgeon, it can offer a lower rate of postoperative incontinence and erectile dysfunction (3). Until recently, all RRP were performed using only one available system, the DaVinci Surgical System.

Senhance Surgical System is a novel robotic system currently used in five European centers for robotic radical prostatectomy and other procedures (4-7). It has an ergonomic open-console platform, with technological features such as haptic feedback, 4K-3D-vision, and eye-tracking camera control. The platform itself has proven to be safe, reliable and applicable in a variety of urological operations, with a rather steep learning curve among surgeons with laparoscopic experience (4, 7). After the introduction of this novel

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robotic platform, it was mainly used for less demanding abdominal and gynecological procedures (8, 9). In 2019, the two Centers published their initial results on the usage of Senhance in urologic surgery, with the main focus on safety and feasibility for radical prostatectomy (10, 11).

The goal of this study is to review the literature dealing with the application of the Senhance robotic platform in radical prostatectomy and to compare oncological and functional results.

## Methods

This review of the literature was structured and written following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement (PRISMA) (12). A systematic search of PubMed and Scopus databases using the keyword "Senhance" in the title, keywords and abstract was performed. All full-text articles reporting the use of Senhance for radical prostatectomy, with reported patient data, operative and oncological outcomes were included. The exclusion criteria excluded the articles reporting on the use of Senhance in procedures other than radical prostatectomy. and duplicated reports as well as consecutive reports from the same series. A flow diagram is presented in Figure 1. The analysis and evaluation of articles eligible for the review were conducted by three authors, independently.

The preoperative data reported in all selected publications were patient age, PSA, clinical stage before radical prostatectomy and biopsy Gleason score. Intraoperative data included operative time and estimated blood loss. Postoperative data provided the information about the duration of hospital stay and catheterization, pathological stage including Gleason score and the number and positivity of lymph nodes, surgical margins status and complications graded in accordance with Clavien-Dindo classification (13). All of the above-mentioned data were extracted and summed up in tables for better clarity.

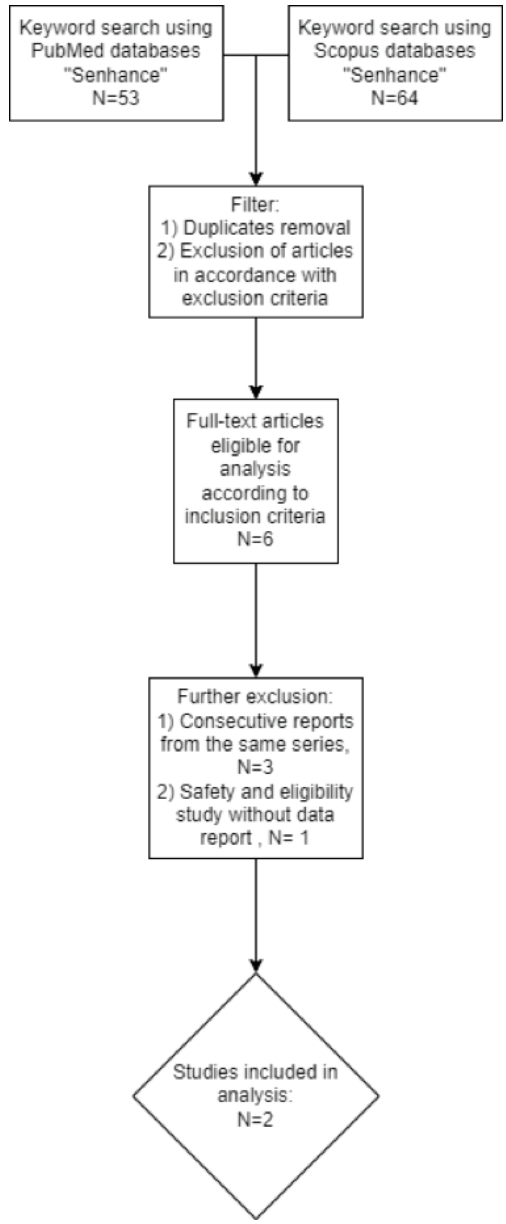


*Figure 1. Flow diagram of selection of articles for inclusion in the review*

## Results

Six articles in total were hand-picked among the results, reporting the use of Senhance for radical prostatectomy (4, 6-8, 11, 14). One of the published articles was a pilot study focused on the safety and eligibility of Senhance, three of the published articles were consecutive reports from a Croatian Center (University Hospital Center Zagreb) and two were consecutive reports from a Lithuanian Center (Klaipeda University Hospital). Two of the last published articles were identified as the last reports in the series from the two Centers and thus eligible for this review (4, 14). Both studies were marked as prospective and published in 2021. The first study included 127 (14) patients and the second study included 107 patients who under-

*Table 1. A data reports from the studies eligible for the review. A side-by-side comparison.*

| Authors | Venckus et al. 2021 (14) | Kulis et al. 2021 (4) |
|---|---|---|
| Cohort | 127 | 107 |
| Age at RP year, median (IQR) | 61,0 (37-73) | 65 (41-79) |
| BMI (kg/m2), median, (IQR) | 26,2 (19,0-40,1) | NA |
| PSA before RP | 5,5 (2,0-26,8) | 6.85 (1,03-25,81) |
| cT stage before RP | N (%) | N (%) |
| cT1 | 42 (33,1) | 63 (58,9%) |
| cT2a/b | 66 (52,0) | 42 (39,3%) |
| cT3 | 19 (15,0) | 0 |
| Positive core biopsy | 4 (1-12) | NA |
| Biopsy Gleason | N (%) | N (%) |
| 6 (grade gr I) | 72 (56,7) | 53 (49,5) |
| 7 (grade gr II-III) | 48 (37,8) | 45 (42,1) |
| 8-10 (grade group 4-5) | 7 (5,5) | 9 (8,4) |
| pT stage at RP | N (%) | N (%) |
| pT2 | 108 (85) | 87 (81,3) |
| pT3a | 12 (9,5) | 15 (14) |
| pT3b | 7 (5,5) | 5 (4,7) |
| Gleason score at RP | N (%) | N (%) |
| 6 | 32 (25,2) | 13 (12,1) |
| 7 | 89 (70,1) | 91 (85,1) |
| 8-10 | 6 (4,7) | 3 (2) |
| Nerve sparing | N (%) | N (%) |
| None | 90 (70,9) | NA |
| One-sided | 31 (24,4) | NA |
| Bilateral | 6 (4,7) | NA |
| Lymph node dissection | N (%) | N (%) |
| Lymphadenectomy performed | 21 (16,5) | 18 (16,8) |
| Positive pN at RP | 3 (14,3) | 1 (5,6%) |
| | Median (IQR) | Median (IQR) |
| Nodes removed | 8 (4-24) | 7 (4-16) |
| Operative outcomes | Median (IQR) | Median (range), [IQR] |
| OR time (min), median, IQR | 180 (150-215) | 195 (120-305) [180-218] |
| Estimated blood loss | 250 (175-400) | 300 (50-800) [200-500] |
| Positive surgical margins | N (%) | N (%) |
| Overall | 43 (33,9) | 30 (28) |
| Positive margins <pT2 (n=108) | 31 (28,7) | NA |
| Positive margins >pT3 (n=19) | 11 (57,9) | NA |
| Complications, n (%) | N (%) | N (%) |
| Overall | 15 (11,8) | 10 (10,7) |
| C-D I | 3 (2,4), subcutaneous emphysema = 3 | 6 (5,6) |
| CD II | 9 (7,1), transfusion =8, orchiepididymitis =1 | 3 (2,8) |
| CD IIIa | 2 (1,6), urethral stricture =1, lymphocele = 1 | 0 |
| CD IIIb | 1 (0,8) vesicoabdominal fistula =1 | 0 |
| CD IV | 0 | 1 (0,9) |

went radical prostatectomy by means of the Senhance (4). The reported operative technique was compared by two teams (7, 14). The reported patients' descriptive, operative and postoperative data were reported side-by-side in Table 1. The median hospital stay was 5 days and the catheter was removed 13 days after the operation, but it was reported in detail only in the group 1 (4). The group 1 stated that the catheter was removed after 10 days and there was no report on the duration of the hospital stay (14). Short-term functional results are also reported in only one group, 79% of patients use one or less pads per day, 15% use 2 pads and 6% use 3 or more pads per day (4). There was no reported conversion to open surgery, however, one group reported an 8,4% conversion rate to laparoscopy (4). In conclusion, both studies stated that the Senhance robotic system is a safe and feasible platform that can be used for radical prostatectomy.

## Discussion

In this manuscript, we reviewed the use of Senhance robotic system for radical prostatectomy. It is a novel robotic platform, used in several European and world centers, but mainly for abdominal and gynecological procedures (5, 8, 10, 15).

To our knowledge, there are two centers at the moment that systematically use the Senhance for radical prostatectomy. Both centers reported their initial experience regarding the safety and feasibility of this novel system (7, 11). After having gained the initial experience, they reported their additional and more detailed experience in 107 and 127 cases (4, 14). One group compared it with their experience in laparoscopic radical prostatectomy and found that Senhance offers better ergonomics and visualization for the surgeon, but laparoscopy offers lower operative costs. There was no significant difference in operative time, blood loss and outcomes observed between the two modalities (6). The report of Venckus et al. (group 1) included 127 patients, while Kulis et al. (group 2) included 107 patients in their cohort. Both groups utilized Senhance at the same time, so it is interesting to observe and compare operative outcomes and learning curves between the two Centers.

When observing the patient selection, patient age and PSA at the time of biopsy could be compared. Group 2 had a higher proportion of cT1, while group 1 had a rather high percentage of cT2 and cT3 patients. On the other hand, preoperative biopsy data were comparable between the two groups. Median operative time (OT) and estimated blood loss (EBL) were comparable between the two groups, with the most important determinant of OT related to whether lymphadenectomy was performed. There was also a discrepancy between the operative time range; group 1 (150-250 mins), group 2 (120-305 mins). Both groups reported significant OT and EBL reduction after the initial learning curve. It will be interesting to see if there will be a further reduction of these parameters in the later series. Postoperative pathological stage and Gleason score reports were comparable, but significant cancer undergrading was observed in both studies when comparing preoperative biopsy and postoperative histopathological reports. This discrepancy of Gleason score between biopsy and radical prostatectomy was also observed by other authors, impacting the definition of clinically significant prostate cancer in order to prevent undertreatment (16, 17). Lymphadenectomy was performed in a minority of cases in both groups. Group 1 stated that they performed standard pelvic lymph node dissection (obturator, internal and external iliac), while group 2 stated that they performed a limited lymphadenectomy of obturator lymph nodes. However, the median number of nodes dissected was similar, with 8 lymph nodes in group 1 and 7 in group 2.

There was a similar rate of positive surgical margins (PSM), and group 1 reported higher PSM in higher stage cancer. When analyzing the reported complications, there were similar complication rates between the two groups, the majority of which were Clavien - Dindo (CD) grade I and II. There were 3 CD grade III complications reported by group 1, and only one grade IV complication reported by group 2 (short-term respiratory arrest that was successfully treated in ICU). There is a discrepancy in the blood transfusion rates between the two groups, (8 patients in group 1, and 1 patient in group 2). There were no reported complications directly associated with the robotic system.

The two centers utilized and reported their experience in radical prostatectomy with the Senhance robotic system. They concluded that this is a safe and feasible platform offering lower maintenance and operative costs when compared to the DaVinci (4, 18, 19). Another advantage is an ease-of-conversion to laparoscopy, if required, using the same trocars. The initial learning curve is steep, with a motivated and

appropriately trained team, experienced in laparoscopic surgery. The only disadvantage, when compared to DaVinci, is the lack of various articulated instruments. There is only one available articulated instrument for the Senhance, a disposable 10-mm needle holder, but there are no reported experiences in its usage for prostatectomy (development of a 5-mm articulated instrument has been notified by the producer). On the other hand, there are other benefits such as an eye-controlled camera and haptic feedback. The OT, EBL, and PSM in these early stages of learning curves are comparable with similar reports on a learning curve with DaVinci (20). Further reduction of these variables is expected with a higher number of patients in later series.

There are only two available reports that are systematic and well written, which is one of the limitations of this review. It is difficult to implement new technologies in medicine, especially in cases where there is an established standard procedure, like with daVinci in robotic surgery. Further studies and reports from multiple Centers are expected to emerge in the future. Although there is a respectable uniformity in reported data, it is still a small total number of cases required to draw unambiguous and strong conclusions. Both of these studies are early in the follow-up period and are lacking the data reporting on long-term oncological and functional outcomes, both of which are mandatory for the proper comparison with laparoscopy and daVinci.

In conclusion, the safety and feasibility of the novel Senhance system in urology have been reviewed by the two Centers. Similar observations, pitfalls, outcomes and standpoints regarding everyday use and future development were reported and debated by the authors (4, 11, 21). This review should encourage other Centers that are considering starting their robotic programs in urology to acknowledge the Senhance robotic platform as a possible alternative to only one until recently available platform.

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Sažetak

## ROBOTSKA RADIKALNA PROSTATEKTOMIJA POMOĆU SENHANCE SUSTAVA

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Robotom asistirana radikalna prostatektomija je, od svog uvođenja u praksu prije više od dvadeset godina, postala standardna metoda liječenja lokaliziranog raka prostate. Donedavno su sve robotom asistirane radikalne prostatektomije bile učinjene koristeći jedini dostupni robotski sustav. Senhance je novi robotski sustav koji je odobren za kliničku upotrebu. Baze podataka PubMed i Scopus su pretraživane za riječ "Senhance", a pronađeni članci su dodatno filtrirani na one koji sadrže odgovarajući dizajn studije i dostupne podatke. Dvije studije su zadovoljile navedene kriterije. Obje studije su prospektivne studije sa ukupno 234 pacijenta te su u njima objavljeni podaci koji su uključivali podatke o operativnim ishodima. Prosječno trajanje operacije je bilo između 180 i 195 minuta, sa gubitkom krvi od 250 do 300 mL. Prijavljene su 3 komplikacije Clavien - Dindo stupnja III i 1 stupnja IV. U jednoj studiji je učinjena usporedba sa laparoskopijom, ali nije nađeno značajne razlike u operativnom vremenu i gubitku krvi između dvije metode. Obje studije su utvrdile da je Senhance sigurna i primjenjiva robotska platforma za korištenje u radikalnoj prostatektomiji.

Ključne riječi: *Senhance, robotska prostatektomija, rak prostate*