DOI: *10.4081/aiua.2024.12531*

ORIGINAL PAPER

The impact of surgical technique on very early functional outcomes after radical prostatectomy

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Summary *Introduction: To determine the very early functional as well as oncological outcomes after robot-assisted radical prostatectomy (RARP) and open radical prostatectomy (ORP) at a single institution.*

Methods: We identified patients who underwent RARP or ORP at our institution between August 2021 and July 2023. The main criterion for surgical technique selection was patient preference. Primary endpoints included anastomosis leakage rate, very early continence rate reported by standardized pad-test, and positive surgical margin rate. Furthermore, we analyzed operation time, hospital stay, postoperative analgesia, and complication rates.

Results: In this prospective study, we analyzed data from 222 radical prostatectomies (111 RARP and 111 ORP). There were no significant differences in preoperative age, prostate size, and risk stratification among the groups. Patients who underwent RARP had lower anastomosis leakage rates (8.1% vs. 18.9%) and slightly lower early continence rates (76.6% vs. 78.4%) when compared to patients who underwent ORP. Positive surgical margin rates were similar, and complication rates were also comparable. Operation time was similar for both techniques, but the hospital stay was significantly shorter in the RARP group (6.3 vs. 9.1 days, p = 0.03). The ORP group experienced significantly higher opioid administration postoperatively (p < 0.001).

Conclusions: From a functional and oncological point of view, both techniques are safe and provide excellent outcomes when performed by experienced surgeons. Nevertheless, patients are likely to benefit from a shortened hospital stay and reduced postoperative pain after RARP.

KEY WORDS: Robot-assisted radical prostatectomy; Open radical prostatectomy; Functional outcomes; Oncological outcomes.

Submitted 1 April 2024; Accepted 11 April 2024

INTRODUCTION

Prostate cancer is a major health concern and represents the second most commonly diagnosed cancer in men, with an estimated 1.4 million new cases worldwide in 2020; incidence is mainly dependent on age (1). The main goal of radical prostatectomy by any approach is the eradication of cancer while, whenever possible, preserving pelvic organ function (2). The initial transperineal open technique was described more than 100 years ago (3), but it was not until the '80s with the retropubic approach, which allowed for nerve-sparing, that the procedure gained popularity (4). The retropubic open approach was considered the gold standard for more than two decades, until about 25 years ago when the first laparoscopic radical prostatectomy was performed (5). Further innovations were to follow, and soon after, in 2002, the first reports of robot-assisted procedures started to emerge (6). Since then, the surgical management of prostate cancer has changed drastically. Nevertheless, the uptake of robotic systems varies even today from country to country and mostly depends on cost, insurance coverage, and government healthcare approval (7). Still, the market share of RARP is extremely high, with up to 85% in the USA and more than 92% in England (8), which does not leave much room for ORP. Considering the immense expansion of robotics in urology, justified questions emerged: should this open surgical technique be performed at all in the robotics era? While RARP is generally accepted to have a shorter hospital stay, there is conflicting evidence regarding functional outcomes and no reliable data on oncological outcomes (9) when the two techniques are compared. The main goal of this prospective study was to assess the safety, functional outcomes, and oncological outcomes after ORP and RARP performed by two experienced surgeons at one institution.

METHODS

We prospectively analyzed the records of patients who underwent radical prostatectomy at our institution between August 2021 and July 2023.

The ethics committee of the *State Medical Chamber of Baden-Württemberg* approved the project (F-2023-120).

The data were obtained from the patient data management software (*CGM Clinical*®), in which all relevant data such as preoperative staging, external imaging findings, therapy-relevant parameters, and complication rates are prospectively updated. The main criterion for surgical technique selection was patient preference. Patients were informed about the available surgical options for their condition during their preoperative consultations with their respective referring urologists. During these consultations, patients were provided with comprehensive information about each surgical approach, including its benefits, risks, and potential outcomes. Patients were

encouraged to express their preferences based on their individual medical history, personal preferences, and understanding of the procedures. We obtained data from 263 patients but excluded 41 to standardize surgical variables, resulting in a final cohort of 222 patients treated by two highly experienced surgeons, each having performed over 2000 procedures in representive technique. During ORP, the retropubic access was used, the endopelvic fascia was incised, and the prostate dissected in ascending order. The vesicourethral anastomosis was performed using six independent single sutures. During RARP, the transperitoneal approach was used, the endopelvic fascia was also incised, but the prostate was dissected in descending order. The vesicourethral anastomosis was performed using one running suture with two needles. Standard lymphadenectomy was performed using anatomical landmarks, regardless of the surgical approach. The catheter was removed directly after the cystography was performed (day 5-6 after RARP and day 7-8 after ORP) given no urinary leakage was evident. In case of leakage, the catheter remained for another 1-2 days, depending on the leakage severity. Upon catheter removal, patients had one day for pelvic floor muscle exercises, explained and taught by a physical therapist. The very early continence was then documented using a standardized pad test. This test measures the amount of involuntary urine loss while performing predefined physical activities with a full bladder within 1h. The urine pad was weighed before and after the test. Full continence was defined as urine loss of 0-10g and one urine pad per day. Mild urinary incontinence grade I and grade II were defined as urine loss of 10-25 g and 25-50 g, respectively. Urine loss of > 50 g represented severe incontinence. The pathologist graded the tumors according to the Gleason system (10), analyzing the entire prostate including every tumor focus. The complication rates were documented using the Clavien-Dindo classification (11). The statistics were performed using SPSS Software v23. The significance level was set at 0.05.

Results

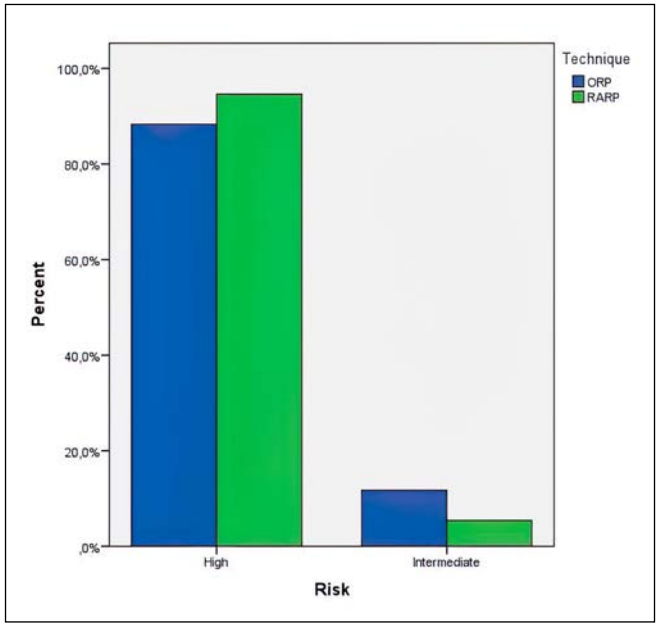
Between August 2021 and July 2023, 222 men with histologically proven prostate cancer underwent radical prostatectomy, of whom 111 underwent ORP and 111 underwent RARP. The main patient characteristics are listed in Table 1. There were no significant differences in preoperative age, PSA, and IPSS between the RARP and ORP groups. Based on *D'Amico's* (12) risk classification of prostate cancer, 13 patients (11.7%) had intermediate-risk and 98 patients (88.3%) had high-risk cancer in the ORP group, as represented in Figure 1. In the RARP group, 6 patients (5.4%) and 105 patients (94.6%) had intermediate- and high-risk cancer, respectively.

Figures 2 and 3 show the disease spread and Gleason score among the groups. Most of the patients had a preoperative prostate volume of ≤ 70 ml on the transrectal ultrasound (RARP 84.6% vs. ORP 86.1%) as shown in Figure 4. Nerve sparing was able to be performed on 37.8% of patients in the RARP group and on 39.6% of patients in the ORP group. *Pelvic lymph node dissection* (PLND) was performed on all patients. The duration of

Table 1.
Patient characteristics.

Variable	RARP n, (%)	ORP n, (%)	p value
Age (median, years)	69.9	70.3	0.24
pPSA (median, ng/ml)	7.2	7.7	0.66
IIEF 5 (median)	12.2	11.8	0.71
IPSS(median)	18.5	19.1	0.69
TRUS (median, cm^3)	45.1	46.3	0.81
pT stage			0.16
pT2	69 (62.2)	79 (71.2)	
pT3a	29 (26.1)	21 (18.9)	
pT3b	13 (11.7)	11 (9.9)	
Nerve sparing			0.64
unilateral	19 (17.1)	18 (16.2)	
bilateral	23 (20.7)	26 (23.4)	
without	69 (62.2)	67 (60.4)	
Positive surgical margins	15 (13.6)	17 (15.3)	0.54
Clavien Dindo			0.74
n.a.	104 (93.7)	101 (91)	
2	6 (5.4)	5 (4.5)	
3a	1 (0.9)	3 (2.7)	
3b	n.a.	1 (0.9)	
4	n.a.	1 (0.9)	
Gleason score			0.27
≤ 7	96 (86.5)	89 (80.2)	
≥ 8	15 (13.5)	22 (19.8)	
Lymph nodes removed (median)	16.1	15.4	0.36
Leakage at contrast cystography	9 (8.1)	21 (18.9)	0.59
Very early full continence rate	85 (76.6)	87 (78.4)	0.72
Operation time (median, minutes)	141.3	151.9	0.79
Hospital stay (median, days)	6.3	9.1	0.03
Epidural analgesia	1 (0.9)	81 (72.9)	< 0.001
Overlapping opioids	1 (0.9)	72 (64.9)	< 0.001
Patient-controlled analgesia pump	4 (3.6)	18 (16.2)	< 0.001

Figure 1.
D'Amico Risk stratification.



the procedure was similar among the groups, as were the positive surgical margin rates (13.6% RARP *vs.* 15.3% ORP). Patients who underwent RARP had lower anastomosis leakage rates (8.1% *vs.* 18.9%) and slightly lower early full continence rates (76.6% *vs.* 78.4%) when compared to patients who underwent ORP, though the differences were not significant (Figure 5). Nevertheless, the hospital stay was significantly shorter in the RARP group (6.3 *vs.* 9.2 days, p = 0.03) and the ORP group experienced significantly higher opioid administration rates postoperatively (1 *vs.* 81 patients, p < 0.001). Finally, the complication rates were assessed and the vast majority of patients in both groups (93.7% for RARP and 91% for ORP) did not experience any deviation from the normal postoperative course.

Figure 2.
Diasease spread.

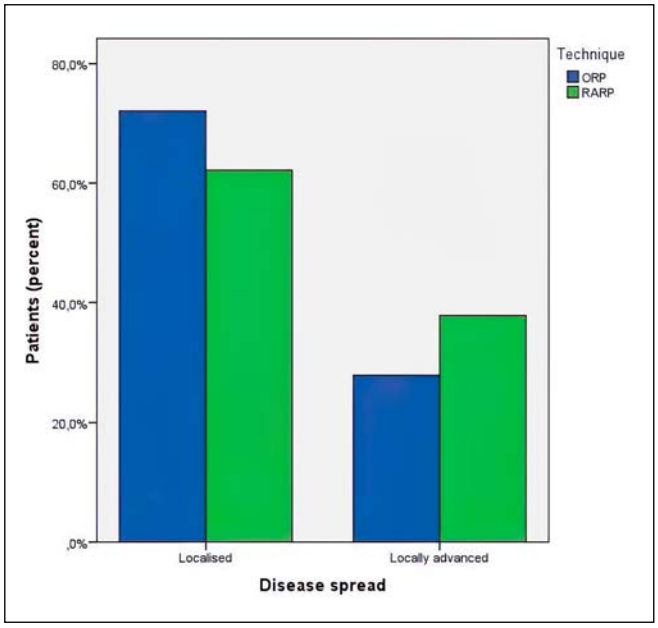


Figure 3.
Distribution of Gleason Score among groups.

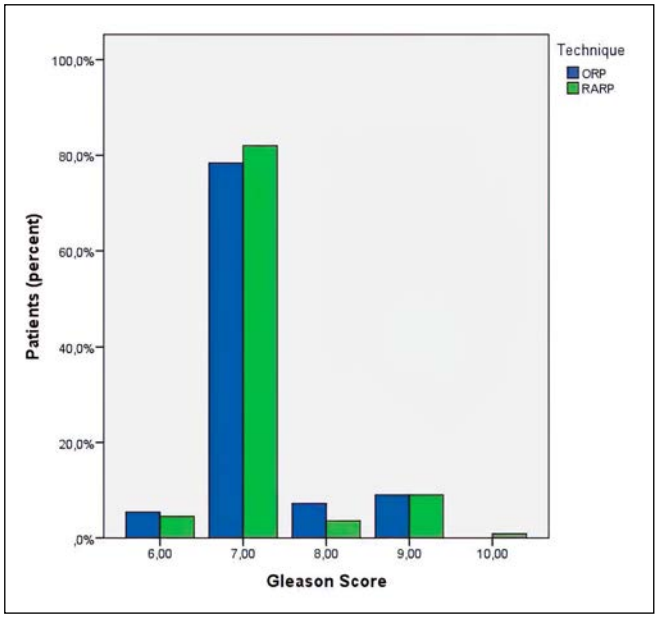


Figure 4.
Distribution of prostate size among groups.

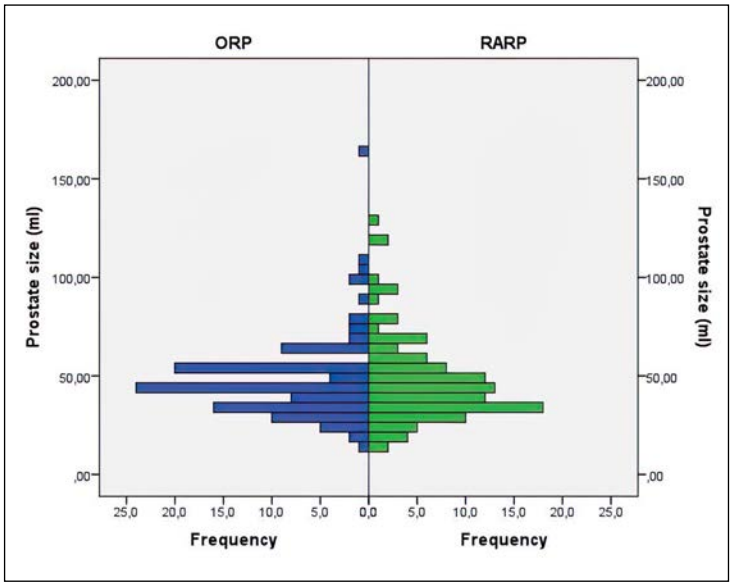
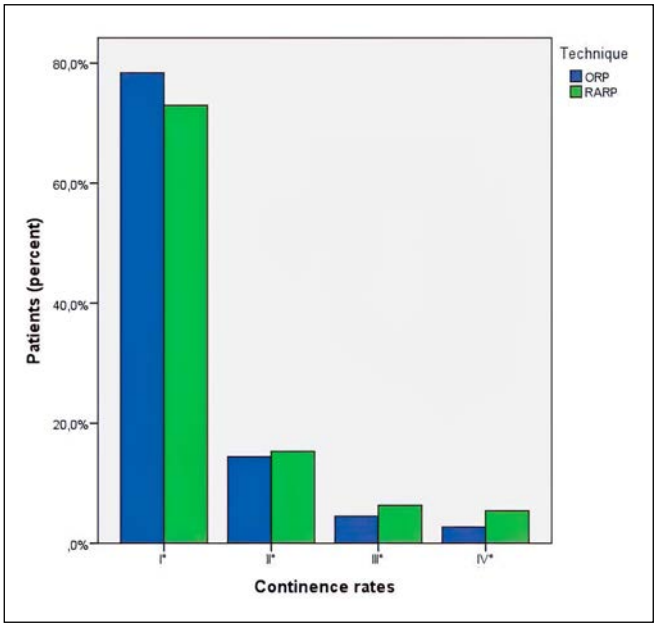


Figure 5.
Early continence rates based on standardized Pad-Test.



Discussion

Despite the paucity of data on anastomosis leakage rates following radical prostatectomy due to many institutions no longer performing contrast cystography, our department remains one of the few that continues this practice. Additionally, we have consistently employed a standardized pad test for the past two decades. This allows us to confidently present our radiologically obtained leakage

results as a reliable measure. Contrary to a prominent meta-analysis suggesting superior early functional outcomes for RARP compared to ORP (13), our research did not corroborate this. We discovered no significant discrepancies regarding the early continence rate between the two procedures. Continence is typically evaluated 12 months post-surgery, with average late continence rates generally being around 80% (14, 15). However, our findings demonstrate exceptionally high early continence rates upon catheter removal of 76.6% for RARP and 78.4% for ORP (16). Furthermore, our severe early incontinence rates barely reached 6% for both techniques, markedly lower than the average 15% cited in existing literature (17, 18). Mirroring another meta-analysis (19), our study detected no significant divergence in positive surgical margin rates between the two techniques. Notably, surgical margin status is a crucial prognostic indicator for biochemical recurrence (20), and positive surgical margin rates can fluctuate considerably, from 7% to 44%, depending on the surgeon's experience (21-23). Regardless of factors such as patient and tumour characteristics and the size of lymph node packets removed, which influence the number of lymph nodes reported in histology (24, 25), our study found an insignificant difference in the number of lymph nodes removed per procedure (median 15.4 *vs.* 16.1; ORP *vs.* RARP). All patients underwent the same tissue processing and blocking procedures in the same laboratory. The disparity in preoperative prostate size, which can act as a predictive factor for functional outcomes, was not a concern as the majority of patients exhibited a preoperative prostate volume of ≤ 70 ml on transrectal ultrasound (RARP 84.6% *vs.* ORP 86.1%). Additionally, both procedures consumed similar operative time.

Hospital stay was significantly shorter after RARP and ORP group experienced significantly higher opioid administration rates postoperatively,

Our data showed that patients undergoing RARP had a significantly shorter hospital stay and fewer postoperative opioid requirements than the ORP group, proving the benefit of minimally invasive surgical approach, as already in literature reported (26). Nonetheless, the vast majority of patients in both groups did not experience any deviation from the normal postoperative course.

We acknowledge that our study has its limitations. Single centre study with just two surgeons evaluated and lack of randomisation being some of them, so that the results might not generalise to other settings. Lack of intraoperative blood loss data and missing potency data being the other limitations. It should be mentioned that no patient required an intraoperative blood transfusion in either group. However, despite these limitations, our study has its strengths. We were able to prospectively analyse two almost identical patient groups who underwent two different surgical techniques. Furthermore, in addition to minimising variability by having standardised procedures, we were also able to have somewhat of a surgeon heterogenity by having one expert in the respective surgical approach, performing all the procedures. As some authors have already stated, the patients should be ancouraged to choose an experianced surgen rather that a specific surgical approach (27).

Our study can be interpreted as a small contribution to a never ending-debate.

Conclusions

The two techniques yield very similar early functional and oncological outcomes when performed by very experienced surgeons. ORP will probably continue to be performed in institutions with financial limitations and limited access to robotics. Nevertheless, patients are likely to benefit from a shortened hospital stay and reduced postoperative pain after RARP.

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Conflict of interest: The authors declare no potential conflict of interest.