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Retzius-sparing Robot-assisted Radical Prostatectomy in High-risk Prostate Cancer Patients: Results from a Large Single-institution Series

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Abstract

Background: Retzius-sparing (RS) robot-assisted radical prostatectomy represents a valid surgical treatment option for prostate cancer (PCa) patients. However, the available evidence on the role of RS in high-risk (HR) PCa setting is sparse.

Objective: To describe our RS technique for HR-PCa patients and to evaluate intra-, peri-, and postoperative oncological and functional outcomes.

Design, setting, and participants: A total of 340 D’Amico HR-PCa patients underwent RS at a single high-volume centre between 2011 and 2020.

Surgical procedure: Surgical procedures were performed by five experienced robotic surgeons.

Measurements: Complications were collected according to the standardised methodology proposed by the European Association of Urology guidelines. Postoperative outcomes were evaluated in patients with complete follow-up data (n = 320). Biochemical recurrence (BCR) was defined as two consecutive prostate-specific antigen values of ≥0.2 ng/ml. Urinary continence (UC) recovery was defined as the use of zero or one safety pad. Kaplan-Meier and multivariable logistic and Cox regression models were performed.

Results and limitations: Fourteen patients (4%) experienced intraoperative complications and 52 90-d complications occurred in 44 patients (14%), of whom 24 had...
1. Introduction

High-risk prostate cancer (PCa) is burdened by an increased risk of prostate-specific antigen (PSA) failure, need for secondary therapy, metastatic progression, and death from PCa [1,2]. According to the European Association of Urology (EAU) guidelines, radical prostatectomy with extended pelvic lymph node dissection is a reasonable option in selected high-risk PCa patients, as part of potential multimodal therapy [1]. Among different surgical approaches, Retzius-sparing robot-assisted radical prostatectomy (RS-RARP) has been considered a valid surgical treatment option for PCa patients [1,3–7]. However, differently from the anterior robot-assisted radical prostatectomy (RARP) and retropubic open prostatectomy, clinicians are sceptic regarding a possible role of the posterior approach (ie, RS-RARP) in the high-risk PCa setting, given the lack of high-level evidence on this surgical system by five experienced robotic surgeons, who had previously performed at least 50 RS-RARP in low- and intermediate-risk PCa patients (clinical stage T2c, biopsy Gleason scores 8–10, or PSA levels >20 ng/ml) [20] treated with RS-RARP and pelvic lymph node dissection (PLND). Overall, 340 high-risk PCa patients were identified. All patients had complete intra- and perioperative data. All patients underwent preoperative computed tomography (CT) and bone scan [1]. Overall, 143 (42.1%) patients underwent preoperative computed tomography (CT) and bone scan [1]. Overall, all patients provided informed consent.

Patient summary: Relying on the largest cohort of high-risk prostate cancer patients treated with Retzius sparing (RS), we observed that the RS approach is safe and allows optimal cancer control, without significantly compromising functional outcomes.

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2. Patients and methods

2.1. Study population

The current study is a retrospective, single-centre, multiple-surgeon, case-series analysis that relied on the database that collected data on 1906 consecutive PCa patients treated with RS-RARP at a single high-volume European centre (ASST Grande Ospedale Metropolitano Niguarda, Milan, Italy) between January 2011 and December 2020. For the purpose of our study, we exclusively focused on D’Amico high-risk PCa patients (clinical stage ≥T2c, biopsy Gleason scores 8–10, or PSA levels >20 ng/ml) [20] treated with RS-RARP and pelvic lymph node dissection (PLND). Overall, 340 high-risk PCa patients were identified. All patients had complete intra- and perioperative data. All patients underwent preoperative computed tomography (CT) and bone scan [1]. Overall, 143 (42.1%) patients underwent preoperative multiparametric magnetic resonance imaging (mpMRI).

Analyses on postoperative outcomes were performed only in patients with available follow-up data (n = 320). All specimens were assessed by three dedicated uropathologists. The study protocol was approved by the institutions’ medical ethics committees, and all patients provided informed consent.

2.2. Surgical technique

All RS-RARP procedures were performed with a four-arm da Vinci Si Surgical System (Intuitive Surgical, Sunnyvale, CA, USA) with a transperitoneal approach by five experienced robotic surgeons, who had previously performed at least 50 RS-RARP in low- and intermediate-risk PCa patients. Patients were placed in the 30° Trendelenburg position. Six laparoscopic trocars were inserted, as described previously.

...
in case of an anterior tumour and/or median lobe and/or enlarged pros-
crincision. During this step, it is crucial to push the bladder upwards with
at the posterior surface of the prostate, the DVF is pushed upwards
opposed to the seeing of the apical borders and avoid entering into the prostate. The
the anterior surface of the Douglas pouch was performed (Fig. 1A). The vasa deferentia were isolated, dissected, and pulled towards the midline with
in the bladder neck, in order to fix the mucosa and easily identify the bladder neck orifice during the vesicourethral anastomosis. The anterior surface of the prostate was bluntly isolated from the Santorini plexus whenever oncologically safe. In case of an anterior tumour, the Santorini plexus can be resected partially or completely. A sharp and blunt apical dissection of the prostate was performed, ventrally and laterally, to improve visualization of the apical borders and avoid entering into the prostate. The apex of the prostate was isolated from the urethra, and the latter was incised carefully (Fig. 1E). Thereafter, a standard Van Velthoven vesicourethral anastomosis was performed [20]. Two separate 15-cm barbed sutures (V-loc 3-0) were used starting from 12 o’clock up to the left anterior quarter (Fig. 1F). Then the right half circle of the suture was carried out up to 6 o’clock, and the posterior left quarter was then completed from 9 to 6 o’clock. In case of wide bladder neck, 23-cm V-loc may be used. The bladder was filled with 120 ml sterile saline solution to perform the leak test for the vesicourethral anastomosis. The transurethral catheter was removed, and a suprapubic tube was inserted under direct vision. In case of bladder cancer history or very wide bladder neck, the transurethral catheter is maintained and the suprapubic tube is not placed. Finally, an extended or superextended PLND was performed based on clinician preference [1]. A unique QR code was generated and linked to the high-resolution video clip.

2.3. Outcomes

Our primary goal was to substantiate the technical reproducibility and safety profile of RS-RARP in the specific setting of high-risk PCA patients. Specifically, we focused on the following:

(1) Oncological outcomes as PSMs, biochemical recurrence (BCR), and need for additional treatments after RS-RARP. A PSM was defined as the presence of inked cells at the edge of the surgical specimen [1]. PSMs were characterised as focally positive (≤1 mm in length) or extensively positive (>1 mm in length) [22]. During follow-up after surgery, serum PSA measurement was tested at 3, 6, and 12 mo, then every 6 mo for 3 yr, and then annually [1]. BCR was defined as two consecutive PSA values of ≥0.2 ng/ml [1]. Additional treatment use was defined as any administration of radiotherapy or hormonal therapy in the adjuvant or salvage setting after RS-RARP, according to the clinical judgement of each treating physician and after discussion with the patient regarding the benefits and possible side effects. The cause of death was defined by the attending urologist or oncologist who followed the patients and/or death certificate.

(2) Intraoperative and 90-d postoperative complications. Intraoperative complications were categorised according to the Intraoperative Adverse Incident Classification (EAUiaiC) proposed by the European Association of Urology ad hoc Complications Guidelines Panel [19]. Postoperative complications were collected based on patient chart review done by a dedicated data manager and were graded according to the Clavien-Dindo classification system [23]. From July 2020 to January 2021, a retrospective collection system for 90-d postoperative complications was performed based on patient interview done by four medical doctors who were not involved in the treatment. The quality criteria for accurate and comprehensive reporting of surgical outcomes recommended by the EAU guidelines on reporting and grading of complications were fulfilled (Supplementary Table 1) [18].

As secondary endpoints, functional outcomes were evaluated: immediate continence recovery was defined as the use of zero or one safety pad per day at transurethral/suprapubic catheter removal. All patients
with a transurethral catheter undergo cystogram before catheter removal. Urinary continence (UC) recovery was defined as the use of zero or one safety pad per day at the last follow-up. Recovery of sexual function (SF) was assessed in preoperatively potent men who underwent full or partial nerve sparing with complete follow-up data (n = 111) and was defined as satisfactory erections for sexual intercourse (defined as erections hard enough for penetration more than half the time) with and without the use of phosphodiesterase-5 inhibitors or intracavernosal injections postoperatively. Continence and SF recovery were assessed at each follow-up visit, namely at 3, 6, and 12 mo after surgery, then every 6 mo for 3 yr, and then annually. Follow-up phone calls were also performed by four medical doctors who were not involved in the treatment.
2.4. Statistical analyses

Statistical analyses consisted of four analytical steps. First, medians and interquartile ranges (IQRs) as well as frequencies and proportions were reported for continuous and categorical variables, respectively. Second, Kaplan-Meier analyses were used to calculate the probability of freedom from BCR and additional treatment use and their corresponding 95% confidence interval (CI). Patients without records of BCR were censored on the date of the last time they were known to be free of BCR, in accordance with the guidelines for reporting statistics [24]. In BCR analysis, adjuvant therapies were censored as an event.

Third, three separate sets of multivariable logistic and Cox regression models were fitted to evaluate the predictors of PSMs, BCR, and additional treatment use. In the multivariable logistic regression model testing for PSMs, adjustment variables were selected a priori and consisted of PSA, prostate volume, ISUP grade group at biopsy, clinical tumour stage cT, nerve-sparing technique, and bladder neck preservation. The adjustment for case-mix in multivariable Cox regression models testing for BCR and additional treatment use included the following variables that were selected a priori: pathological tumour stage, pathological ISUP grade group, PSMs, and pathological nodal stage pN, along with adjuvant treatment for BCR. Finally, we estimated UC and SF recovery using the Kaplan-Meier method. For all statistical analyses, R software for statistical computing and graphics (version 3.6.3) was used. All tests were two sided, with a level of significance set at \( p < 0.05 \).

3. Results

3.1. Preoperative characteristics

Table 1 summarises the descriptive characteristics of our cohort. The median age and body mass index were, respectively, 67 yr (IQR: 62–71) and 26 kg/m\(^2\) (IQR: 24–28). Of the patients, 50% had a Charlson comorbidity index of 2. The median PSA was 9 ng/ml (IQR: 6.3–20). Overall, 106 (31.2%), 165 (48.5%), and 54 (15.8%) patients harboured clinical \( \geq T3 \) disease, biopsy ISUP grade group 4, and biopsy ISUP grade group 5, respectively.

3.2. Intra-/perioperative characteristics and cancer control outcomes

The median operative time and estimated blood loss were 200 min (IQR: 141–240) and 200 ml (IQR: 100–300), respectively. Overall, 294 (86.5%) and 131 (38.5%) patients underwent, respectively, full bladder neck preservation and partial or full nerve sparing (Table 1 and Supplementary Table 2). All patients received PLND (95.9% extended vs 4.1% superextended). Two patients (0.6%) received intraoperative transfusion. The median hospital stay and catheter removal were 3 d (IQR: 2–4) and 7 d (IQR: 7–8), respectively.

Pathological T stages were T3a and \( \geq pT3b \) in, respectively, 107 (31.5%) and 81 (23.8%) patients. Pathological ISUP grade groups were 4 and 5 in 99 (29.1%) and 69 (20.3%) patients, respectively.

PSMs were noted in 98 (28.8%) patients (9.4% focal vs 19.4% extended PSMs), and 16.7% of patients had nodal disease. At a multivariable logistic regression analysis, prostate volume (odds ratio [OR]: 1.03, 95% CI: 1.01–1.04, \( p = 0.001 \)), ISUP 4–5 grade group at prostate biopsy (OR: 2.6, 95% CI: 1.4–4.3, \( p = 0.002 \)), partial or full nerve sparing (OR: 1.9, 1.4–4.3, \( p = 0.001 \)), Charlson comorbidity index, and previous abdominal surgery were significant predictors of PSMs on multivariable analysis (Table 2).

| Preoperative variables (n = 340) | \( n \)   | \( \% \) |
|-------------------------------|----------|---------|
| Preoperative variables (n = 340) | \( n \)   | \( \% \) |
| Age (yr), median (IQR)        | 67       | 62–71   |
| BMI (kg/m\(^2\)), median (IQR) | 26       | 24–28   |
| ASA score, n (%)              | 1        | 79 (23.2) |
|                             | 2        | 136 (40)  |
|                             | 3        | 109 (32.1) |
|                             | 4        | 16 (4.7)   |
|                             | 5        | 0        |
| Charlson comorbidity index, n (%) | 0–1     | 56 (16.5) |
|                             | 2        | 170 (50)   |
|                             | 3        | 114 (33.5) |
| Previous abdominal surgery, n (%) | 125     | 36.8    |
| Pathological ISUP grade group, n (%) | 18      | 5.3     |
| PSA at RS-RARP (ng/ml), median (IQR) | 9       | 6.3–20  |
| Clinical tumour stage, n (%)  | \( \geq cT2a \) | 72 (21.2) |
|                             | cT2b     | 97 (28.5)  |
|                             | cT2c     | 65 (19.1)  |
|                             | \( \geq cT3 \) | 106 (31.2) |
| ISUP grade group at prostate biopsy, n (%) | 1       | 40 (11.8) |
|                             | 2        | 39 (11.9)  |
|                             | 3        | 42 (12.4)  |
|                             | 4        | 165 (48.5) |
|                             | 5        | 54 (15.8)  |
| Prostate volume (ml), median (IQR) | 40     | 30–50   |
| Intra- and perioperative variables (n = 340) | 200     | 141–240 |
| Operative time (min), median (IQR) | 200    | 141–240 |
| Median lobe, n (%)            | 19       | 5.6     |
| Bladder neck preservation, n (%) | 294     | 86.5    |
| Partial preservation          | 40       | 11.8    |
| Wide dissection               | 6        | 1.7     |
| Nerve-sparing technique \( n \) (%) | Full NS | 81 (23.8) |
|                             | Partial NS | 50 (14.7) |
|                             | No NS    | 209 (61.5) |
| Lymph node dissection \( n \) (%) | Extended | 326 (95.9) |
|                             | Superextended | 14 (4.1)   |
| Abdominal drain, n (%)        | 0        |         |
| Urine drain, n (%)            | 53       | 15.6    |
| Urethral catheter             | 287      | 84.4    |
| Suprapubic catheter           | 200      | 100–300 |
| Estimated blood loss (ml), median (IQR) | 4      | 2 (0.6)  |
| Hospital stay (d), median (IQR) | 3        | 2–4     |
| Pathological tumour stage, n (%) | 7       | 7–8     |
| pT2                           | 152      | 44.7    |
| pT3a                          | 107      | 31.5    |
| \( \geq pT3b \)               | 81       | 23.8    |
| Pathological ISUP grade group, n (%) | 1       | 23 (6.8) |
|                             | 2        | 67 (19.7) |
|                             | 3        | 82 (24.1) |
|                             | 4        | 99 (29.1) |
|                             | 5        | 69 (20.3) |
| Surgical margins, n (%)       | 242      | 71.2    |
| Negative margins             | 98       | 28.8    |
| Overall positive margins      | 32        | 9.4     |
| Focal                         | 66       | 19.4    |
| Total lymph nodes removed, median (IQR) | 20    | 16–25   |
| Pathological nodal stage, n (%) | 283     | 83.3    |
| pN0                           | 57       | 16.7    |
| pN1                           | 107      | 31.5    |

(continued on next page)
95% CI: 1.2–3.4, p = 0.02), and full bladder neck preservation (OR: 2.2, 95% CI: 1.1–4.5, p = 0.03) were independent predictors of PSMs (Table 2).

A total of 113 (35.3%) patients harboured BCR. The median (IQR) time to BCR was 15 (6–40) mo. The median (IQR) follow-up for patients who did not experience BCR was 47 (24–70) mo. The 4-yr probabilities of freedom from BCR and additional treatment were, respectively, 63.6% (95% CI: 58–70; Fig. 2A) and 56.6% (95% CI: 51–63; Fig. 2B). Overall, ten patients died during follow-up, four of them from PCa.

At multivariable Cox regression analysis predicting BCR, the pathological ISUP 4–5 grade group (hazard ratio [HR]: 1.5, 95% CI: 1.01–2.2, p = 0.04) and PSMs (HR: 2.3, 95% CI: 1.5–3.5, p < 0.001) reached the independent predictor status (Table 3). Pathological ISUP 4–5 grade group (HR: 1.5, 95% CI: 1.01–2, p = 0.04), PSMs (HR: 2.4, 95% CI: 1.7–3.4, p < 0.001), pT stage ≥3b (HR: 1.8, 95% CI: 1.2–2.7, p = 0.002), and pN stage 1 (HR: 1.8, 95% CI: 1.2–2.6, p = 0.003) were independent predictors of additional treatment after RS-RARP (Table 3).

3.3. Complications

A total of 14 intraoperative complications were reported in 14 patients (Table 4). Intraoperative complications were represented by injury of the epigastric artery during trocar positioning (n = 6), injury of the iliac vessels during PLND (n = 3), injury of the ureter during PLND (n = 2), complete dissection of the left obturator nerve (n = 1), and injury of the bladder nearby the right ureteral orifice that required double J stent positioning (n = 1) and below the bladder neck (n = 1).

Table 5 shows the 90-d postoperative complications. Overall, 52 postoperative complications occurred in 44 patients (44/320 = 14%). The overall rates of Clavien-Dindo I and II were 5.3% (n = 17) and 3.4% (n = 11), respectively. The most common Clavien-Dindo I and II were represented by prolonged catheterisation due to urethrovessical leakage (n = 17; 5.3%) and urinary tract infection requiring antibiotic therapy (n = 7; 2.2%). Twenty-two patients (6.9%) experienced Clavien-Dindo IIIa (19 lymphocele treated with percutaneous drainage and three acute urinary retention requiring bladder catheterisation). Two patients (0.6%) had Clavien-Dindo IIIb for reoperation to drain abdominal haematoma and revise the urethrovessical anastomosis (n = 1), and to remove a needle fragment in the pelvic area (n = 1). No perioperative deaths were reported.

3.4. Functional outcomes

Immediate UC recovery was observed in 53% (169/320) of patients. The 1- and 2-yr UC recovery were 84% (95% CI: 79–87) and 85% (95% CI: 81–89), respectively (Fig. 2C).

Among men who were preoperatively potent (n = 252) and underwent full or partial nerve sparing with complete follow-up data (n = 111), the 1- and 2-yr SF recovery were 43.1% (95% CI: 33–51) and 50% (95% CI: 39–58), respectively (Fig. 2D). Among those patients who had SF recovery during the study period, 53% used phosphodiesterase-5 inhibitors, 4% used penile injection, and 43% had spontaneous erection.

4. Discussion

High-level evidence evaluating the role of RS-RARP in high-risk PCa patients is unavailable. Only few retrospective studies [15–17] attempted to circumvent this lack of data relying on a small sample size, short follow-up, and no standardised methodology to report complications according to the EAU guidelines [1,18,19]. Our objective was to evaluate whether the safety profile of RS-RARP observed in low- and intermediate-risk PCa [4–7] is also substantiated in the specific setting of high-risk disease. We described our surgical technique and presented the largest cohort of high-risk PCa patients treated with RS-RARP at a single high-volume centre.

First, our results demonstrated that RS-RARP is a safe approach in terms of oncological outcomes. Specifically, the rate of PSMs was 28.8% (9.4% focal vs 19.4% extended PSMs), which is in line with those reported by the largest available series on D’Amico high-risk PCa treated with anterior RARP at tertiary care referral centres (PSM rate range: 25.3–34.8%) [25]. Kumar et al [26] and Abdollah et al [27]...
analysed 557 and 868 high-risk PCa patients reporting 25.2% and 34% PSM rates, respectively. The rate of PSMs in the largest cohort of high-risk patients (n = 1110) treated with an anterior RARP approach is 34.8% [28]. Our PSMs are in line with those recently reported by Mazzone et al [29] who focused on more aggressive PCa patients (ie, pre-operative posterior T3a and T3b at mpMRI) treated with an anterior approach at a single high-volume centre. In the current study, we also observed that patients with enlarged prostate and who harboured ISUP 4–5 grade group at biopsy had a higher risk of PSMs at final pathology. Noteworthy, patients who underwent full or partial nerve sparing and who received full bladder neck preservation had an approximately two-fold higher probability of harbouring PSMs at final pathology. The latter findings strongly suggest that surgeons performing RS-RARP should remain humble in front of high-risk PCa patients and improve surgical planning by performing wider surgical resection. When recurrence was evaluated, we observed that the 4-yr probability of freedom from BCR was 63.6%, in line with previous studies on high-risk PCa patients who underwent an anterior RARP approach [27,28]. Moreover, our analyses showed that high-grade disease and PSMs were independent predictors of inferior BCR and additional treatment after RS-RARP. Likewise, higher pathological stage and lymph node invasion were associated with an increased risk of additional treatment after RS-RARP. Knowledge of these factors may help clinicians improve patient counselling by adopting a risk-stratified approach. Moreover, these findings suggest that high-risk patients with negative surgical

Fig. 2 – Kaplan-Meier plots depicting (A) biochemical recurrence-free survival, (B) additional treatment-free survival, (C) urinary continence recovery, and (D) sexual function recovery after Retzius-sparing robot-assisted radical prostatectomy in high-risk prostate cancer patients. BCR = biochemical recurrence.
margins, low-grade disease, lower pathological stage, and no lymph node invasion might be optimal candidates for RS-RARP without the need of additional treatment at intermediate-term follow-up. Overall, our results on oncological outcomes overwhelmingly suggest that RS-RARP allows optimal cancer control in high-risk PCa patients and represents a valid alternative to the anterior RARP approach for surgical management of high-risk disease.

Second, the safety profile of RS-RARP in a high-risk setting was also provided by the acceptable rate of intra- and postoperative complications reported. Specifically, 14 intraoperative complications were reported in 14 patients (4%) and 52 postoperative complications occurred in 44 patients (14%), with 7.5% Clavien-Dindo III. The perioperative complication rates found in the available non–population-based studies on high-risk PCa patients treated with an anterior RARP approach range from 4% to 14.3% [25], with the major complication rates ranging from 0.6% to 9.1%. These wide ranges might be explained by variations in recording and reporting of perioperative complication data. The robustness of our data is ensured by the fact that, differently from the aforementioned studies [25], we relied on the standardised methodology proposed by the EAU guidelines to collect postoperative complications [18], which was proved to

Table 3 – Multivariable Cox regression models predicting biochemical recurrence in 320 high-risk prostate cancer patients treated with the Retzius-sparing approach at a single European high-volume centre.

| Variables                                  | Biochemical recurrence HR (95% CI) | p value | Additional treatment use HR (95% CI) | p value |
|---------------------------------------------|-----------------------------------|---------|-------------------------------------|---------|
| Pathological tumour stage                   |                                   |         |                                     |         |
| pT3a                                        | Ref.                              |         | Ref.                                |         |
| pT3b                                        | 1.3 (0.9–2.6)                     | 0.1     | 1.8 (1.2–2.7)                      | 0.002   |
| Pathological ISUP grade group               |                                   |         |                                     |         |
| 1–3                                         | Ref.                              |         | Ref.                                |         |
| 4–5                                         | 1.5 (1.01–2.2)                    | 0.04    | 1.5 (1.01–2)                       | 0.04    |
| Positive surgical margins                   |                                   |         |                                     |         |
| No                                          | Ref.                              |         | Ref.                                |         |
| Yes                                         | 2.3 (1.5–3.5)                     | <0.001  | 2.4 (1.7–3.4)                      | <0.001  |
| Pathological nodal stage                    |                                   |         |                                     |         |
| pN0                                         | Ref.                              |         | Ref.                                |         |
| pN1                                         | 1.3 (0.7–2.5)                     | 0.4     | 1.8 (1.2–2.6)                      | 0.003   |
| Adjuvant treatment                          |                                   |         |                                     |         |
| No                                          | Ref.                              |         |                                     |         |
| Yes                                         | 0.6 (0.4–1.3)                     | 0.2     |                                     |         |

CI = confidence interval; HR = hazard ratio; ISUP = International Society of Urological Pathology; Ref. = reference.

Table 4 – Summary of intraoperative complications in 340 patients with complete follow-up data treated with Retzius-sparing robot-assisted radical prostatectomy using the EAUiaiC.

| Complication and procedure                      | n | % | MF |
|------------------------------------------------|---|---|----|
| Injury of the left external iliac vein during LND |   |   |    |
| Grade 1                                        | 2 | 0.6| 0.6|
| Injury of the left internal iliac artery during LND |   |   |    |
| Grade 1                                        | 1 | 0.3| 0.3|
| Injury of the epigastric artery during trocar positioning |   |   |    |
| Grade 0                                        | 5 | 1.5| 1.8|
| Grade 1                                        | 1 | 0.3| 0.3|
| Partial injury of the right ureter during LND   |   |   |    |
| Grade 2                                        | 1 | 0.3| 0.3|
| Partial injury of the left ureter during LND    |   |   |    |
| Grade 2                                        | 1 | 0.3| 0.3|
| Complete dissection of the left obturator nerve |   |   |    |
| Grade 2                                        | 1 | 0.3| 0.3|
| Injury of the bladder nearby right ureteral orifice that required double J stent positioning |   |   |    |
| Grade 2                                        | 1 | 0.3| 0.3|
| Injury of the bladder below the bladder neck    |   |   |    |
| Grade 1                                        | 1 | 0.3| 0.3|

EAUiaiC = Intraoperative Adverse Incident Classification by the European Association of Urology ad hoc Complications Guidelines Panel; LND = lymph node dissection; MF = mode frequency.

* Grade 0: simple cautery of the vessel; grade 1: small widening of the cutaneous incision and sealing of the artery.

Table 5 – Summary of 90-d postoperative complications in 320 patients with complete follow-up data treated with Retzius-sparing robot-assisted radical prostatectomy.

| Overall complications (n = 52 in 44 patients, 14%) |
|---------------------------------------------------|
| Category                                          | Type of complication                                      | n | %  |
| Clavien-Dindo I (n = 17, 5.3%)                    | Prolonged catheterisation due to urethrovesical leakage at cystogram | 17 | 5.3|
| Clavien-Dindo II (n = 11, 3.4%)                   | Urinary tract infection requiring ABT                      | 7  | 2.2|
|                                                  | Pulmonary thromboembolism                                 | 1  | 0.3|
|                                                  | Deep venous thrombosis                                    | 3  | 0.9|
| Clavien-Dindo IIIa (n = 22, 6.9%)                 | Lymphocele treated with percutaneous drainage             | 19 | 5.9|
| Clavien-Dindo IIIb (n = 2, 0.6%)                  | Acute urinary retention requiring bladder catheterisation  | 3  | 0.9|
|                                                  | Abdominal haematoma treated with explorative laparotomy and revision of the urethrovesical anastomosis | 1  | 0.3|
|                                                  | Videolaparoscopic removal of needle fragment in pelvic area| 1  | 0.3|

ABT = antibiotic therapy.

* Lymphocele was defined as any clearly definable fluid collection and was considered clinically significant when requiring treatment. Ultrasound examination was used to detect lymphoceles.
avoid missing critical information that could lead to an underestimation of perioperative complications [30–33].

Third, we demonstrated, for the first time ever, that functional outcomes of high-risk PCa patients treated with RS-RARP were not compromised significantly. Indeed, despite the wider excision of the tissue surrounding the prostate, optimal immediate UC recovery (ie, 53%) was recorded. The rate of immediate UC recovery observed is significantly higher than those available in the literature for an anterior RARP approach [34,35], suggesting that RS-RARP is associated with faster and higher UC recovery in the short term also in the high-risk PCa setting. When functional outcomes were evaluated in the longer term, the 1- and 2-yr UC recovery were 84% and 85%, and SF recovery were 43.1% and 50%, respectively. These rates are similar to those reported by the largest available series on high-risk PCa patients treated with an anterior RARP approach (ie, 1- and 2-yr UC: 85.2% and 89.1%; 1- and 2-yr SF recovery: 33.8% and 52.3%) [34].

Our study must be interpreted in light of its limitations. First, our findings were derived from a retrospective review of prospectively collected observational data. Thus, our results must be interpreted within the bounds of the limitations of such data. Second, evolution in postoperative treatment protocols over time might have led to differences in the outcomes that we cannot account for. Third, our findings were derived from a centre with a high annual caseload and from surgeons experienced in RS-RARP. Therefore, our results might not be applicable to smaller centres with a limited surgical volume. Fourth, no validated questionnaires (eg, International Index of Erectile Function—Erectile Function) were used to quantify recovery of potency. Fifth, none of our high-risk PCa patients underwent anterior RARP. Future comparative studies are needed to confirm that RS-RARP is a valid surgical treatment option in the specific setting of high-risk PCa patients. Nonetheless, our study represents the largest report on high-risk PCa patients treated with RS-RARP as the primary treatment modality and the first one that reported intermediate-term oncological and functional outcomes and postoperative complications according to the standardised reporting methodology proposed by the EAU guidelines.

5. Conclusions

RS-RARP in high-risk PCa patients is associated with optimal intra-, peri-, and postoperative outcomes. The Retzius-sparing approach should be considered a valid surgical treatment option for high-risk PCa patients in expert hands.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.euros.2022.02.007.

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