REVIEW ARTICLE

Vol. 49 (6): 677-687, November - December, 2023
doi: 10.1590/S1677-5538.IBJU.2023.0467

Outcomes of Salvage Robotic-assisted Radical Prostatectomy in the last decade: systematic review and perspectives of referral centers.

Marcio Covas Moschovas [1, 2, 3], Carlo Andrea Bravi [4], Paolo Dell'Oglio [5], Filippo Turri [6], Ruben de Groote [3, 7], Nikolaos Liakos [8], Mike Wenzel [9], Christoph Würnschimmel [10], Fabrizio Di Maida [11], Federico Piramide [12], Iulia Andras [13], Alberto Breda [14], Alexandre Mottrie [3,7], Vipul Patel [1,2], Alessandro Larcher [15] *On behalf of Junior ERUS-YAU Working Group Robotic in Urology

[1] AdventHealth Global Robotics Institute, Florida, USA; [2] University of Central Florida (UCF), Florida, USA; [3] ORSI Academy, Ghent, Belgium; [4] Department of Urology, The Royal Marsden NHS Foundation Trust, London, UK; [5] ASST Grande Ospedale Metropolitano Niguarda, Milan, Italy; [6] ASST Santi Paolo e Carlo - La Statale University, Milan, Italy; [7] Department of Urology, OLV Hospital, Aalst, Belgium; [8] University of Freiburg Medical Centre, Germany; [9] University Hospital Frankfurt, Germany; [10] Luzerner Kantonsspital, Switzerland; [11] University of Florence, Florence, Italy; [12] University of Turin, San Luigi Gonzaga Hospital, Italy; [13] Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania; [14] Autonoma University of Barcelona at Fundacio Puigvert, Barcelona, Spain; [15] San Raffaele Hospital, Milan, Italy

ABSTRACT

Purpose: Salvage robotic-assisted radical prostatectomy (S-RARP) has gained prominence in recent years for treating patients with cancer recurrence following non-surgical treatments of Prostate Cancer. We conducted a systematic literature review to evaluate the role and outcomes of S-RARP over the past decade.
Material and Methods: A systematic review was conducted, encompassing articles published between January 1st, 2013, and June 1st, 2023, on S-RARP outcomes. Articles were screened according to PRISMA guidelines, resulting in 33 selected studies. Data were extracted, including patient demographics, operative times, complications, functional outcomes, and oncological outcomes.
Results: Among 1,630 patients from 33 studies, radiotherapy was the most common primary treatment (42%). Operative times ranged from 110 to 303 minutes, with estimated blood loss between 50 to 745 mL. Intraoperative complications occurred in 0 to 9% of cases, while postoperative complications ranged from 0 to 90% (Clavien 1-5). Continence rates varied (from 0 to 100%), and potency rates ranged from 0 to 66.7%. Positive surgical margins were reported up to 65.6%, and biochemical recurrence ranged from 0 to 57%.
Conclusion: Salvage robotic-assisted radical prostatectomy in patients with cancer recurrence after previous prostate cancer treatment is safe and feasible. The literature is based on retrospective studies with inherent limitations describing low rates of intraoperative complications and small blood loss. However, potency and continence rates are largely reduced compared to the primary RARP series, despite the type of the primary treatment. Better-designed studies to assess the long-term outcomes and individually specify each primary therapy impact on the salvage treatment are still needed. Future articles should be more specific and provide more details regarding the previous therapies and S-RARP surgical techniques.

ARTICLE INFO

Marcio Covas Moschovas
https://orcid.org/0000-0002-3290-7323

Keywords:
Salvage Robotic-assisted radical prostatectomy, prostate cancer recurrence, robotic surgery

Int Braz J Urol. 2023; 49: 677-87

Submitted for publication:
September 22, 2023

Accepted after revision:
September 26, 2023

Published as Ahead of Print:
September 30, 2023

INTRODUCTION

Since the first robotic platform was cleared by the FDA (Food and Drug Administration) in 2000, robotic surgery has expanded and improved in multiple fields with the use of different consoles in urologic surgeries. Currently, radical prostatectomy (RP) is the most common urologic procedure performed with robotic assistance, and it is the gold-standard surgical treatment for localized prostate cancer (PCa) in centers with access to robotic surgery (1). However, despite these technological advancements, other less-invasive therapies and technologies have also been described, and the surgical approach is not the only option available for treating PCa.

Concurrent with robotic surgery development, the armamentarium for treating prostate cancer without surgery is vast in the current literature, including several modalities of radiation therapy (RT) (2, 3) and different techniques of focal therapy (FT) (4, 5). However, the best management for the local cancer recurrence after a non-surgical primary treatment is still under discussion, and despite the variety of non-surgical treatments for localized PCa, every therapy causes anatomical modifications and consequences that will impact the outcomes of a subsequent salvage robotic-assisted radical prostatectomy (S-RARP).

As a minimally invasive surgical approach, due to increased experience by robotic surgeons, S-RARP has rapidly gained momentum over the last decade, transforming the landscape of prostate cancer salvage therapy. Unlike traditional open surgeries, robotic-assisted techniques employ advanced technology, enabling surgeons to achieve unparalleled dexterity and visual magnification. This revolution in surgical technology has allowed for greater preservation of critical anatomical structures, leading to reduced rates of postoperative complications and improved functional outcomes. However, even with robotic surgery advantages, S-RARP is still a challenging procedure for surgeons and patients. Therefore, we performed a systematic literature review assessing the outcomes and the robotic surgery role in the past decade to approach salvage radical prostatectomy.

EVIDENCE ACQUISITION

Literature Search Strategy

We performed a systematic literature review (PROSPERO number CRD42023429052) of articles published in the last ten years (from January 1st, 2013 to June 1st, 2023), assessing the available studies describing outcomes of salvage robotic-assisted radical prostatectomy (S-RARP). The literature screening included PubMed®, Web of Science, and Cochrane using the terms "salvage robotic-assisted radical prostatectomy, salvage robotic laparoscopic prostatectomy, and salvage robotic radical prostatectomy."

Afterward, two investigators (M.C.M and C.B) independently screened and checked all articles using standardized data extraction forms. In case of any discrepancy about eligibility, the article was evaluated by a third author (P.D). The review was performed according to preferred reporting items for Systematic reviews and Meta-analyses (PRISMA) guidelines (6, 7).

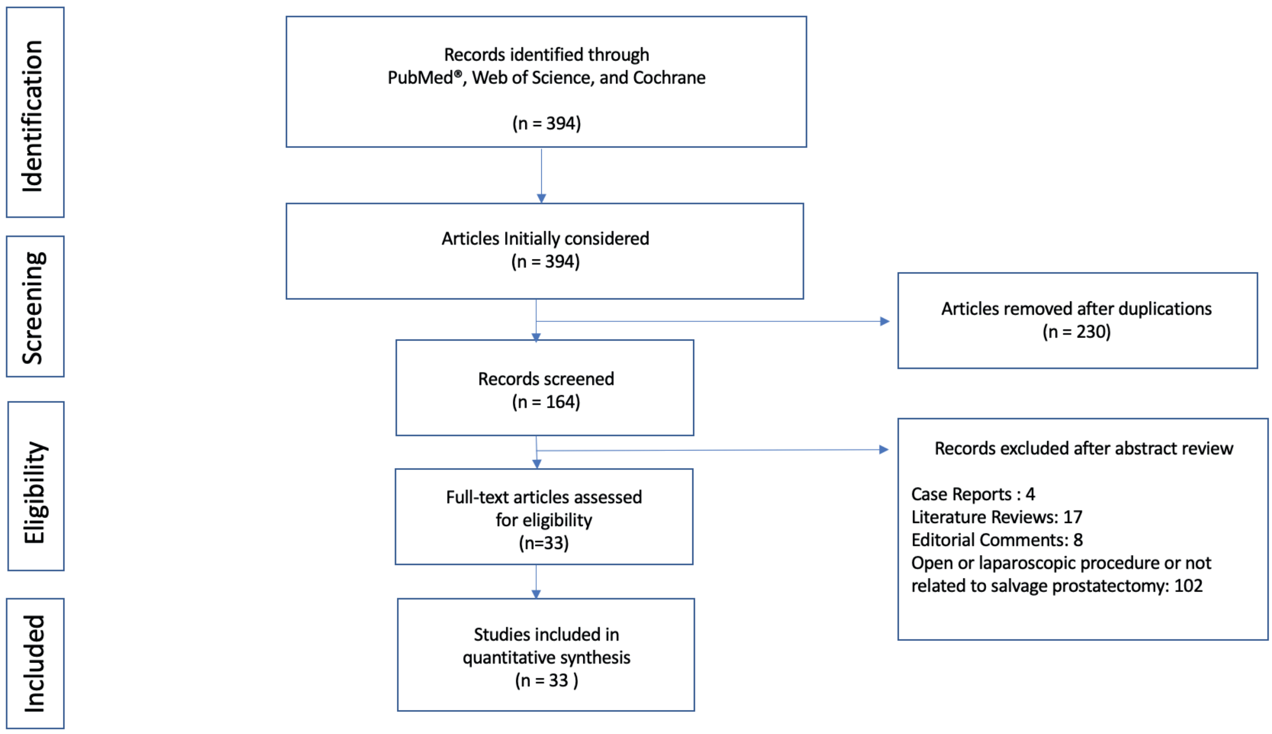
Inclusion and exclusion criteria

We selected articles written in English describing research and studies in humans. When finding studies from the same institution with overlapping patients and outcomes, we considered only the most recent data. We also excluded previous literature reviews, studies mixing the data of different approaches (open, laparoscopic, and robotic) without specifying the robotic surgery outcome, conference abstracts, and case reports of techniques previously described in the literature. When evaluating studies with different groups of S-RARP, we considered only the robotic surgery data. Figure-1 illustrates a flowchart with the selection criteria used. References were manually reviewed and reported according to the PubMed® citation format.

Variables and outcomes definition

We included relevant data regarding the year of the article publication: number of patients undergoing S-RARP in the study, type of primary therapy, total operative time (TOT), console time (CT), intraoperative complications (IOC), estimated blood loss (EBL), postoperative complications

Figure 1 - Flowchart illustrating the literature search with exclusion criteria until reaching the number of articles used in the review.



(POC), positive surgical margins (PSM), continence recovery rates, potency recovery rates, biochemical recurrence (BCR), and median follow-up (MFU).

The primary endpoint of our review is to evaluate and report complication rates, functional and oncological outcomes of S-RARP.

EVIDENCE SYNTHESIS

Summary of the studies

Similar to the primary intervention, the salvage treatment for prostate cancer can be performed with different approaches, such as surgery, RT, HIFU, Cryo, EBRT, and androgen deprivation. However, in this section, we will describe the literature specific on the surgical treatment with salvage robotic-assisted radical prostatectomy (S-RARP).

Overall, we identified 394 articles that fulfilled our search criteria, of which 230 were duplications. From 164 remaining articles, we excluded 131 after the abstract review. In summary, 33 articles were selected containing the robotic surgery approach to patients who underwent previous non-surgical treatment for prostate cancer (Figure-1) (8-40).

Overall, we identified a total of 33 articles with a median follow-up that ranged from 7 to 44 months. Table-1 illustrates the articles from 2013 to 2019, while Table-2 illustrates articles from 2020 to 2023. The tables include the data collected on each study, including the year of publication, the number of patients of each study, type of primary therapy, total operative time (TOT), console time (CT), intraoperative complications (IOC), estimated blood loss (EBL), postoperative complications (POC) according to Clavien-Dindo (Clv), positive surgical margins (PSM), continence, potency, biochemical recurrence (BCR), and median follow-up (MFU) in months.

Primary therapy for PCa before S-RARP

Overall, in the past 10 years, a total of 1630 patients reported in the literature underwent S-RARP, with radiotherapy being the most com-

Table 1 - Articles included from 2013 to 2019.

Author	Year	N. of patients	Primary Therapy	TOT/CT (minutes)	IOC (%)	EBL (mL)	POC in 90 days (%) Clavien range	PSM (%)	Continence/ Potency (%)	BCR (%)	MFU months
Kaffenberger et al. (8)	2013	34	BRC-19 RT-11 HIFU-4	NA/ NA	3 rectal	NA	30 (Clv 1-3)	26	39/21	18	16
Zugor et al. (9)	2014	13	EBRT-7 BRC-6	154/ NA	0	130	30 (Clv 1-3)	0	54/23	23	22.8
Yuh et al. (10)	2014	51	BRC-23 Cryo- 3 EBRT- 18 HIFU-1 PB-6	179/ NA	5	175	47 (Clv1-5)	31	45/23	43	36
Vora et al. (11)	2015	6	RT	NA/ NA	0	NA	16.7	NA	83.4/ NA	16.7	7.2
Kenney et al. (12)	2016	20	RT	303/ NA	5	381	30 Clv ≥3	15	NA/ NA	22	9.5
Ozu et al. (13)	2016	1	HIRT	244/ 189	0	100	0	0	NA/NA	0	10
Peretsman et al. (14)	2017	9	HIFU (Sonablate)	130/ NA	0	125	NA	NA	100/20	NA	NA
Orré et al. (15)	2017	7	BCR	148/ NA	0	NA	14 Clv ≥3	14	50/ 66	14	24
Ou et al. (16)	2017	14	RT-11 CKR-2 HIFU-1	NA/ 134	7	100	21	21.4	71.4/ 66.7	21	32.4
Nunes-Silva et al. (17)	2017	22	FT	134/ NA	9.1	465	NA	4.5	53.8/ NA	31.8	12
Ogaya-Pinies et al. (38)	2018	60	EBRT-35 BCR-10 PB-6 Cryo-7 HIFU-2	131/ NA	0	130	5 Clv 1-2	NA	50 / NA	NA	12
Bonet et al. (22)	2018	80	RT-63 ABL-17	NA/ NA	0	NA	NA	NA	53.7/ 16.6	31	22.5
Ogaya-Pinies et al. (40)	2018	96	EBRT-37 BCR-14 BCR+EBRT-13 CYK-3 PB-1 Cryo-18 HIFU-7 Others 4	125/ NA	0	100	26 Clv 1-4	16.7	57.3/ 55	15	14

Marconi et al. (18)	2019	82	HIFU-57 Cryo-16 IRE-4 VTP-3 PRX302-2	NA/ NA	0	400	6.1 Clv 1-3b	13.4	83/ 14	41.5	13
Gontero et al. (19)	2019	209	RT-121 BCR-55 Cryo-14 HIFU-9 Others-10	228/ NA	0.48 rectal	222	34.9 Clv1-4	NA	63.9/ 8.1	NA	28.8
Onol et al. (20)	2019	126	RT-94	129/84	0	106	20 Clv 1-4	17	51.3/ 13	17	32
			ABL-32	122/84	0	93	9 Clv 1-3a	43.8	87.5/ 27	18	29

Clv (Clavien-Dindo); EBL (estimated blood loss); PSM (positive surgical margins); TOT (total operative time); CT (console time); IOC (intraoperative complication); POC (postoperative complications); NA (not available); MFU (median follow up); PB (proton bean); Cryo (cryotherapy); CYK (Cyberknife); BCR (biochemical recurrence on the period of the study); Primary Therapy: RT (radiotherapy); HIRT (heavy iron radiotherapy therapy); BRC (Brachytherapy); HIFU (high intensity focused ultrasound); FT (focal therapy); EBRT (external-bean radiotherapy); ABL (ablation); IRE (Irreversible Electroporation) VTP (vascular-targeted photodynamic therapy); PRX302 (Topsalysin)

mon primary treatment (42%), followed by HIFU (18%), brachytherapy (10%), and cryotherapy (5%). The remaining patients (25%) underwent other therapies or a combination of therapies as primary treatment for PCa.

Surgical Performance and Complications

The total operative time range was from 110 to 303 minutes (reported by most articles), and the console time ranged from 84 to 199 minutes (reported by few studies).(12,20,23,36) Estimated blood loss ranged from 50 to 745 mL.(23,30) Intra- and postoperative complications ranged from 0 to 9,1% and 0 to 90%, respectively (Clavien 1 to 5). Rectal injury ranged from 0.48 to 3%. (8, 19, 25, 37).

Functional Outcomes

Functional outcomes are illustrated in Tables 1 and 2. The continence rates ranged from 0 to 100% (14, 24, 33, 34), and the studies diverge regarding the definition of continence. Twenty-one studies defined continence as no pads use (10, 12, 15-22, 25, 26, 30, 31, 33, 35-40), five studies considered up to one pad (8, 9, 23, 28, 32), one study evaluated continence using EPIC-26 questionnaire 24, and one study considered the ICIQ-score questionnaire (29). We were not able to find continence definition in five studies (11, 13, 14, 27, 34).

Potency rates ranged from 0 to 66.7% (16, 21, 30) and most studies defined potency as the capacity to have intercourse with or without phosphodiesterase 5 (PDE-5) inhibitors (8-10, 14-16, 18-22, 25, 26, 31, 33, 37, 39,40). One study evaluated potency recovery using the EPIC-26 questionnaire 24, and two studies using the IIEF-5 (29, 36). In some studies, we were not able to find data on potency (11-13, 17, 23, 27, 28, 30, 32, 34, 35, 38), continence, or BCR. Finally, most authors described the number of events in the follow-up period and failed to demonstrate functional outcomes in Kaplan-Meyer curves (time to event) to estimate early potency or continence following surgery.

Pathological and Oncological Outcomes

Tables 1 and 2 describe the oncological outcomes. Positive surgical margins after S-RARP reached up to 65.6%(28), while biochemical recurrence ranged from 0 to 57% (32). All studies reported BCR according to RTOG-ASTRO Phoenix Criteria (1). However, in most studies, BCR in five years was not available due to the short-term fol-

Table 2: Articles included from 2020 to 2023.

Author	Year	N. of patients	Primary Therapy	TOT/CT (minutes)	IOC (%)	EBL (mL)	POC (Clavien) In 90 days (%)	PSM (%)	Continence/ Potency (%)	BCR (%)	MFU months
Thompson et al. (21)	2020	45	HIFU	NA/ 140	0	200	17.8 Clv 1-3	44.4	65.5/ 0	5.3	17.7
Bonet et al. (39)	2020	120	RT ABL	127/ 84	0	103	14.2 Clv1-4	22.5	55,8/ 19.2	32.5	44
De Groote et al. (35)	2020	106	HIFU-59 RT-27 BRC-10 Others -10	142/NA	0	200	8 Clv 1-3	39	50/ 5	13	25
Madi et al. (23)	2021	*RS (20) Usual (6)	EBRT-18 BRC-4 Cryo-2 CYK-2	NA/ 141 NA/ 199	0 0	50 100	10 Clv 1-3 16,7 Clv 3	30 33	100/NA 44/NA	20 33,3	18
Cathcart et al. (24)	2021 (RCT)	23	Cryo (4) HIFU (17) Electro (1)	NA	0	NA	4 (Clv 1)	35	100/52	18	12
Martinez et al. (25)	2021	26	BRC (3) EBRT (19) IMRT (3)	NA	3.8 rectal	150	11.5(Clv 3-5)	26,9	90.9/4.5	39.1	47
Nathan et al. (26)	2021	135	N/A	165/NA	0.8 rectal	200	13.3 (Clv 1-5)	37.8	78.8/5.2	22.2	43
Nunes-Silva (27)	2021	*RS (12)	EBRT (10) BRC (2)	NA/138	0	81	8.3(Clv 3)	25	91.6/NA	16.6	12
Kowalczyk et al. (28)	2021	*RS (40)	EBRT (21) BRC (12) HIFU (7)	NA/130	2.5	100	12.5 (Clv 1-5)	57.5	54.1/10	23.1	23
Kowalczyk et al. (28)	2021	32	EBRT (16) BRC (9) Cryo (5) RT (2)	NA/175	0	150	28.1(Clv 1- 3)	65.6	6.3/12.5	37.5	36
Spitznagel et al. (29)	2021	13	HIFU	260/NA	0	230	46.2 (Clv 1-3)	7.7	NA/NA	0	12
Bozkurt et al. (30)	2021	10	PTB	230/NA	0	745	90 (Clv 1-4)	20	12.5/0	10	31.8
Bhat et al. (31)	2021	53	FT	NA/121	0	100	21 (Clv1-2)	40	56/13	17	36.3

Schuetz et al. (32)	2021	*RS (21)	RT (8) HIFU (9) BRC (2) Cryo (1) FT (1)	228/NA	0	300	NA	19	19/NA	14.3	12
Schuetz et al. (32)	2021	7	RT (4) HIFU (1) BRC (2)	252/NA	0	500	NA	57,1	0/NA	57,1	36
Blazevski et al. (33)	2022	15	FT	NA/NA	0	200	NA	7	100/60	0	22
Mortensen et al. (34)	2022	5	EBRT	205/NA	0	120	60 (Clv 1-3)	60	0/NA	20	13
Nathan et al. (37)	2022	100	HIFU (92) Cryo (5) IRE (2)	170/NA	0	200	9 (Clv 1-3)	25	84,7/21	23	16,5
De Luca et al. (36)	2022	11	HIFU	110/NA	0	NA	20 (Clv 1)	27	81/18	0	12

Clv (Clavien-Dindo), EBL (estimated blood loss), PSM (positive surgical margins), TOT (total operative time), CT (console time), IOC (intraoperative complication), POC (postoperative complications), NA (not available), MFU (median follow up), PB (proton bean), Cryo (cryotherapy), CYK (Cyberknife), BCR (biochemical recurrence on the period of the study). Primary Therapy: RT (radiotherapy), HIRT (heavy iron radiotherapy therapy), BRC (Brachytherapy), HIFU (high intensity focused ultrasound), FT (focal therapy), EBRT (external-bean radiotherapy), IRE (Irreversible Electroporation), Electro (Electroporation), IMRT (Intensity-modulated radiotherapy), *RS (Retzius-sparing), PTB (proton bean).

low-up. Most authors described BCR as the number of events in the follow-up period with percentages and failed to demonstrate it in Kaplan-Meyer curves (time to event) to estimate the recurrence time following surgery in a better fashion.

Retzius-Sparing (RS) approach to S-RARP

Only four articles, comprising 93 patients, described the RS approach to S-RARP. In these studies, PSM ranged from 23.8 to 57.5% and continence from 19 to 100%. None of the studies described or compared early continence following RS. Potency was available in only one study (10%) (28). BCR ranged from 14.3 to 23.1% (23, 27, 28, 32).

DISCUSSION

We have summarized the past decade of all studies describing outcomes of salvage robotic-assisted radical prostatectomy for prostate cancer recurrence after primary treatment. Reporting and comparing the outcomes of S-RARP is challenging because the available data is based on retrospective studies with a small number of patients and all its inherent risks of bias. The current literature is inconsistent, and most studies reported the overall outcomes adding different primary therapies without specifying or separating the patients and results according to the primary approach. Furthermore, the surgeries were performed by several surgeons with diverse levels of experience and techniques, which also impacts the outcomes of each patient (39). In addition, most studies failed to report the primary therapy details, such as radiation dose and fractions, type of energy used on the focal approach (full or partial ablation), side and histology of the primary tumor, and details of preoperative hormone treatment, which may impact in the positive surgical margins rates. In this scenario, due to the multifactorial risks of bias and inconsistencies, avoiding misleading conclusions regarding S-RARP, we reported and evaluated the current articles individually instead of conducting a meta-analysis.

Recent studies described the importance of selection criteria for S-RARP to optimize operative outcomes (41). According to the European Association of Urology (EAU), candidates for S-RARP should have low comorbidity, life expectancy of at least 10 years, PSA lower than 10, International Society of Urological Pathology (ISUP) grade group ≤ 2/3, no lymph node involvement on preoperative imaging exam, and clinical stage T1 or T2. Calleris and colleagues described significant differences and benefits for patients selected according to these variables. Unfortunately, being a recent study and guideline by EAU, most articles included in our review were published before 2022 and violated at least one criterion for selecting candidates for S-RARP (41). Therefore, we believe that outcomes of Robotic-assisted Salvage Prostatectomy should improve in the following years when selecting patients according to these guidelines.

Only one randomized clinical trial (RCT) was reported with a small number of patients (23), describing 100% continence rates after 12 months and 58% of potency recovery in patients treated with previous Focal Therapy (24). The largest series of S-RARP to date was published by Gontero et al., reporting the outcomes of 18 tertiary centers comparing open and robotic groups of salvage prostatectomy. In this retrospective study, 209 patients underwent S-RARP, and the author reported up to 34.9% of postoperative complication rates, with 0.48% of rectal injuries. Potency and continence for the robotic group reached 8.1% and 57.5%, respectively. PSM and BCR were not assessed in this study (19). Even with a relatively high number of patients reported by this study, evaluating functional and oncological outcomes in S-RARP is challenging due to several factors that impact surgical results. From this article, it is reasonable to conclude that intraoperative complications and rectal injury have low rates, but continence and potency recovery are suboptimal and challenging to perform a critical analysis of due to a lack of data on the preoperative function of these patients. In a subsequent study, the same group published a cohort of 414 patients describing the oncological outcomes. However, we excluded this data from our review because open and robotic results were mixed and not reported individually (42).

Some studies have assessed the S-RARP outcomes of patients selected according to the primary therapy. Two of them reported and compared the results of S-RARP following ablation and radiation. The authors had similar conclusions in terms of functional outcomes between the therapies (20, 35). In both articles, potency and continence rates were higher in patients who underwent primary ablations. However, the results are still suboptimal, even in the ablation group, which in theory had only partial damage on the prostate during the primary treatment. Kenney et al. also described the S-RARP in patients with previous radiation and reported complications with Clavien-Dindo ≥ 3 reaching up to 30%, while PSM and BCR reached 15% and 22%, respectively (12). In another study, Orré M et al. reported 14% of PSM and 14% of BCR in patients with previous brachytherapy (15). However, even with compatible results presented by these studies, PSM and BCR are also influenced by several factors such as tumor histology, previous hormone treatment, radiation fractions and dose, brachytherapy technique, and surgeon's experience.

Furthermore, nine articles including 374 patients exclusively reported the S-RARP following Focal Therapy (14, 17, 18, 21, 26, 29, 31, 33, 36). The complication rates ranged from 6.1 to 46.2%, PSM from 4.5% to 44%, and BCR from 0 to 41.5%. In these series, it is also challenging to stratify the patients due to a lack of information regarding the type of energy used in the Focal therapy (Focal One or Sonablate), whole or partial gland ablation, initial tumor histology and stage, preoperative potency, and continence. In this context, Bhat and colleagues described worse functional and oncological outcomes of S-RARP post Focal Therapy compared to primary radical prostatectomy, showing that focal ablations often cause contralateral prostate damage and also impact functional outcomes (31).

The Retzius-sparing approach to S-RARP has also been described in 4 studies comprising 93 patients (23, 27, 28, 32). The results were compatible with other series of S-RARP with intraoperative complications ranging from 0 to 2.5%, biochemical recurrence from 14.3 to 23%, continence from 19 to 100%, and most studies did not describe potency recovery rates. In one study, continence rates were 100% for the RS versus 44% for the conventional approach (27). However, due to the small number of cases reported and some missing data on outcomes in the literature, we still need more studies evaluating outcomes of this approach in salvage settings. The RS approach to S-RARP is feasible and safe when performed by experienced surgeons. We believe the challenge lies in the tumor recurrence and lack of landmarks posed by the primary treatment, not in the RS technique.

Among all possible intraoperative complications in patients undergoing S-RARP, rectal injury is one of the most feared by surgeons. Due to the technical challenges and lack of anatomic landmarks posed by the primary treatment, posterior adhesions between the prostate and rectum are common in this type of surgery. In addition, the primary therapy aggression on the rectum, especially radiation, usually makes the intestinal tissue more susceptible to dehiscence and fistula after an eventual repair. Evaluating the current articles in the literature, intraoperative complications ranged from 0 to 9%, and only three studies described rectal injury, being one patient with local staging pT4 disease (8,19,25). However, it is important to note that the literature on salvage prostatectomy is based on retrospective studies with great potential for selection bias, and we believe that the percentage of rectal injuries could be underestimated and underreported. In this scenario, patients and surgeons should be aware of the increasing risks of rectal injuries in these cases, and we recommend always having a general surgeon consultation and backup before operating on these patients.

Despite its strengths, our study is not devoid of limitations. First, as previously described, the current literature is based on retrospective studies and all its inherent limitations, especially selection bias. Second, most articles grouped different primary therapies and reported the outcomes without individualizing the primary approach with more details, such as radiation fractions and dose, previous hormone treatment and type of regimen (agonist or antagonist), type of ablation (whole or focal gland), and initial tumor histology and staging before primary treatment. Third, the articles have some inconsistencies in the definitions and reports of the trifecta (potency, continence, and BCR). Also, some studies reported only part of these outcomes. Fourth, most articles reported the overall rates of biochemical recurrence without specifying the time to recurrence on Kaplan-Meyer curves and the next steps on the treatment after recurrence following S-RARP. However, despite the literature limitations on S-RARP, we believe we could summarize the most important aspects of this challenging procedure, adding valuable inputs from experts in this field.

CONCLUSIONS

In the last decade, salvage robotic-assisted radical prostatectomy in patients with cancer recurrence after previous prostate cancer treatment was safe and feasible. The literature is based on retrospective studies with inherent limitations describing low rates of intraoperative complications and small blood loss. However, potency and continence rates are largely reduced compared to the primary RARP series, despite the type of the primary treatment. In this scenario, patients should be aware and counseled about technical and anatomical challenges posed by the primary therapy and potential risk of rectal injury during the procedure. Better-designed studies to assess the long-term outcomes and individually specify each primary therapy impact on the salvage treatment are still needed. Future articles should be more specific and provide more details regarding the previous therapies and S-RARP surgical techniques.

CONFLICT OF INTEREST

None declared.

REFERENCES

1. Mottet N, van den Bergh RCN, Briers E, Van den Broeck T, Cumberbatch MG, De Santis M, et al. EAU-EANM-ESTRO-ESUR-SIOG Guidelines on Prostate Cancer-2020 Update. Part 1: Screening, Diagnosis, and Local Treatment with Curative Intent. Eur Urol. 2021;79:243-62.

2. Valle LF, Lehrer EJ, Markovic D, Elashoff D, Levin-Epstein R, Karnes RJ, et al. A Systematic Review and Meta-analysis of Local Salvage Therapies After Radiotherapy for Prostate Cancer (MASTER). Eur Urol. 2021;80:280-92.
3. Wallis CJD, Saskin R, Choo R, Herschorn S, Kodama RT, Satkunasivam R, et al. Surgery Versus Radiotherapy for Clinically-localized Prostate Cancer: A Systematic Review and Meta-analysis. Eur Urol. 2016;70:21-30.
4. Abreu AL, Kaneko M, Cacciamani GE, Lebastchi AH. Focal Therapy for Prostate Cancer: Getting Ready for Prime Time. Eur Urol. 2022;81:34-6.
5. Valerio M, Cerantola Y, Eggener SE, Lepor H, Polascik TJ, Villers A, et al. New and Established Technology in Focal Ablation of the Prostate: A Systematic Review. Eur Urol. 2017;71:17-34.
6. Moher D, Liberati A, Tetzlaff J, Altman DG; PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. BMJ. 2009;339:b2535.
7. Hutton B, Salanti G, Caldwell DM, Chaimani A, Schmid CH, Cameron C, et al. The PRISMA extension statement for reporting of systematic reviews incorporating network meta-analyses of health care interventions: checklist and explanations. Ann Intern Med. 2015;162:777-84.
8. Kaffenberger SD, Keegan KA, Bansal NK, Morgan TM, Tang DH, Barocas DA, et al. Salvage robotic assisted laparoscopic radical prostatectomy: a single institution, 5-year experience. J Urol. 2013;189:507-13.
9. Zugor V, Labanaris AP, Porres D, Heidenreich A, Witt JH. Robot-assisted radical prostatectomy for the treatment of radiation-resistant prostate cancer: surgical, oncological and short-term functional outcomes. Urol Int. 2014;92:20-6.
10. Yuh B, Ruel N, Muldrew S, Mejia R, Novara G, Kawachi M, et al. Complications and outcomes of salvage robot-assisted radical prostatectomy: a single-institution experience. BJU Int. 2014;113:769-76.
11. Vora A, Agarwal V, Singh P, Patel R, Rivas R, Nething J, et al. Single-institution comparative study on the outcomes of salvage cryotherapy versus salvage robotic prostatectomy for radio-resistant prostate cancer. Prostate Int. 2016;4:7-10.
12. Kenney PA, Nawaf CB, Mustafa M, Wen S, Wszolek MF, Pettaway CA, et al. Robotic-assisted laparoscopic versus open salvage radical prostatectomy following radiotherapy. Can J Urol. 2016;23:8271-7.
13. Ozu C, Aoki K, Nakamura K, Yagi Y, Muro Y, Nishiyama T, et al. The Initial Case Report: Salvage Robotic Assisted Radical Prostatectomy After Heavy Ion Radiotherapy. Urol Case Rep. 2016;7:45-7.
14. Peretsman S, Brooks J. Salvage robotic prostatectomy following whole gland high-intensity focused ultrasound with a Sonablate 500 device: technical feasibility and safety. J Robot Surg. 2017;11:217-21.
15. Orré M, Piéchaud T, Sargos P, Richaud P, Roubaud G, Thomas L. Oncological and functional results of robotic salvage radical prostatectomy after permanent brachytherapy implants. Cancer Radiother. 2017;21:119-23.
16. Ou YC, Hung SC, Hwang LH, Yang CK, Hung SW, Tung MC. Salvage Robotic-assisted Laparoscopic Radical Prostatectomy: Experience with 14 Cases. Anticancer Res. 2017;37:2045-50.
17. Nunes-Silva I, Barret E, Srougi V, Baghdadi M, Capogrosso P, Garcia-Barreras S, et al. Effect of Prior Focal Therapy on Perioperative, Oncologic and Functional Outcomes of Salvage Robotic Assisted Radical Prostatectomy. J Urol. 2017;198:1069-76.
18. Marconi L, Stonier T, Tourinho-Barbosa R, Moore C, Ahmed HU, Cathelineau X, et al. Robot-assisted Radical Prostatectomy After Focal Therapy: Oncological, Functional Outcomes and Predictors of Recurrence. Eur Urol. 2019;76:27-30.
19. Gontero P, Marra G, Alessio P, Filippini C, Oderda M, Munoz F, et al. Salvage Radical Prostatectomy for Recurrent Prostate Cancer: Morbidity and Functional Outcomes from a Large Multicenter Series of Open versus Robotic Approaches. J Urol. 2019;202:725-31.
20. Onol FF, Bhat S, Moschovas M, Rogers T, Ganapathi H, Roof S, et al. Comparison of outcomes of salvage robot-assisted laparoscopic prostatectomy for post-primary radiation vs focal therapy. BJU Int. 2020;125:103-11.
21. Thompson JE, Sridhar AN, Shaw G, Rajan P, Mohammed A, Briggs TP, et al. Peri-operative, functional and early oncologic outcomes of salvage robotic-assisted radical prostatectomy after high-intensity focused ultrasound partial ablation. BMC Urol. 2020;20:81.
22. Bonet X, Ogaya-Pinies G, Woodlief T, Hernandez-Cardona E, Ganapathi H, Rogers T, et al. Nerve-sparing in salvage robot-assisted prostatectomy: surgical technique, oncological and functional outcomes at a single high-volume institution. BJU Int. 2018;122:837-44.
23. Madi R, Sayyid RK, Hiffa A, Thomas E, Terris MK, Klaassen Z. Early Experience with Salvage Retzius-sparing Robotic-assisted Radical Prostatectomy: Oncologic and Functional Outcomes. Urology. 2021;149:117-21.
24. Cathcart P, Ribeiro L, Moore C, Ahmed HU, Leslie T, Arya M, et al. Outcomes of the RAFT trial: robotic surgery after focal therapy. BJU Int. 2021;128:504-10.

25. Martinez PF, Romeo A, Tobia I, Isola M, Giudice CR, Villamil WA. Comparing open and robotic salvage radical prostatectomy after radiotherapy: predictors and outcomes. Prostate Int. 2021;9:42-7.
26. Nathan A, Fricker M, De Groote R, Arora A, Phuah Y, Flora K, et al. Salvage Versus Primary Robot-assisted Radical Prostatectomy: A Propensity-matched Comparative Effectiveness Study from a High-volume Tertiary Centre. Eur Urol Open Sci. 2021;27:43-52.
27. Nunes-Silva I, Hidaka AK, Monti CR, Tobias-Machado M, Zampolli HC. Salvage Retzius sparing robotic assisted radical prostatectomy: the first brazilian experience. Int Braz J Urol. 2021;47:1279-80.
28. Kowalczyk KJ, Madi RH, Eden CG, Sooriakumaran P, Fransis K, Raskin Y, et al. Comparative Outcomes of Salvage Retzius-Sparing versus Standard Robotic Prostatectomy: An International, Multi-Surgeon Series. J Urol. 2021;206:1184-91.
29. Spitznagel T, Hardenberg JV, Schmid FA, Rupp NJ, Westhoff N, Worst TS, et al. Salvage Robotic-assisted Laparoscopic Radical Prostatectomy Following Focal High-Intensity Focused Ultrasound for ISUP 2/3 Cancer. Urology. 2021;156:147-53.
30. Bozkurt Y, Atar M, Pisters LL. Early Experience with Salvage Robotic-Assisted Radical Prostatectomy in Proton Beam Radiotherapy Failures. Balkan Med J. 2021;38:310-15.
31. Bhat KRS, Covas Moschovas M, Sandri M, Noel J, Reddy S, Perera R, et al. Outcomes of Salvage Robot-assisted Radical Prostatectomy After Focal Ablation for Prostate Cancer in Comparison to Primary Robot-assisted Radical Prostatectomy: A Matched Analysis. Eur Urol Focus. 2022;8:1192-7.
32. Schuetz V, Reimold P, Goertz M, Hofer L, Dieffenbacher S, Nyarangi-Dix J, et al. Evolution of Salvage Radical Prostatectomy from Open to Robotic and Further to Retzius Sparing Surgery. J Clin Med. 2021;11:202.
33. Blazevski A, Gondoputro W, Scheltema MJ, Amin A, Geboers B, Barreto D, et al. Salvage robot-assisted radical prostatectomy following focal ablation with irreversible electroporation: feasibility, oncological and functional outcomes. BMC Urol. 2022;22:28.
34. Mortensen MA, Poulsen CA, Ahlgren G, Madsen K, Poulsen MH. Introduction of salvage prostatectomy in Denmark: the initial experience. BMC Res Notes. 2022;15:185.
35. De Groote R, Nathan A, De Bleser E, Pavan N, Sridhar A, Kelly J, et al. Techniques and Outcomes of Salvage Robot-Assisted Radical Prostatectomy (sRARP). Eur Urol. 2020;78:885-92.
36. De Luca S, De Cillis S, Piramide F, Alessio P, Russo F, Amparore D, et al. Robotic radical prostatectomy in post HIFU salvage setting: tertiary center experience and review of the current literature. Mini-invasive Surg 2022;6:13. [Internet]. Available at. <https://misjournal.net/article/view/4636>
37. Nathan A, Fricker M, De Groote R, Arora A, Phuah Y, Flora K, et al. Salvage Versus Primary Robot-assisted Radical Prostatectomy: A Propensity-matched Comparative Effectiveness Study from a High-volume Tertiary Centre. Eur Urol Open Sci. 2021;27:43-52.
38. Ogaya-Pinies G, Kadakia Y, Palayapalayam-Ganapathi H, Woodlief T, Jenson C, Syed J, et al. Use of Scaffolding Tissue Biografts To Bolster Vesicourethral Anastomosis During Salvage Robot-assisted Prostatectomy Reduces Leak Rates and Catheter Times. Eur Urol. 2018;74:92-8.
39. Bonet X, Moschovas MC, Onol FF, Bhat KR, Rogers T, Ogaya-Pinies G, et al. The surgical learning curve for salvage robot-assisted radical prostatectomy: a prospective single-surgeon study. Minerva Urol Nephrol. 2021;73:600-9.
40. Ogaya-Pinies G, Linares-Espinos E, Hernandez-Cardona E, Jenson C, Cathelineau X, Sanchez-Salas R, et al. Salvage robotic-assisted radical prostatectomy: oncologic and functional outcomes from two high-volume institutions. World J Urol. 2019;37:1499-505.
41. Calleris G, Marra G, Benfant N, Rajwa P, Ahmed M, Abreu A, et al. Salvage Radical Prostatectomy for Recurrent Prostate Cancer Following First-line Nonsurgical Treatment: Validation of the European Association of Urology Criteria in a Large, Multicenter, Contemporary Cohort. Eur Urol Focus. 2023;9:645-9.
42. Marra G, Karnes RJ, Calleris G, Oderda M, Alessio P, Palazzetti A, et al. Oncological outcomes of salvage radical prostatectomy for recurrent prostate cancer in the contemporary era: A multicenter retrospective study. Urol Oncol. 2021;39:296.e21-296.e29.

Correspondence address:
Marcio Moschovas, MD
AdventHealth Global Robotics Institute,
380 Celebration Pl Suite 401,
Celebration, FL 34747, USA
Telephone: +1 407 303-4673
E-mail: Marcio.doc@hotmail.com