Prostate International 12 (2024) 179–185

Contents lists available at ScienceDirect

Prostate International

journal homepage: https://www.journals.elsevier.com/prostate-international

Review article

Effects of bladder neck sparing on continence outcomes of robotic-assisted radical prostatectomy: a systemic review and metaanalysis

Joongwon Choi [a,★], Yun-Jung Yang [b,★], Chung Un Lee [a], Jung Hoon Kim [a], Jin Wook Kim [a], Jong Hyun Tae [c], Se Young Choi [c], In Ho Chang [c], Eun-Jung Yang [d], Yong Seong Lee [a,*]

[a] Department of Urology, Chung-Ang University Gwangmyeong Hospital, Chung-Ang University College of Medicine, Gwangmyeong, Korea
[b] Department of Convergence Science, College of Medicine, Catholic Kwandong University International St. Mary's Hospital, Incheon, Korea
[c] Department of Urology, Chung-Ang University Hospital, Chung-Ang University College of Medicine, Seoul, Korea
[d] Department of Plastic and Reconstructive Surgery, Institute for Human Tissue Restoration, Yonsei University College of Medicine, Seoul, Korea

ARTICLE INFO

Article history:
Received 3 April 2024
Received in revised form
18 April 2024
Accepted 25 April 2024
Available online 29 April 2024

Keywords:
Metaanalysis
Prostatectomy
Robotics
Urinary incontinence

ABSTRACT

Restoration of postoperative urinary continence after robot-assisted radical prostatectomy (RARP) is affected by diverse factors. We compared the pad-free and positive margin rates of patients who underwent RARP with or without bladder neck sparing (BNS) for prostate cancer. During this systematic review and metaanalysis, we performed an electronic search of the Web of Science, Embase, Cochrane Central Register of Controlled Trials, and PubMed to find original articles comparing RARP with and without BNS for prostate cancer. We identified six studies (2,351 patients in total) who underwent RARP with or without BNS. A metaanalysis of the pad-free rate at 3 months was performed. The overall pad-free rate at 3 months for patients who underwent RARP with BNS was significantly higher than that of patients who underwent RARP alone (control group) (odds ratio, 1.86; 95% confidence interval [CI], 1.22 −2.82), with high heterogeneity ($P = 0.005$; $I^2 = 67.45\%$). The pad-free rates at 7 days, 6 months, and 1 year and positive surgical margin rates of patients who underwent BNS were not significantly different than those in the control group. Although no statistical difference was observed, the catheterization period of the BNS group was shorter than that of the control group (standardized mean difference = −0.08; 95% CI, −0.16 to 0.01). Although RARP with BNS did not affect the long-term outcome of continence, it had a significant effect on the early recovery of continence.

1. Introduction

Prostate cancer is the second most prevalent cancer and the fifth leading cause of cancer-related mortality among men worldwide.[1] Prostate cancer ranks as the third most prevalent cancer across 20 Asian nations. The rise in prostate cancer cases correlates with extended life spans and the adoption of a Westernized lifestyle.[2] In recent decades, notable advancements have revolutionized prostate cancer management and detection, driven by the emergence of multiparametric MRI and the novel PET-CT.[3,4] Further, robot-assisted radical prostatectomy (RARP) has become the gold standard surgical approach for clinically localized prostate cancer, even in individuals aged 75 and older.[5–7] Although the primary objective of RARP is optimal cancer control, its secondary objective is the maintenance of urinary continence, which is a primary concern that affects the quality of life after radical prostatectomy (RP).[8]

Restoration of urinary continence after RARP is affected by diverse factors, including patient and disease characteristics, surgical proficiency, and methodologies used for surgical dissection and reconstruction. Ficarra et al found that the prevalence of urinary continence after RARP is 89–92%. Furthermore, age, body mass index, lower urinary tract symptoms, and prostate volume have emerged as the most pertinent preoperative predictors of urinary incontinence.[9]

Surgeons have made various modifications, such as the use of neurovascular bundle-sparing, to the radical prostatectomy (RP) technique to enhance functional outcomes such as continence and erectile function.[10] Many studies have analyzed the potential effects of various surgical techniques, such as anterior and posterior reconstruction before the urethrovesical anastomosis.[11–14]

* Corresponding author. Department of Urology, Chung-Ang University Gwangmyeong Hospital, Chung-Ang University College of Medicine, Gwangmyeong, Korea.
E-mail address: yongslee@cau.ac.kr (Y.S. Lee).
★ These authors contributed equally to this work.

https://doi.org/10.1016/j.prnil.2024.04.004
p2287-8882 e2287-903X/

During the past two decades, several studies have focused on the idea of preserving the bladder neck during RP to improve functional outcomes without compromising oncological outcomes.[11,15] However, bladder neck sparing (BNS) in RP could result in a higher incidence of positive surgical margins (PSM), subsequently contributing to the deterioration of oncological outcomes, including an increased rate of biochemical recurrence (BCR).[16,17]

Although there have been reviews of various surgical techniques for RARP, to the best of our knowledge, no study has compared the effects of RARP with or without BNS. The advantages of the robotic technique include its ability to provide a more expanded field of three-dimensional (3D) vision and allow surgical procedures with greater precision compared to laparoscopy. Therefore, it is assumed that BNS is more likely to be performed appropriately with the robotic technique, which is better for identifying circular fibers during the preservation of the bladder and neck. Therefore, we aimed to compare the pad-free rates (at 7 days [immediately], 3 months, 6 months, and 1 year) and PSM rates of patients who underwent RARP with or without BNS for prostate cancer.

2. Materials and methods

2.1. Protocol and registration

The protocol for this systematic review was registered with PROSPERO (registration number: CRD42024496444). Additionally, this systematic review adhered to the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 (PRISMA 2020) statement.[18]

2.2. Search strategy

A proficient medical librarian conducted electronic searches of the Web of Science, Embase, Cochrane Central Register of Controlled Trials, and PubMed (via the National Library of Medicine) databases from inception to December 2023 (Supplementary Table 1). The following search terms were used: prostatic neoplasms, prostatectomy, urinary incontinence, bladder, and robotic surgical procedures. Moreover, we examined the reference lists of published narratives and systematic reviews to identify studies that might not have been captured by our electronic search. We used the International Clinical Trials Registry Platform and ClinicalTrials.gov search portals to identify ongoing trials.

2.3. Inclusion and exclusion criteria

Studies comprising patients who underwent RARP followed by interventions, including BNS, were included. The outcomes of interest included the postoperative pad-free rates (continence) at 7 days (immediately), 3 months, 6 months, and 1 year. An investigation of the differences in surgical margin rates was also performed. The comparison group received no interventions. The following types of studies were excluded: clinical trials that did not compare procedures with and without BNS; studies without available full text (including reviews, conference abstracts, editorial notes/letters, and narrative reviews); studies that did not include outcome parameters; and studies that were not published in English.

2.4. Study selection

After eliminating duplicates, we imported all references into Covidence (www.covidence.org). Two members (J. Choi and Y.J. Yang) of the study team independently assessed each reference and abstract based on the predetermined selection criteria. If the two members disagreed, then a majority decision was reached based on the opinion of a third team member (Y.S. Lee). Abstract screening was performed to exclude studies that did not meet the inclusion criteria. For studies that progressed beyond this stage, two members of the study team independently conducted full-text reviews.

2.5. Data extraction

General information such as the first author's name, year when the study was performed, country where the study was performed, study type, and outcomes were extracted from the remaining studies. The extracted outcomes were the postoperative pad-free rates (continence) at 7 days (immediately), 3 months, 6 months, and 1 year, catheter removal date, BCR rate, follow-up duration (months), and differences in surgical margin rates.

2.6. Methodological quality assessment

The risk of bias for each eligible study was assessed using the Newcastle–Ottawa scale (NOS) for nonrandomized controlled trials (non-RCTs) and the Cochrane risk of bias tool for RCTs.[19,20] NOS consists of six items, with 1 point assigned to each item except comparability with the unexposed cohort. Hence, the maximum achievable score was 6 points. During this study, NOS scores $\geq$5 were categorized as “good” and scores $\geq$3 but <5 were considered “fair.” Additionally, the Cochrane “Risk of Bias” tool was used to assess the risks of selection bias, performance bias, detection bias, attrition bias, reporting bias, and others as low, unclear, or high. The methodological quality was independently evaluated by two reviewers (J. Choi and Y.J. Yang). If there were discrepancies in the results of the literature quality assessment, both authors discussed or consulted with a third author (Y.S. Lee).

2.7. Statistical analysis

Statistical analyses were performed using STATA/MP (version 18.0; Stata Corp., College Station, TX, USA). The odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for the pad-free rates at 7 days, 3 months, 6 months, and 1 year and a positive surgical margin rates using a random effects model. The standardized mean difference (SMD) and 95% CI were calculated using a random-effect Hedge's g model to estimate the catheter removal date. Statistical heterogeneity was evaluated using the chi-square test and I^2 values. Substantial heterogeneity was detected at P <0.10 and I^2 >50%. Publication bias was assessed using funnel plots and Egger's test. Statistical significance was set at P <0.05.

3. Results

3.1. Literature retrieval results

Our electronic search yielded 2,598 references from four databases. Of these, 558 duplicates were excluded (Fig. 1). Subsequently, 963 articles were excluded because they were conference abstracts (n = 586), editorial notes/letters (n = 132), narrative reviews (n = 180), or not written in English (n = 65), resulting in 1,077 articles that were subjected to further screening. During the initial screening phase, based on the title and abstract, 1,031 articles were excluded. Subsequently, screening of the full text of the remaining 46 studies were conducted, resulting in the exclusion of 40 studies. These studies were excluded because they did not include predefined subjects and/or methods (n = 29), had overlapping subjects and outcome indicators (n = 9), or were not original studies (n = 2).

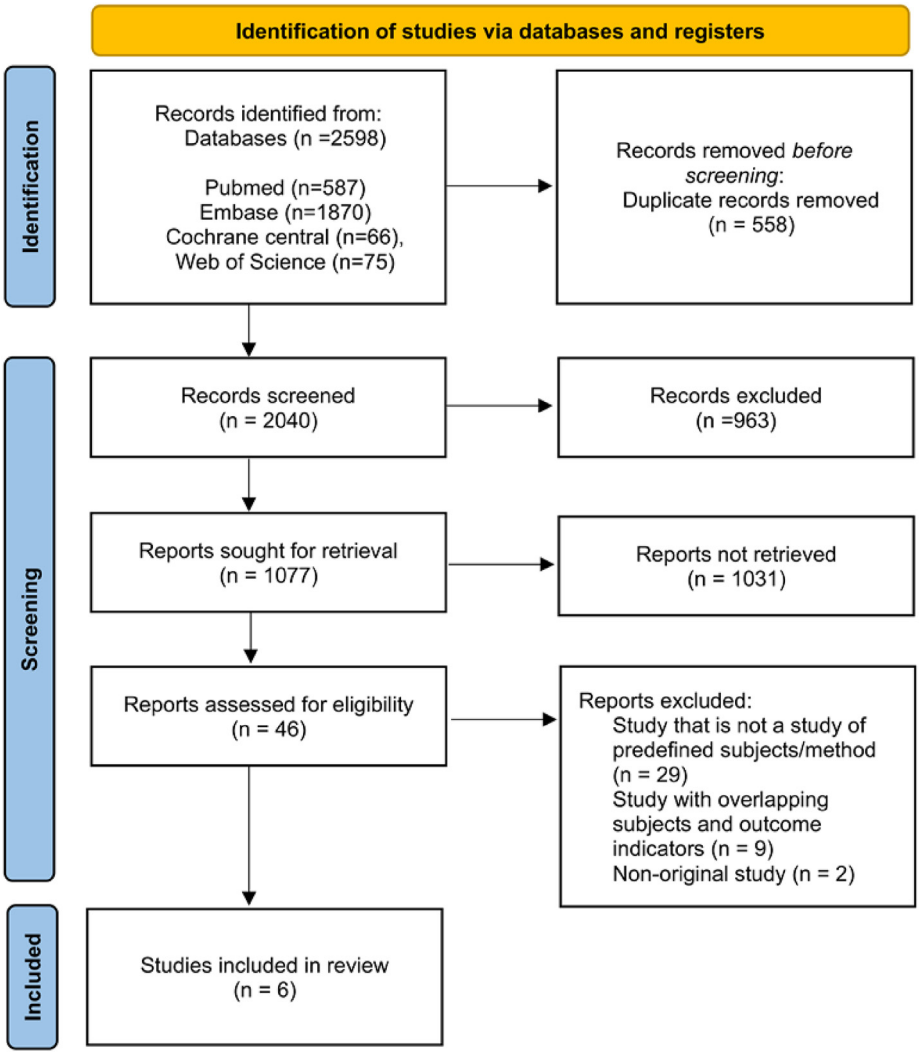

Fig. 1. Flowchart of the study selection procedure.

3.2. Study characteristics

Six original articles comprising 2,527 patients who underwent RARP with or without BNS that were published between 2012 and 2020 were included (Table 1). Five eligible observational studies performed in Europe,[21–23] Canada,[24] or Korea[25] recruited 2,319 patients who underwent RARP with or without BNS. The only included RCT enrolled 208 patients underwent RARP.[26] The majority of studies used conventional RARP as the control method.[21,22,25,26] Additionally, two studies performed RARP and bladder neck resection for the control groups.[23,24] The primary objective of this study was to investigate the pad-free rates by subdividing them into social continence rates (0–1 pad) at 0, 3, 6, and 12 months. However, although the mean urine loss was examined, it was excluded from the metaanalysis because these measurements were not reported by the other studies.

The study by Bartoletti et al included 208 patients and had a unique prospective design based on information obtained via phone interviews.[21] The studies by Preisser et al, Rajih et al, and You et al had a retrospective design and included 322, 107, and 88 patients, respectively.[23–25]

The studies by Bartoletti et al and You et al were not independently performed; however, they included posterior musculofascial reconstruction.[21,25] Although there was potential bias because posterior musculofascial reconstruction is commonly performed with RARP, these studies were included in the analysis. The study by Dal Moro et al used extreme BNS ($\geq$1 cm) as a criterion and, according to the authors' standards, the typical length of the spared bladder neck during RARP did not differ; therefore, it was included in the research.[22]

Additionally, the study by Bartoletti et al slightly differed from the others because it based the continence rate on the use of no pads rather than social continence.[21] Generally, continence rates reported by the studies were not clearly defined; furthermore, some studies included both the continence rate based on the use of no pads and the social continence rate.

Table 1
Characteristics of studies included in the systematic review.

Study	Setting, country	Enrollment criteria	Study conducted	Control method	Patients, *n*		Primary outcomes	Secondary outcomes
					Intervention	Control		
Bartoletti, 2017	Phone call interview, Italy	RARP + BNS + PRec	2009–2016	RARP only	105	125	Severe incontinence (12 mo)	Continence rate (no pad) at early, 3, 6, 12 mo
Nyarangi-Dix, 2013	RCT, Germany	RARP + BNS	2013	RARP only	104	104	Mean urine loss (cc) at 0, 3, 6, 12 mo	Social continence rate (0–1 pad) at 0, 3, 6, 12 mo & QOL
Preisser, 2020	Retrospective, Germany	RARP + BNS	2010–2017	RARP + bladder neck resection	382	1,130	Median time to catheter removal	Pad-free rate at 7 days, 3 mo, 1 yr
Rajih, 2019	Retrospective, Canada	RARP + BNS	2006–2015	RARP + bladder neck resection	245	77	0-pad continence at 1,3,6,12,24 mo	None
You, 2012	Retrospective, Korea	RARP + BNS + PRec	2008–2010	RARP	48	31	Mean catheterization time	Continence at 3, 6 mo, PSM
Dal Moro, 2020	Prospective, Italy	RARP + BNS (≥1 cm)	2015–2018	RARP	88	88	PSM	None

BNS, bladder neck sparing; mo, months; PRec, posterior musculofascial reconstruction; PSM, positive surgical margin rate; RARP, robot assisted radical prostatectomy.

3.3. Methodological quality assessment

Of the six included studies, five were observational studies, and one was an RCT. The methodological quality of the observational studies were generally poor to good, according to the NOS (Supplementary Table 2). According to the Cochrane risk of bias tool, the RCT had a low risk of bias (Supplementary Fig. 1).[26]

3.4. Quantitative analysis

The comparison of the robot field of view between BNS and without BNS techniques is illustrated in Fig. 2. The five observational studies included 884 patients who underwent RARP with BNS and 1,467 who underwent RARP without BNS (control group) and described the pad-free rate at 3 months.[21,23–26] The pad-free rate at 3 months in the BNS group was significantly higher than that in the control group (OR, 1.86; 95% CI, 1.22–2.82) (Fig. 3A), with high heterogeneity ($P = 0.005$ and $I^2 = 67.45\%$). Publication bias was not detected in studies that reported the pad-free rate at 3 months (Egger's test; $t = 0.34$ and $P = 0.731$) (Fig. 3B).

The pad-free rates at 7 days, 6 months, and 1 year and positive surgical margin rates did not significantly differ between the BNS and control groups (Table 2). Substantial heterogeneity was detected in studies that reported pad-free rates at 7 days, 6 months, and 1 year. Publication bias was not observed in the pooled results of the pad-free rates at 6 months and 1 year and positive surgical margin rates (Supplementary Fig. 2A–D). The publication bias of the results of the pad-free rate at 7 days could not be analyzed because only two included studies reported this rate.

The catheter removal date was reported by two studies (2,579 patients) that recruited 1,173 patients who underwent RARP with BNS and 1,406 patients who underwent RARP without BNS (control group) (Preisser, 2020; Friedlander, 2012). The pooled results showed no significant difference between the two groups, but the catheter removal period of the BNS group was slightly shorter than that of the control group (SMD = −0.08; 95% CI, −0.16 to 0.01), with low heterogeneity ($P = 0.377$; $I^2 = 0.01\%$). Publication bias could not be analyzed because only two included studies estimated the pooled results of the catheter removal date.

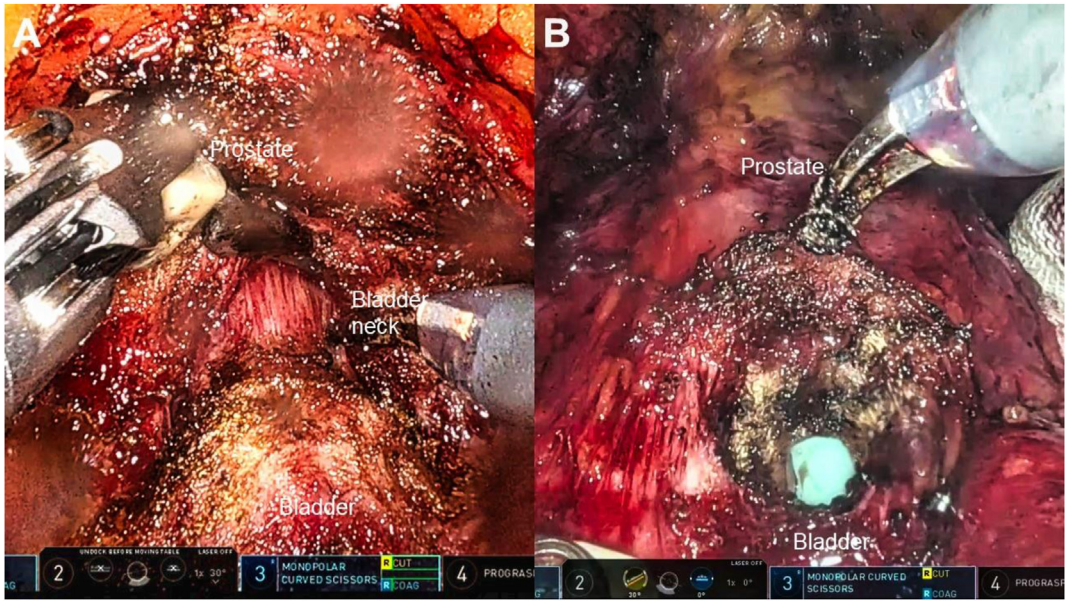

Fig. 2. Comparison of robot field of view between (A) bladder neck sparing and (B) without bladder neck sparing techniques.

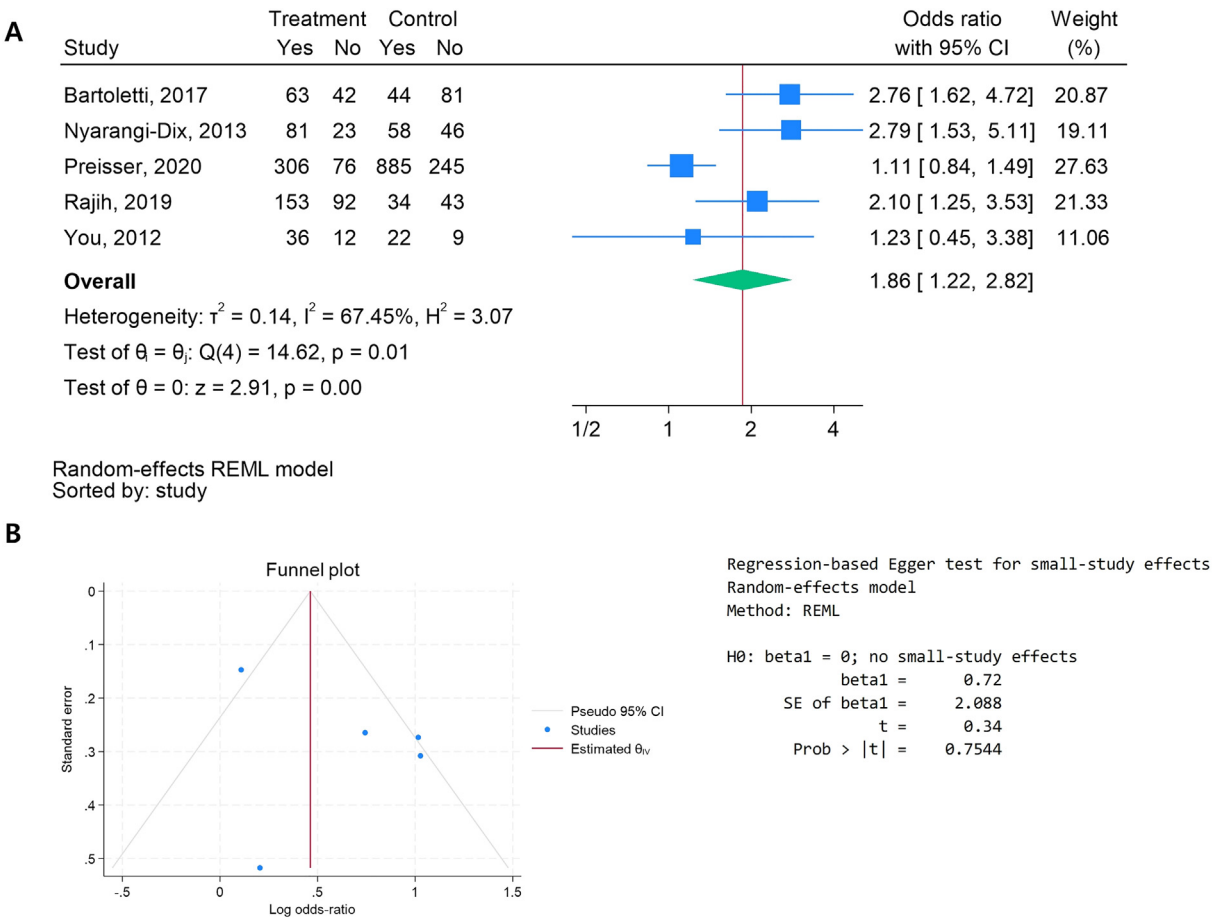

Fig. 3. A random effects model was used to create the (A) forest plot and (B) funnel plot comparing the pad-free rates of patients who underwent bladder neck sparing (BNS) and the control group at 3 months.

Table 2
Summary of the results from metaanalysis on postoperative outcomes between patients with bladder neck sparing and control group using random effect model.

Outcome measures	Stu-dies	Total (*n*)		Intervention (*n*)		Control (*n*)		OR (95% CI)	Heterogeneity			Egger's test			Ref
		Yes	No	Yes	No	Yes	No		Q	df	$P_{\text{-hetero}}$	I^2	t	*P*	
Pad free rate at 7 days	2	908	834	269	218	639	616	1.75 (0.82−1.58)	5.7	1	0.017	82	-	-	21,23
Pad free rate at 3 months	5	1,682	669	639	245	1,043	424	1.86 (1.22−2.82)	14.6			67	0.34	0.010	21,23−26
Pad free rate at 6 months	4	578	261	369	133	209	128	1.40 (0.51−3.79)	13.2	3	0.004	88	−2.28	0.150	21,24−26
Pad free rate at 1 year	4	1,888	364	668	148	1,220	216	1.56 (0.79−3.07)	20.1	3	<0.001	83	3.86	0.060	21,23,24,26
Surgical margin positive rate	4	236	1,739	64	558	172	1,181	0.77 (0.56−1.05)	2.9	3	0.404	0	−0.39	0.731	22,23,25,26

CI, confidence interval; df, degree of freedom; OR, odds ratio; $P_{\text{-hetero}}$, probability level associated with the Q test; Q, homogeneity test.

3.5. *Qualitative results*

Among the included studies, one reported that the continence rate of the BNS group was significantly higher than that of the control group on day 7 (49.4% vs. 24.7%).[21] Owing to the insufficient number of studies, *P* values could not be obtained.

Bartoletti et al classified the use of more than two pads per day as severe incontinence, which was analyzed separately, and found that the severe incontinence rates of the BNS group and control group were 4.93% and 15.05%, respectively; furthermore, they observed a statistically significant difference at 1 year ($P = 0.03$).[21]

Preisser et al found no difference in the BCR rate based on the performance of BNS in both the univariable ($P = 0.2$) and multivariable models ($P = 0.9$). Furthermore, during the 48-month follow-up period, the BNS group had a lower BCR-free survival rate ($P = 0.022$).[23] Unfortunately, a metaanalysis could not be performed because the number of relevant studies was insufficient.

You et al categorized positive surgical margin areas as apical, base, and lateral, and no significant differences were observed between the BNS and control groups.[25] However, because an insufficient number of studies used this method, additional subgroup analyses could not be performed.

Friedlander et al performed a large-scale prospective study of 1,067 patients and presented continence rates graphically without precise numerical values.[27] Additionally, during this study, the early continence rate at up to 3 months was less than 20%, which was significantly different from that of other studies; therefore, it was excluded from the analysis. The BCR rate in this study was not significantly different regardless of the use of BNS.

4. Discussion

In this study, RARP with BNS had a significantly greater effect on the continence rate at 3 months (OR, 1.81). However, the pad-free rates at 7 days, 6 months, and 1 year and positive surgical margin rates did not significantly differ between the RARP with and without BNS groups.

Urinary incontinence can significantly impact the quality of life of patients undergoing RP.[9,28] Despite the unclear and intricate physiology of mechanisms associated with urinary continence after RP, BNS plays a pivotal role.[29] BNS has the benefit of preserving the rhabdosphincter, which is located between the verumontanum and prostatic apex.[30]

Therefore, the effect of BNS on the continence rates of patients who underwent RARP was assessed. The debate regarding the effects of BNS on continence and its oncological safety are ongoing.[29,31] Nevertheless, RARP has emerged as the predominant surgical approach for RP in the United States.[32] The enhanced 3D vision provided by the robotic system may facilitate more straightforward identification of muscular fibers during BNS; therefore, it could ensure better functional outcomes and fewer positive surgical margins than open surgery or laparoscopy. Lee et al presented their methodology and emphasized the significance of the BNS grade in early postoperative continence; furthermore, they concluded that BNS is graded in degrees rather than as a binary result and found that a higher degree of BNS was linked to a quicker return to continence without compromising oncological outcomes.[31]

Similarly, less recent metaanalyses suggested a nonsignificant impact of BNS on incontinence associated with RP, and recent studies, particularly those involving robotic techniques, suggested that BNS during RP can contribute to early recovery.[16,33,34] Our study confirmed these findings by conducting a metaanalysis that exclusively involved RARP.

Surgical skills are pivotal when performing urological surgery, particularly when utilizing diverse techniques for RARP. The selection of the surgical approach may be influenced by the previously identified independent predictors of urinary continence and the extent of the disease. BNS is associated with various variables, including prostate size, history of radiation or hormone therapy, presence of median lobe enlargement, and degree of intravesical prostatic protrusion, and all of these can affect outcomes. Additionally, these parameters may be linked to long-term functional results.[30,35]

Functional aspects are important after RARP, but oncologic outcomes should be given priority above all. In a systematic review, PSM was reported more often in RARP with BNS than in RARP without BNS (mean base PSM 4.9% vs. 1.85%).[36] However, in our study, it was found that there was no difference in PSM between RARP with BNS and without BNS, so it is feasible to perform RARP with BNS expecting an early recovery of continence while maintaining the oncologic outcome.

This study had some limitations. First, some studies only included BNS, and others included posterior musculofascial reconstruction. Second, there was inconsistency in the use of terms such as pad-free rate, continence rate, and social continence rate (0–1 pad), and many articles did not provide precise definitions. Third, the use of various data sources was another limitation. The number of RCTs was limited, and the analysis included both retrospective and prospective studies. Fourth, due to insufficient data, we were unable to derive results for the continence outcome beyond 12 months. Overall, analyzing surgical techniques can be challenging, with differences in the heterogeneous nature of surgeons, study designs, and the inherent impossibility of double-blinding studies, leading to the potential for selection bias. Therefore, there are inherent limitations to metaanalysis.

The attainment of continence after RARP is multifactorial and relies on various surgical approaches rather than a single procedure. However, there is value in understanding the effect of a single technique on RARP and its outcomes through a metaanalysis rather than a generalized analysis of various methods.

5. Conclusions

The implementation of BNS with RARP significantly affected the postoperative continence rate at 3 months. However, no significant difference was observed compared to the control group in the subsequent period in terms of continence rate. Although it did not affect long-term outcome, BNS with RARP showed early recovery in continence compared to the control group. Further studies are needed to better investigate the impact of this technique on continence.

Funding

This work was supported by the Chung-Ang University Research Grants in 2022.

Conflicts of interest

All authors have no potential conflicts of interest.

Acknowledgments

We thank Da Mi Jeoung (Librarian at Yonsei University Medical Library, Seoul, S. Korea) for her generous assistance during the search process.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.prnil.2024.04.004.

References

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2021;71(3):209–49. https://doi.org/10.3322/caac.21660. Epub 20210204. PubMed PMID: 33538338.
2. Chung Y, Hong SK. Shifting to transperineal prostate biopsy: a narrative review. Prostate Int 2024;12(1):10–4. https://doi.org/10.1016/j.prnil.2023.11.003. Epub 20231130. PubMed PMID: 38523899; PubMed Central PMCID: PMCPMC10960089.
3. Kim JK, Song YS, Lee WW, Lee HJ, Hwang SI, Hong SK. Diagnostic accuracy of F-18-Fluorocholine PET/CT and multiparametric MRI for prostate cancer. Prostate Int 2022;10(3):152–7. https://doi.org/10.1016/j.prnil.2022.04.003. Epub 20220429. PubMed PMID: 36225289; PubMed Central PMCID: PMCPMC9520420.
4. Byun HJ, Shin TJ, Jung W, Ha JY, Kim BH, Kim YH. The value of magnetic resonance imaging and ultrasonography (MRI/US)-fusion biopsy in clinically significant prostate cancer detection in patients with biopsy-naive men according to PSA levels: a propensity score matching analysis. Prostate Int 2022;10(1):45–9. https://doi.org/10.1016/j.prnil.2021.10.002. Epub 20211104. PubMed PMID: 35510102; PubMed Central PMCID: PMCPMC9042765.
5. Choi YH, Lee CU, Song W, Chang Jeong B, Seo SI, Jeon SS, et al. Combination of multiparametric magnetic resonance imaging and transperineal template-guided mapping prostate biopsy to determine potential candidates for focal therapy. Prostate Int 2023;11(2):100–6. https://doi.org/10.1016/j.prnil.2022.12.003. Epub 20221214. PubMed PMID: 37409092; PubMed Central PMCID: PMCPMC10318325.
6. Hong SK, Song SH, Kim HJ, Lee HS, Nam JH, Lee SB. Temporal changes of PIRADS scoring by radiologists and correlation to radical prostatectomy pathological outcomes. Prostate Int 2022;10(4):188–93. https://doi.org/10.1016/j.prnil.2022.07.001. Epub 20220719. PubMed PMID: 36570646; PubMed Central PMCID: PMCPMC9747593.
7. Lee J, Song J, Jung G, Song SH, Hong SK. Prognosis after radical prostatectomy in men older than 75 years: long-term results from a single tertiary center. Prostate Int 2024;12(1):15–9. https://doi.org/10.1016/j.prnil.2023.09.004.

Epub 20230928. PubMed PMID: 38523903; PubMed Central PMCID: PMCPMC10960082.
8. Kretschmer A, Hubner W, Sandhu JS, Bauer RM. Evaluation and management of postprostatectomy incontinence: a systematic review of current literature. Eur Urol Focus 2016;2(3):245–59. https://doi.org/10.1016/j.euf.2016.01.002. Epub 20160115. PubMed PMID: 28723370.
9. Ficarra V, Novara G, Rosen RC, Artibani W, Carroll PR, Costello A, et al. Systematic review and meta-analysis of studies reporting urinary continence recovery after robot-assisted radical prostatectomy. Eur Urol 2012;62(3):405–17. https://doi.org/10.1016/j.eururo.2012.05.045. Epub 20120601. PubMed PMID: 22749852.
10. Choi WW, Freire MP, Soukup JR, Yin L, Lipsitz SR, Carvas F, et al. Nerve-sparing technique and urinary control after robot-assisted laparoscopic prostatectomy. World J Urol 2011;29(1):21–7. https://doi.org/10.1007/s00345-010-0601-z. Epub 20101020. PubMed PMID: 20959992.
11. Gazel E, Kaya E, Acikgoz O, Yalcin S, Yilmaz S, Aybal C, et al. The effects of bladder neck sparing with an additional anterior urethral fixation on postoperative continence after robot-assisted radical prostatectomy. North Clin Istanb 2021;8(1):57–62. https://doi.org/10.14744/nci.2020.00533. Epub 20201124. PubMed PMID: 33623874; PubMed Central PMCID: PMCPMC7881433.
12. Menon M, Muhletaler F, Campos M, Peabody JO. Assessment of early continence after reconstruction of the periprostatic tissues in patients undergoing computer assisted (robotic) prostatectomy: results of a 2 group parallel randomized controlled trial. J Urol 2008;180(3):1018–23. https://doi.org/10.1016/j.juro.2008.05.046. Epub 20080717. PubMed PMID: 18639300.
13. Hurtes X, Roupret M, Vaessen C, Pereira H, Faivre d'Arcier B, Cormier L, et al. Anterior suspension combined with posterior reconstruction during robot-assisted laparoscopic prostatectomy improves early return of urinary continence: a prospective randomized multicentre trial. BJU Int 2012;110(6):875–83. https://doi.org/10.1111/j.1464-410X.2011.10849.x. Epub 20120119. PubMed PMID: 22260307.
14. Sammon JD, Muhletaler F, Peabody JO, Diaz-Insua M, Satyanaryana R, Menon M. Long-term functional urinary outcomes comparing single- vs double-layer urethrovesical anastomosis: two-year follow-up of a two-group parallel randomized controlled trial. Urology 2010;76(5):1102–7. https://doi.org/10.1016/j.urology.2010.05.052. PubMed PMID: 20869107.
15. Latiff A. Preservation of bladder neck fibers in radical prostatectomy. Urology 1993;41(6):566–7. https://doi.org/10.1016/0090-4295(93)90106-k. PubMed PMID: 8516994.
16. Deliveliotis C, Protogerou V, Alargof E, Varkarakis J. Radical prostatectomy: bladder neck preservation and puboprostatic ligament sparing–effects on continence and positive margins. Urology 2002;60(5):855–8. https://doi.org/10.1016/s0090-4295(02)01956-8. PubMed PMID: 12429315.
17. Golabek T, Jaskulski J, Jarecki P, Dudek P, Szopinski T, Chlosta P. Laparoscopic radical prostatectomy with bladder neck preservation: positive surgical margin and urinary continence status. Wideochir Inne Tech Maloinwazyjne 2014;9(3):362–70. https://doi.org/10.5114/wiitm.2014.45085. Epub 20140905. PubMed PMID: 25337159; PubMed Central PMCID: PMCPMC4198659.
18. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372n71. https://doi.org/10.1136/bmj.n71. Epub 20210329. PubMed PMID: 33782057; PubMed Central PMCID: PMCPMC8005924.
19. Lo CK, Mertz D, Loeb M. Newcastle-Ottawa Scale: comparing reviewers' to authors' assessments. BMC Med Res Methodol 2014;14:45. https://doi.org/10.1186/1471-2288-14-45. Epub 20140401. PubMed PMID: 24690082; PubMed Central PMCID: PMCPMC4021422.
20. Sterne JAC, Savovic J, Page MJ, Elbers RG, Blencowe NS, Boutron I, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ 2019;366l4898. https://doi.org/10.1136/bmj.l4898. Epub 20190828. PubMed PMID: 31462531.
21. Bartoletti R, Mogorovich A, Francesca F, Pomara G, Selli C. Combined bladder neck preservation and posterior musculofascial reconstruction during robotic assisted radical prostatectomy: effects on early and long term urinary continence recovery. BMC Urol 2017;17(1):119. https://doi.org/10.1186/s12894-017-0308-1. Epub 20171215. PubMed PMID: 29246146; PubMed Central PMCID: PMCPMC5732441.
22. Dal Moro F, Zazzara M, Morlacco A, Gardiman MP, Costa G, Zattoni F. Is “extreme” bladder neck preservation in robot-assisted radical prostatectomy a safe procedure? Urologia 2020;87(3):149–54. https://doi.org/10.1177/0391560319899253. Epub 20200122. PubMed PMID: 31964317.
23. Preisser F, Busto Martin L, Pompe RS, Heinze A, Haese A, Graefen M, et al. Effect of bladder neck sparing at robot-assisted laparoscopic prostatectomy on postoperative continence rates and biochemical recurrence. Urol Oncol 2020;38(1):1 e11–6. https://doi.org/10.1016/j.urolonc.2019.09.005. Epub 20191002. PubMed PMID: 31586543.
24. Rajih E, Meskawi M, Alenizi AM, Zorn KC, Alnazari M, Zanaty M, et al. Perioperative predictors for post-prostatectomy urinary incontinence in prostate cancer patients following robotic-assisted radical prostatectomy: long-term results of a Canadian prospective cohort. Can Urol Assoc J 2019;13(5):E125–31. https://doi.org/10.5489/cuaj.5356. Epub 20181015. PubMed PMID: 30332593; PubMed Central PMCID: PMCPMC6520054.
25. You YC, Kim TH, Sung GT. Effect of bladder neck preservation and posterior urethral reconstruction during robot-assisted laparoscopic radical prostatectomy for urinary continence. Korean J Urol 2012;53(1):29–33. https://doi.org/10.4111/kju.2012.53.1.29. Epub 20120125. PubMed PMID: 22323971; PubMed Central PMCID: PMCPMC3272553.
26. Nyarangi-Dix JN, Radtke JP, Hadaschik B, Pahernik S, Hohenfellner M. Impact of complete bladder neck preservation on urinary continence, quality of life and surgical margins after radical prostatectomy: a randomized, controlled, single blind trial. J Urol 2013;189(3):891–8. https://doi.org/10.1016/j.juro.2012.09.082. Epub 20120924. PubMed PMID: 23017512.
27. Friedlander DF, Alemozaffar M, Hevelone ND, Lipsitz SR, Hu JC. Stepwise description and outcomes of bladder neck sparing during robot-assisted laparoscopic radical prostatectomy. J Urol 2012;188(5):1754–60. https://doi.org/10.1016/j.juro.2012.07.045. Epub 20120919. PubMed PMID: 22998904.
28. Braun 3rd AE, Washington SL, Cowan JE, Hampson LA, Carroll PR. Impact of stress urinary incontinence after radical prostatectomy on time to intervention, quality of life and work status. Urology 2023;180:242–8. https://doi.org/10.1016/j.urology.2023.06.027. Epub 20230711. PubMed PMID: 37442296.
29. Stolzenburg JU, Kallidonis P, Hicks J, Do M, Dietel A, Sakellaropoulos G, et al. Effect of bladder neck preservation during endoscopic extraperitoneal radical prostatectomy on urinary continence. Urol Int 2010;85(2):135–8. https://doi.org/10.1159/000314842. Epub 20100513. PubMed PMID: 20460882.
30. Walz J, Epstein JI, Ganzer R, Graefen M, Guazzoni G, Kaouk J, et al. A critical analysis of the current knowledge of surgical anatomy of the prostate related to optimisation of cancer control and preservation of continence and erection in candidates for radical prostatectomy: an update. Eur Urol 2016;70(2):301–11. https://doi.org/10.1016/j.eururo.2016.01.026. Epub 20160202. PubMed PMID: 26850969.
31. Patel VR, Coelho RF, Chauhan S, Orvieto MA, Palmer KJ, Rocco B, et al. Continence, potency and oncological outcomes after robotic-assisted radical prostatectomy: early trifecta results of a high-volume surgeon. BJU Int 2010;106(5):696–702. https://doi.org/10.1111/j.1464-410X.2010.09541.x. Epub 20100812. PubMed PMID: 20707793.
32. Preisser F, Nazzani S, Mazzone E, Knipper S, Bandini M, Tian Z, et al. Regional differences in total hospital charges between open and robotically assisted radical prostatectomy in the United States. World J Urol 2019;37(7):1305–13. https://doi.org/10.1007/s00345-018-2525-y. Epub 20181012. PubMed PMID: 30315358.
33. Ma X, Tang K, Yang C, Wu G, Xu N, Wang M, et al. Bladder neck preservation improves time to continence after radical prostatectomy: a systematic review and meta-analysis. Oncotarget 2016;7(41):67463–75. https://doi.org/10.18632/oncotarget.11997. PubMed PMID: 27634899; PubMed Central PMCID: PMCPMC5341889.
34. Marcovich R, Wojno KJ, Wei JT, Rubin MA, Montie JE, Sanda MG. Bladder neck-sparing modification of radical prostatectomy adversely affects surgical margins in pathologic T3a prostate cancer. Urology 2000;55(6):904–8. https://doi.org/10.1016/s0090-4295(00)00451-9. PubMed PMID: 10840106.
35. Jo JK, Hong SK, Byun SS, Zargar H, Autorino R, Lee SE. Urinary continence after robot-assisted laparoscopic radical prostatectomy: the impact of intravesical prostatic protrusion. Yonsei Med J 2016;57(5):1145–51. https://doi.org/10.3349/ymj.2016.57.5.1145. PubMed PMID: 27401645; PubMed Central PMCID: PMCPMC4960380.
36. Bellangino M, Verrill C, Leslie T, Bell RW, Hamdy FC, Lamb AD. Systematic review of studies reporting positive surgical margins after bladder neck sparing radical prostatectomy. Curr Urol Rep 2017;18(12):99. https://doi.org/10.1007/s11934-017-0745-0. Epub 20171107. PubMed PMID: 29116405; PubMed Central PMCID: PMCPMC5676800.