REVIEW

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Quality of Life in Prostate Cancer Patients Following Radical Prostatectomy: A Systematic Review and Meta-Analysis

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Abstract

Objective: Quality of life (QoL) is a key outcome for assessing the effectiveness of treatment and surgical techniques. Radical prostatectomy (RP) impacts QoL in both psychological and physical aspects. This systematic review and meta-analysis aim to evaluate QoL changes in prostate cancer patients before and after RP. **Methods:** PubMed, EMBASE, and the Cochrane Central Register were searched for studies on PCa patients undergoing RP, with QoL assessed using EORTC QLQ-C30 and/or QLQ-PR25 questionnaires before and one year after surgery. Primary outcomes included overall QoL with open and laparoscopic robotic/hand-assisted RP. Secondary outcomes covered emotional, social, and sexual functioning, urinary symptoms, and pain. Statistical analysis was performed using Review Manager 5.3, following PRISMA guidelines. **Results:** A total of 14 studies were incorporated. Overall QoL significantly improved one year after RP (SMD = -0.14; 95%CI [-0,21 - 0,07]; p<0.0001). Laparoscopic/robotic-assisted RP showed statistically significant QoL improvement (SMD = -0.11; 95%CI [-0,15 – 0,07], p<0.0001), while open RP did not (SMD = -0.11; 95%CI[-0,22 – 0,01]; p=0.07). Emotional function improved (SMD = -0.40; 95%CI[-0,49 – 0,31]; p<0.0001), but social function (SMD = 0.07; 95%CI[-0,01 – 0,15]; p=0.09), urinary symptoms (SMD = -0.01; 95%CI[-0,17 – 0,16]; p=0.94), and pain (SMD = 0.01; 95%CI[-0,04 – 0,06]; p=0.70) showed no significant changes. Post-therapy sexual function decreased significantly (SMD = 0.31; 95%CI[0,14 – 0,49]; p=0.0005). **Conclusion:** RP is the gold standard for localized PCa, with a significant impact on QoL. The laparoscopic approach offers better QoL outcomes than open RP, though sexual function, urinary symptoms, and social function show limited improvement.

Keywords: Prostate Cancer- Quality of Life- Radical Prostatectomy- EORTC QLQ-C30- EORTC QLQ-PR25

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Introduction

Prostate cancer (PCa) represents a significant global health concern, with notable variations in incidence rates across different regions of the world. While Asia has historically been categorized as an area with low incidence rates, there has been a marked increase in both the incidence and mortality associated with PCa throughout the continent [1]. The diagnosis and treatment of PCa carry significant implications for the patient's future well-being. Individuals who receive a new diagnosis of early-stage PCa are confronted with a challenging decision-making process regarding various treatment alternatives, including active surveillance, radical prostatectomy (RP), external beam radiotherapy, or novel hormonal therapies [2, 3]. In making these decisions, patients must weigh the dual objectives of maximizing both the quantity and quality of their lives. It is crucial to consider patient-related outcomes when evaluating the physical and psychological impacts of the treatments administered. Health-related quality of life (HRQOL) has emerged as a vital consideration for PCa patients undergoing radical prostatectomy, given the procedure's potential side effects, including urinary incontinence and erectile dysfunction. Information pertaining to HRQOL in the context of RP may be especially beneficial for patients as they navigate their treatment options [4].

The quantification and comparison of quality of life (QoL) present significant challenges due to its inherently subjective nature, which can vary in meaning among different individuals. Nevertheless, certain characteristics are frequently shared among the majority of patients. In the context of men diagnosed with PCa, specific tools known as PROMs have been developed and validated, drawing upon these common characteristics. These instruments are designed to evaluate prevalent concerns that emerge following a diagnosis of PCa and the subsequent treatment, producing scores that reflect the influence on perceptions of HRQoL. Among the available instruments, the EORTC QLQ-C30 and QLQ-PR25 have exhibited

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the most robust evidence regarding their psychometric properties and feasibility, thereby establishing them as the most appropriate tools for application in both routine clinical practice and research environments aimed at assessing PROMs in patients with localized PCa [5].

Numerous studies have documented the adverse effects associated with radical prostatectomy (RP), which include complications related to sexual function, as well as urinary and bowel issues [2, 5, 6]. Presently, minimally invasive surgical techniques, such as robot-assisted radical prostatectomy (RARP) and laparoscopic radical prostatectomy (LRP), are commonly employed alongside the traditional open retropubic radical prostatectomy (RRP). Although all surgical methods are reported to yield comparable oncological outcomes, a systematic review and meta-analysis have suggested that no single surgical technique demonstrates superiority over the others concerning functional outcomes [4, 7, 8]. The objective of the current systematic review and meta-analysis is to evaluate the changes in QoL within the PCa patient population before and after undergoing RP.

Materials and Methods

Search Strategy

The present study adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A systematic online search was conducted to identify pertinent studies published between January 2000 and June 2024 [9]. Databases including PubMed, EMBASE, and the Cochrane Central Register of Controlled Trials were systematically queried to identify eligible studies. The search utilized specific keywords, including "Quality of Life" OR "QoL," AND "Health-Related Quality of Life" OR "HRQoL," AND "EORTC QLQ-C30," AND "EORTC QLQ-PR25," AND "Prostate Cancer" OR "Prostate Carcinoma," AND "Radical Prostatectomy." To maintain consistency in methodology and ensure reliable evaluation of study quality, we limited the search to English-language publications. This decision was based on concerns that translating non-English articles could introduce interpretation challenges and potential bias. To enhance the sensitivity of our search strategy and to acquire data from additional relevant publications, a manual cross-search was performed to supplement the initial findings.

Study Selection

Publications meeting the following inclusion criteria were reviewed and incorporated into the study after an initial screening: (I) A comparative analysis of HRQoL in PCa patients before and after RP; (II) HRQoL differences were assessed using the EORTC QLQ-C30 and QLQ-PR25 questionnaires. The exclusion criteria for publications were as follows: (I) Studies focusing on different diseases; (II) patients who received treatments for PCa other than RP; and (III) insufficient texts or data available to assess outcomes. The PRISMA flow diagram illustrating the selection and exclusion process is presented in Figure 1.

Data Extraction and Quality Assessment

Data pertaining to patient demographics, QoL measures, treatment cohorts, relevant domains, and follow-up duration were independently extracted by two authors, Dhani F.K. and Purnomo A.F. The data extraction process specifically targeted continuous QoL data collected both prior to and one year following radical prostatectomy. The primary outcome measures included overall QoL with open radical prostatectomy (ORP) and laparoscopic robotic/hand assisted radical prostatectomy. Secondary outcome measures encompassed emotional functioning, social functioning, sexual functioning, urinary symptoms, and pain. To ensure the quality of the study, the Newcastle-Ottawa Scale for non-randomized studies was employed [10].

Statistical Analysis

Review Manager 5.3 was used for statistical analysis. Standardized mean difference (SMD) was used to compare continuous variables with the same domain. All results were described by 95% CI. Health related QOL data are measured by QLQ-C30 and QLQ-PR25 questionnaires.

Results

A total of 6394 studies were obtained, and fourteen studies were included according to inclusion criteria into the present meta-analysis. The PRISMA diagram for the study selection is presented in Figure 1. Included literature covered a total of 17091 patients. The follow-up time was one month to 5 years. Only studies that scored 6 on the Newcastle-Ottawa scale were included in this meta-analysis (Table 1). See Table 2 for the literature information.

Figure 2 shows that most included studies demonstrated a low risk of bias in random sequence generation, allocation concealment, incomplete outcome data, selective reporting, and other bias domains. However, a consistently high risk was identified in the domains of blinding of participants, personnel, and outcome assessment, reflecting the inherent limitations of studies relying on patient-reported quality-of-life outcomes. Overall, the main concern lies in performance and detection bias, while other domains were generally well controlled.

Overall QoL Before vs After RP

Fourteen studies including 16,273 men was assessed in overall QoL in the analysis, generally twelve month after RP including ORP and laparoscopic hand assisted/robotic assisted approach, patients had significant improvement compared before RP. Due to substantial heterogeneity among the studies, a random-effects model was employed for the analysis (SMD = -0.14, 95%CI[-0,21, -0,07], I^2 = 78%, $p<0.0001$). Overall QoL before and after RP showed in Figure 3.

QoL ORP Before vs After RP

Eight studies including 1929 man was assessed in overall QoL in the analysis, generally twelve month after ORP patients had not significant improvement compared

Table 1. Newcastle-Ottawa Scale for Non-Randomized Study

Study, year	Number of Stars			Overall
	Selection*	Comparabillity†	Outcome‡	
Acar, [11]	****	*	*	6
Bach, [2]	***	*	**	6
Borchers, [12]	***	*	**	6
Ernstmann, [13]	***	*	***	7
Giberty, [14]	***	*	***	7
Herkommer, [15]	***	*	***	7
Holze, [16]	****	**	**	8
Jakobsson, [17]	***	*	***	7
Karagiotis, [18]	***	*	**	6
Krahn, [19]	***	*	**	6
Kretschmer, [20]	***	*	**	6
Pompe, [21]	***	*	***	7
Shin, [5]	***	*	***	7

*Maximum 4 stars; †Maximum 2 stars; ‡Maximum 3 stars

before RP. Due to substantial heterogeneity among the studies, a random-effects model was employed for the analysis (SMD = -0.11, 95%CI[-0,22, 0,01], I^2 = 58%, p= 0.07). QoL in patient underwent ORP was showed in Figure 4.

QoL Laparoscopic Robotic/Hand Assisted RP

Four studies including 3880 man was assessed in overall QoL in the analysis, generally twelve months after laparoscopic robotic/hand assisted RP patients had significant improvement compared before RP. Given the low level of heterogeneity among the included studies, a fixed-effects model was applied for the analysis (SMD = -0.11, 95%CI[-0,15, 0,01], I^2 = 0%, p< 0.00). The QoL data in patient underwent laparoscopic robotic or hand

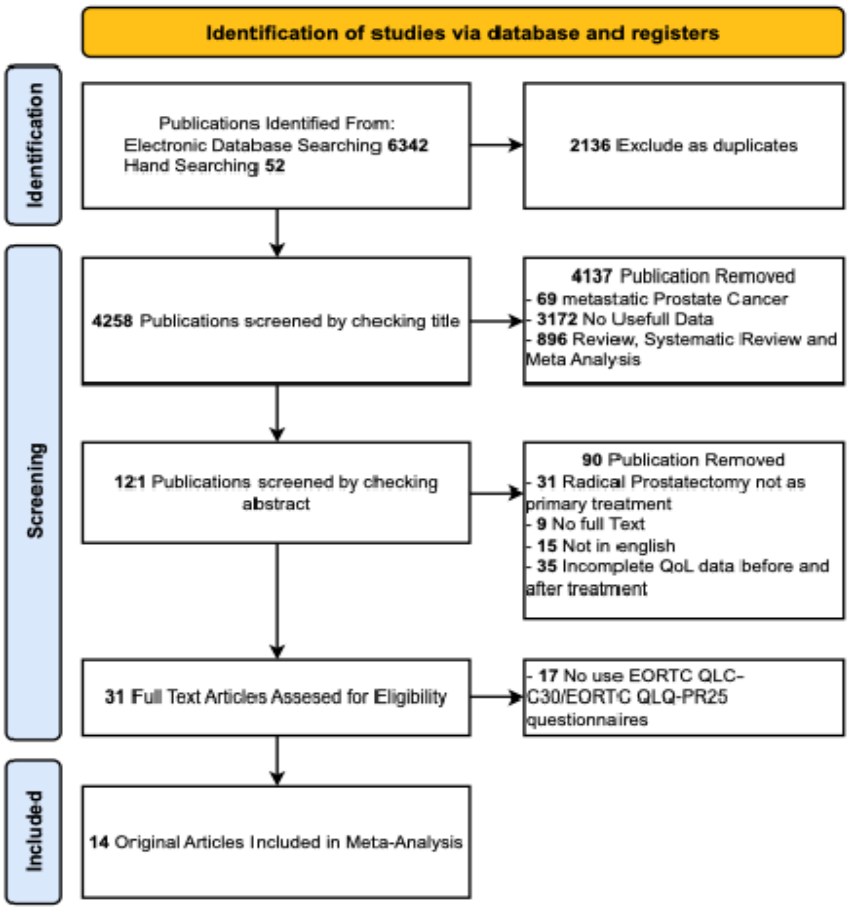

Figure 1. PRISMA Flow Diagram for Selection Studies

Table 2. Characteristics of Included Studies

No	Author, Year	Study Design	Country	Characteristics of Population Underwent Radical Prostatectomy				Quality of Life Assessment	
				N	Age (SD)	Clinical Stage	Surgical Technique	EORTC Questionnaire	Timing
1	Acar, 2014 [11]	Cohort	Netherland	65	59.5 (6.1)	T1-T2a	Robot-Assisted Laparoscopic Prostatectomy	QLC-30 & QLC-PR25	Before RP, mean follow up 29.7 Months
2	Bach, 2011 [2]	Cohort	Germany	185	66,5 (5.1)	pT1-pT4	Open Radical Retropubic Prostatectomy	QLC-30 & QLC-PR25	Before RP, mean follow up 28.6 Months
3	Borchers, 2004a,b [12]	Cohort	Germany	132	65.2 (4.9)	pT1-pT3b	Open Radical Prostatectomya	QLC-30	Before RP, mean follow up 6.12 months
							Open Radical Prostatectomy + Nerve Sparingb		
4	Ernstmann, 2016 [13]	Cohort	Germany	1772	65 (5.1)	T1-T2c	Radical Prostatectomy	QLC-30	Before RP, 6, 12, and 24 months, and 3 years
5	Giberty, 2009 [14]	Cohort	Italy	200	65.3 (8.7)	T1-T2a	Open Radical Retropubic Prostatectomy	QLC-30 & QLC-PR25	Before RP, 1, 6, and 12 months, and 5 years
6	Herkommer, 2014 [15]	Cohort	Germany	501	66.6 (10.6)	T1-T3	Open Radical Retropubic Prostatectomy	QLC-30	Before RP, 6, and 12 months
7	Holze, 2022c,d [16]	Cohort	Germany	782	65 (4.1)	pT1-pT4	Laparoscopic Radical Prostatectomyc	QLC-30 & QLC-PR25	Before RP, 1,3,6, and 12 months
							Robot-Assisted Laparoscopic Radical Prostatectomyd		
8	Jakobsson, 2013 [17]	Cohort	Sweden	222	62.7 (6.09)	T1-T3	Open Radical Retropubic Prostatectomy	QLC-30 & QLC-PR25	Before RP, 3 months, 1, 2, 4, and 5 years
9	Karagiotis, 2022 [18]	Cohort	Germany	2871	63 (5.6)	pT1-pT4	Robot-Assisted Laparoscopic Prostatectomy	QLC-30	Before RP and 24 months
10	Krahn, 2009 [19]	Cohort	Canada	305	60 (6.3)	pT1-pT4	Open Radical Retropubic Prostatectomy	QLC-30	Before RP, 2, and 12 months
11	Kretschmer, 2020e,f [20]	Cohort	Germany	418	58.3 (4.8)	T1-T2c	Open Radical Retropubic Prostatectomye	QLC-30	Before RP, 3, 6, 12, and 24 months
							Robot-Assisted Laparoscopic Prostatectomyf	QLC-30	
12	Pompe, 2017 [21]	Cohort	Germany	8573	64.9 (6.8)	T1-T2c	Radical Prostatectomy	QLC-30	Before RP, 3 months, 1, 2, and 3 years
13	Shin, 2019 [5]	Cohort	Korea	209	66.6 (6.6)	T1-T3	Open, Laparoscopic, and Robotic Prostatectomy	QLC-30 & QLC-PR25	Before RP, 3, and 12 months

RP, Radical Prostatectomy; EORTC, European Organization for the Research and Treatment of Cancer; QLQ, Quality of Life Questionnaire

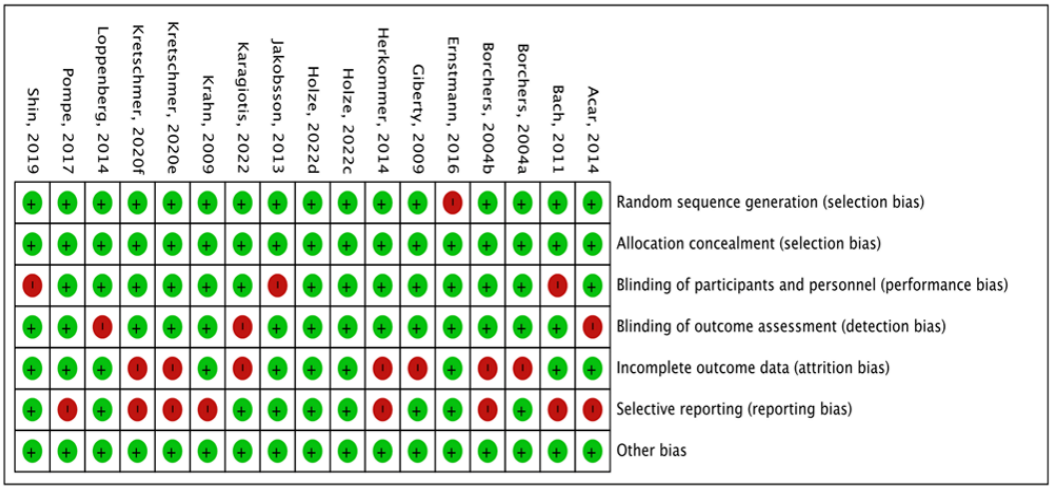

Figure 2. Risk of Bias Summary: review authors' judgements about each risk of bias item for each included study

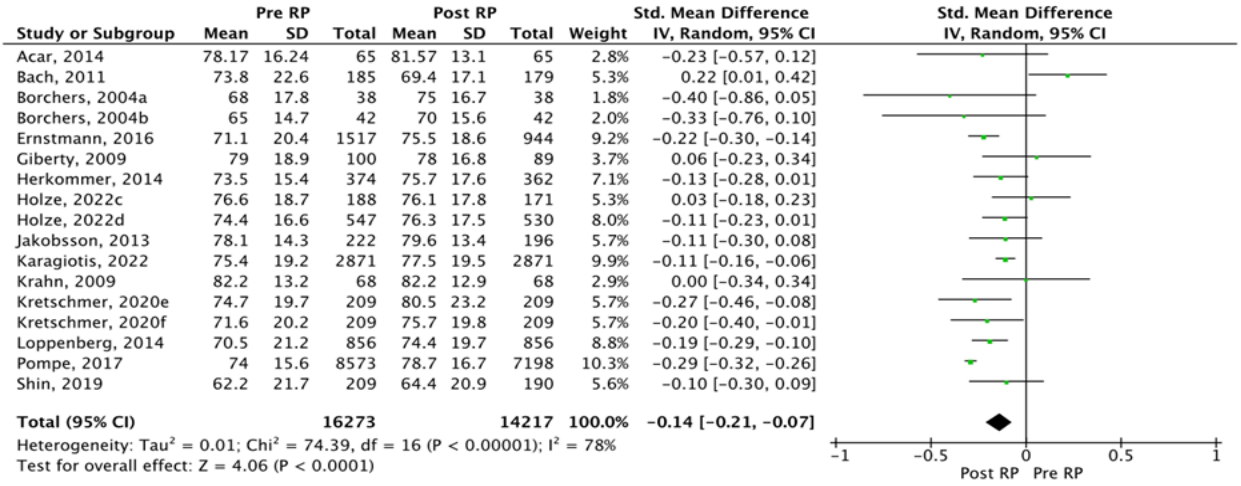

Figure 3. Forest Plot of Overall QoL

assisted RP was showed in Figure 5.

Emotional Function Before and After RP

Eleven studies including 4772 man was assessed in emotional function domain in QoL, generally twelve months after RP patients had significant improvement compared before RP. Due to substantial heterogeneity among the studies, a random-effects model was employed for the analysis (SMD = -0.40, 95%CI[-0,49, -0,31], I^2 = 72%, p < 0.00). The emotional function before and after RP was showed in Supplementary Figure 1.

Social Function Before and After RP

Eleven studies including 4790 man was assessed in social function domain in QoL, generally twelve month after RP patients had not significant improvement compared before RP. Due to substantial heterogeneity among the studies, a random-effects model was employed

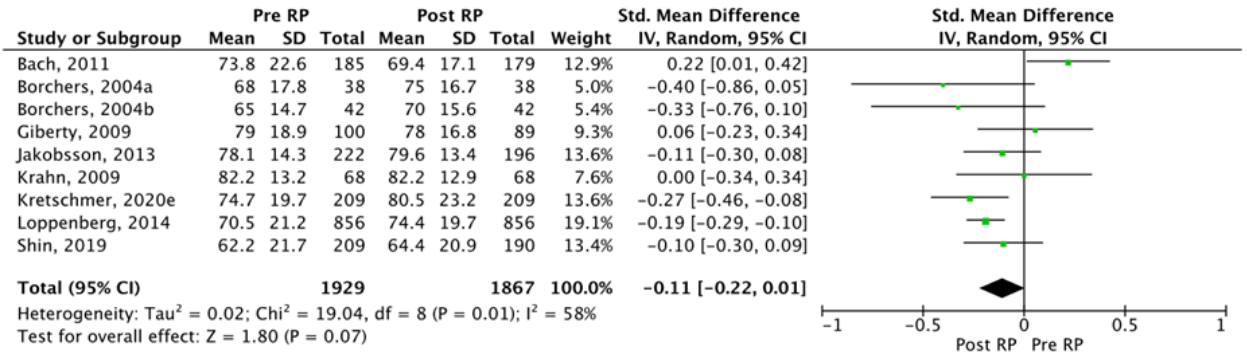

Figure 4. Forest Plot of QoL in Patient Underwent ORP

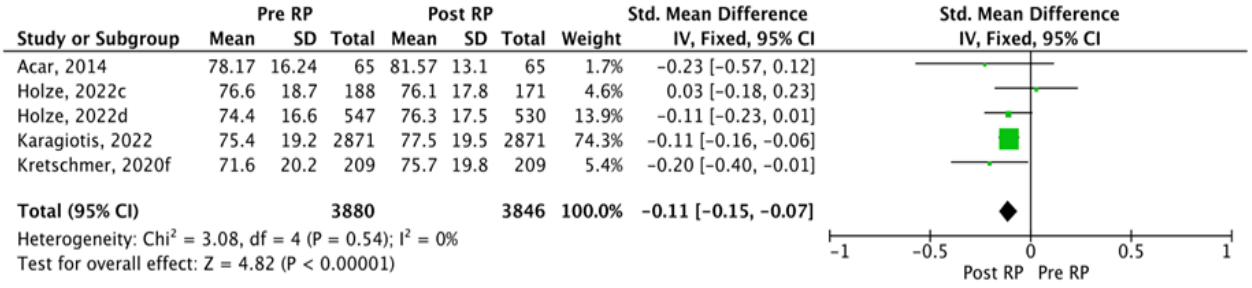

Figure 5. Forest Plot of QoL in Patient underwent Laparoscopic Robotic/hand assisted RP

for the analysis (SMD = 0.07, 95%CI[-0,01, 0,15], I^2 = 67%, p = 0.09). The social function before and after RP showed in Supplementary Figure 2.

Sexual Function Before and After RP

Eleven studies including 4790 man was assessed in sexual function domain in QoL, generally twelve month after RP patients significantly had negative impact. A random-effects model was used to account for the significant heterogeneity observed among the included studies (SMD = 0.31, 95%CI[0,14, 0,49], I^2 = 79%, p < 0.00). The sexual function before and after RP showed in Supplementary Figure 3.

Pain Before and After RP

Eight studies including 2793 man was assessed in pain domain in QoL, generally twelve month after RP patients had not significant improvement compared before RP. A fixed-effects model was utilized in the analysis, as the included studies exhibited low heterogeneity (SMD = 0.01, 95%CI[-0,04, 0,06], I^2 = 48%, p = 0.7). Pain assessment before and after RP showed in Supplementary Figure 4.

Urinary Symptoms Before and After RP

Five studies including 1451 man was assessed in urinary symptoms domain in QoL, generally twelve month after RP patients had not significant improvement compared before RP. A random-effects model was used to account for the significant heterogeneity observed among the included studies (SMD = -0.01, 95%CI[-0,17, 0,16], I^2 = 77%, p = 0.94). Urinary symptoms before and after RP showed in Supplementary Figure 5.

Discussion

This systematic review and meta-analysis provide comprehensive insights into the QoL outcomes for PCa patients who undergo RP. The findings suggest that while RP is effective in treating localized PCa, it has significant effects on several aspects of patients' QoL, particularly in the domains of urinary function, sexual function and social function [22, 23]. These results align with previous research, which consistently identifies urinary incontinence (UI) and erectile dysfunction (ED) as common post-operative challenges. However, psychological well-being in social function appears to vary across studies, suggesting that patient support networks and pre-surgical counseling may play a crucial role in moderating mental health outcomes.

One of the most prevalent complications post-RP in urinary function is UI, which has been shown to significantly impair QoL. For instance, studies have reported that UI affects up to 71% of patients, leading to increased feelings of confusion, depression, and anger, which inversely correlate with both physical and mental well-being [22, 23]. Furthermore, the presence of UI has been linked to a decrease in overall life satisfaction, highlighting the importance of addressing this issue in postoperative care [24]. The impact of UI on QoL is not only immediate but can persist for years, with some patients experiencing long-term effects that hinder their daily activities and social interactions [25].

In addition to UI, sexual dysfunction, particularly ED, is another significant concern for men undergoing RP. While some studies suggest that the impact of ED on overall QoL may be limited, it remains a critical factor in treatment decisions and patient satisfaction [26, 27]. The psychological ramifications of ED can exacerbate feelings of inadequacy and affect interpersonal relationships, further complicating the recovery process [28].

Moreover, the social aspects of QoL are also affected post-surgery. Study from Jurys et al. [29] has indicated that up to 30% of patients report feelings of social constraint following RP, which can stem from both physical limitations and psychological distress. The role of social support, surgical approach and the healthcare environment plays a crucial role in mediating these effects, as patients who perceive strong support systems tend to report better QoL outcomes [29].

In order comparing the surgical approach, ORP and robotic-assisted radical prostatectomy (RARP) has garnered significant attention in recent years, as both surgical approaches are prevalent in the treatment of localized PCa. For instance, a systematic review indicated that RARP is linked to improved transfusion rates and fewer intraoperative adverse events, which may contribute to a more favorable postoperative recovery trajectory [30, 31]. These factors can significantly influence the immediate QoL post-surgery, as patients may experience less discomfort and quicker return to daily activities. In this meta-analysis, ORP did not demonstrate a significant improvement in QoL compared to laparoscopic and RARP, including hand-assisted approaches.

However, the long-term functional outcomes, particularly concerning urinary and sexual function, present a more complex picture. Research indicates that while RARP may offer some advantages in terms of early recovery of sexual function, the differences in UI rates between RARP and ORP are less clear. A population-based study found a trend suggesting improved continence recovery after ORP compared to RARP, although this did not reach statistical significance [32, 33]. Furthermore, a meta-analysis highlighted that both surgical approaches yield comparable outcomes regarding urinary function and QoL, suggesting that the choice of surgical technique may not significantly impact these long-term outcomes [34].

The clinical implications of these findings are profound. Physicians must engage in detailed discussions with patients about the potential trade-offs associated with RP, ensuring that patients are aware of the possible impacts on their post-operative QoL. Moreover, our results emphasize the need for integrated personalized care approaches that include early rehabilitation strategies, such as pelvic floor exercises to mitigate UI, and sexual health counseling.

Despite the strengths of this review, such as the inclusion of a broad range of high-quality studies and the use of rigorous statistical techniques, several limitations must be acknowledged. The heterogeneity between studies, particularly in terms of the QoL measurement instruments used, may have introduced variability in our results. Additionally, the relatively short follow-up periods in some studies may not fully capture the long-term QoL outcomes.

Looking forward, future research should aim to investigate long-term QoL outcomes, as well as explore the impact of emerging treatment options, such as nerve-sparing surgical techniques and focal therapies, which may offer improved QoL benefits. Further studies comparing RP with other treatment modalities, such as active surveillance or radiotherapy, are also warranted to help clinicians tailor treatment plans based on patient preferences and QoL priorities.

In conclusion, while RP remains a gold standard treatment for localized PCa, its impact on QoL is considerable. The laparoscopic approach appears to offer modest improvements in QoL outcomes compared to ORP. Nevertheless, not all domains exhibit improvement, particularly in the realms of sexual function, urinary symptoms, and social function. Therefore, further research could delve into targeted interventions or personalized treatment approaches to address these specific domains and enhance the overall postoperative QoL for PCa patients.

Author Contribution Statement

PNT: conceptualization, methodology, writing-original draft, investigation, supervision, validation. BD: conceptualization, methodology, writing-original draft, investigation, supervision, validation. TNB: conceptualization, methodology, writing-original draft, investigation, supervision, validation. PS: conceptualization, methodology, writing-original draft, investigation, supervision, validation. AFP: conceptualization, methodology, writing-original draft, investigation, data curation, supervision. FKD: methodology, writing-original draft, investigation, data curation. AFR: visualization, project administration.

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General

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