

Pelvic Floor Muscle Exercises can Effectively Improve Urinary Incontinence after Radical Prostatectomy: Systematic Review and Meta-Analysis Based on Randomised Controlled Trials

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Objective: This study aims to assess the effect of pelvic floor muscle exercise (PFME) on urinary incontinence after radical prostatectomy.

Methods: PubMed, Web of Science, Embase, Cochrane Library, China National Knowledge Infrastructure (CNKI), VIP and other domestic and foreign databases were searched for published literature until December 2023 on the effect of pelvic muscle exercise on urinary incontinence in patients after radical prostatectomy. The retrieved literatures were screened, and data were extracted. After evaluating the quality of the literatures, RevMan 5.4 software was used for meta-analysis.

Results: This work included nine articles consisting of 1208 sufferers with urinary incontinence after radical prostatectomy. The forest plot showed that patients in the experimental group had better postoperative outcomes at 1 month (Relative Risk (RR) = 3.38, 95% confidence interval (CI) (1.83; 6.25)), 3 months (RR = 1.99, 95% CI (1.67; 2.38)) and 6 months (RR = 1.34, 95% CI (1.20; 1.49)). The incidence of urinary incontinence was statistically significant compared with the control group ($p < 0.05$). Patients in the experimental group 12 months after surgery (RR = 1.13, 95% CI (0.99; 1.23)) showed no significant difference in the incidence of urinary incontinence compared with the control group ($p > 0.05$).

Conclusions: PFME can significantly increase the recovery rate of urinary incontinence in sufferers with prostate cancer at 1, 3 and 6 months after radical surgery but have no significant improvement at 12 months. Urodynamic analysis may be needed for patients with long-term urinary incontinence.

Keywords: pelvic floor muscle exercises; radical prostatectomy; urinary incontinence; systematic review; meta-analysis

Introduction

Prostate cancer is commonly seen in the urinary system of men as a malignant tumour, and its incidence increases with age; It is the main factor that leads to tumour-related death in men [1]. Coupled with the increasing global aging problem, the incidence of this disease has further increased to 37.5/100,000 [2]. Radical prostatectomy is one of the most effective methods for clinical treatment of prostate cancer at the present stage, which can effectively remove tumour lesions and improve the condition of patients [3]. However, in the course of operation, it will inevitably lead to myogenic or neurogenic urethral sphincter destruction and, eventually, to urinary incontinence and other complications, which carry a great deal of weight in the quality of rehabilitation and quality of life of sufferers [4,5]. Therefore, the urine control function of patients should be restored after radical prostatectomy.

Pelvic floor muscle exercise (PFME) is a common conservative treatment for improving urinary incontinence, which can increase the power of pelvic floor striated mus-

cles and enhance the coordination of internal and external anal sphincter by repeatedly contracting muscles [6–9]. PFME has been recognised as an economical and safe remedy for sufferers. However, whether PFME can promote the rehabilitation of urinary incontinence after radical prostatectomy remains controversial, and systematic analysis is lacking. The present study systematically analysed the published literature on the effect of PFME on urinary incontinence after radical prostatectomy to provide reference for reducing the hazard of postoperative urinary incontinence and ameliorating patients' life quality.

Materials and Methods

Document Retrieval Strategy

The literatures about the influence of PFME on urinary incontinence after radical prostatectomy were searched in PubMed, Web of Science, Embase, Cochrane Library, China National Knowledge Infrastructure (CNKI), VIP and other domestic and foreign databases until December 2023.

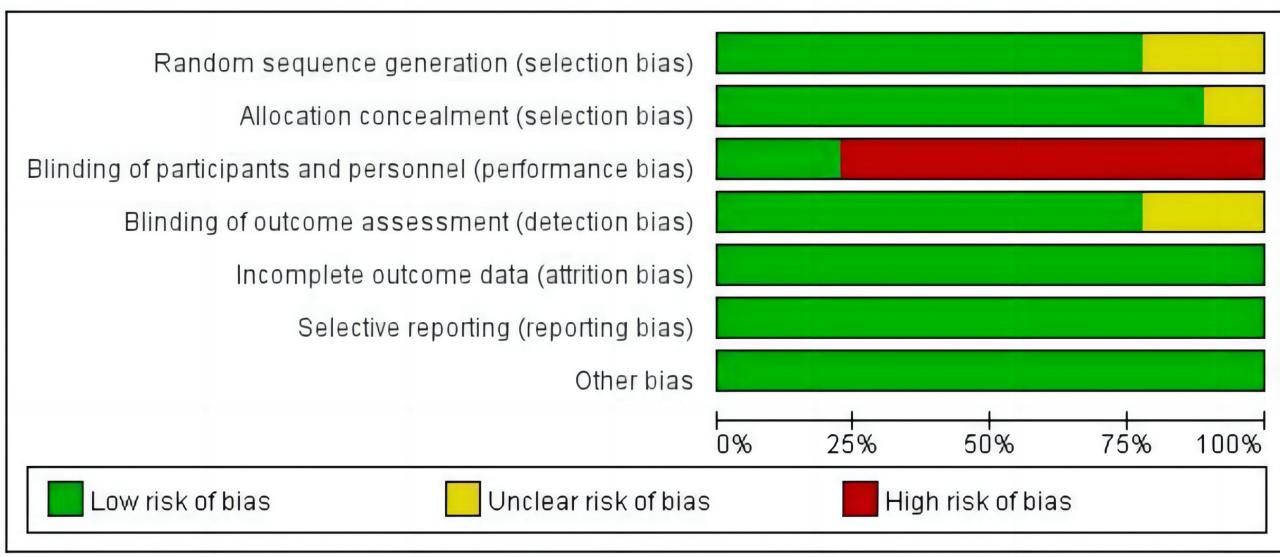


Fig. 1. Bias risk assessment for inclusion in the literature.

The key words were pelvic floor muscle exercise, pelvic floor rehabilitation, prostate cancer, radical prostatectomy, urinary incontinence, and urinary leakage, with PubMed as an example: (pelvic floor muscle exercise OR pelvic floor rehabilitation) AND (prostate cancer OR radical prostatectomy) AND (urinary incontinence OR leakage).

Literature Inclusion Criteria

The inclusion criteria were as follows: (1) Randomised controlled trials (RCT) written in Chinese and English languages; The use of blind method was not restricted; (2) They met the diagnostic criteria of prostate cancer and were diagnosed as prostate cancer by pathological examination; (3) All received radical prostatectomy; (4) Treatment: The experimental group received PFME intervention or PFME combined with biofeedback (BF), electrical stimulation (ES) and bladder training intervention, and the control group received routine intervention; And (5) outcome index: Effective treatment of urinary incontinence at 1, 3, 6 and 12 months after surgery.

Literature Exclusion Criteria

The exclusion criteria included the following: (1) The literature of repeated publication and incomplete data; (2) Animal experiments or reviews; (3) Documents with insufficient accuracy, such as obvious errors in the data; (4) Literature with unclear outcome index; (5) Abstract, case report and meeting minutes; (6) Literature with unclear treatment measures; And (7) literature with unclear sources.

Literature Screening and Data Extraction

The results of database retrieval were placed into Endnote X8 (Clarivate Analytics, Philadelphia, PA, USA) document management software to summarise and sort out the repeatedly published literature. Two researchers were selected to screen the documents on the basis of the research purpose, inclusion criteria and exclusion criteria. The headline, abstract and the whole text were read to screen the literature again and determine whether the literature was included in the study. The inclusion of the literature should be cross-checked. If the two researchers disagree on whether the literature is included or not during the screening process, then they can discuss and determine whether the literature is included or not; In case of persistent dispute, a third researcher can intervene and decide. Data need to be independently extracted by two researchers according to the unified data form. Data extracted included first author, country, publication time, sample size, treatment method, outcome index and so on.

Document Quality Evaluation

Bias risk assessment tool of Cochrane in RevMan 5.4 (Cochrane Collaboration, Oxford, UK) was selected to evaluate the literature quality in terms of random sequence generation, allocation hiding, blind method, data integrity, selective reporting and other sources of bias. The included literature was classified as “high risk”, “low risk” and “unknown”. If the literature meets all the above criteria, then it is regarded as grade A, and only part of the standards is regarded as grade B. Grade C does not meet all the above standards, and C-level literature is excluded (Fig. 1).

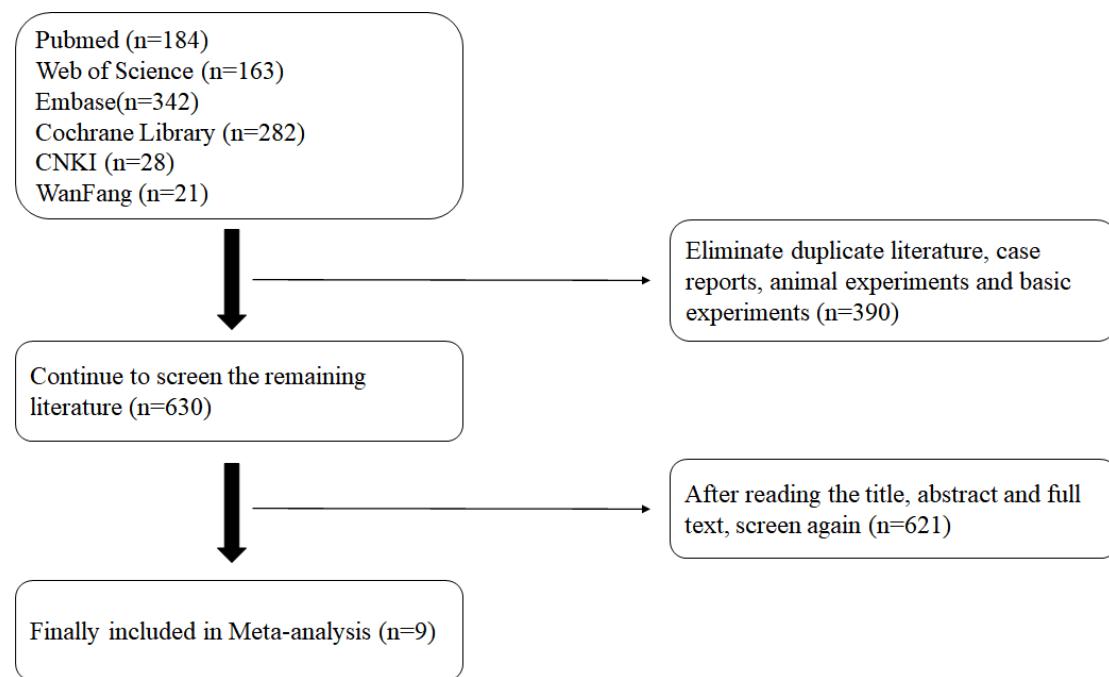


Fig. 2. Basic traits of inclusion in the literature.

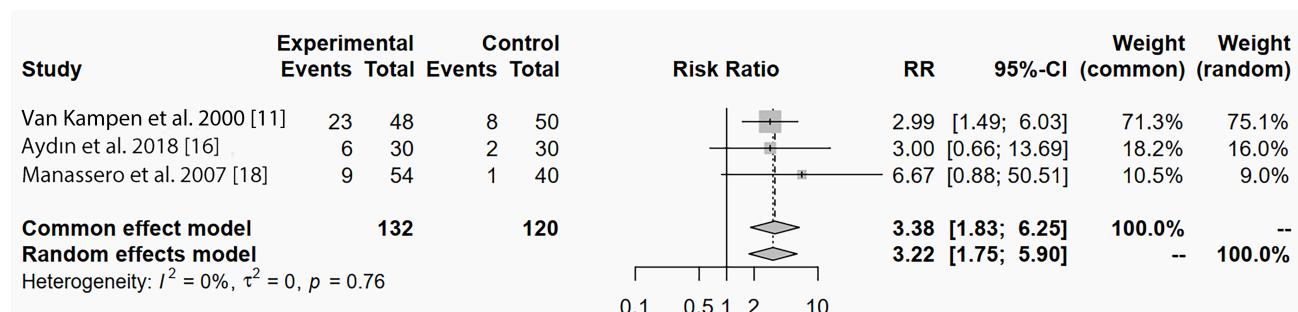


Fig. 3. Forest map of effectiveness analysis of urinary incontinence intervention in two groups of patients 1 month.

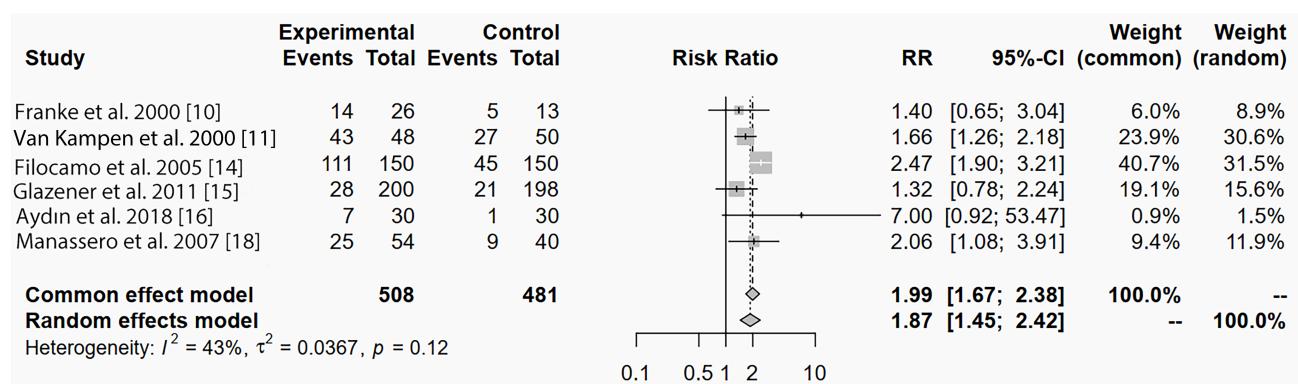


Fig. 4. Two groups of patients after operation.

Statistical Methods

Meta-analysis was carried out by RevMan 5.4 software, and Relative Risk (RR) was opted as the evaluation index. The corresponding 95% confidence interval (CI) was computed and shown in a forest map. If heterogeneity

is found between studies through I^2 ($p > 0.1$, $I^2 < 50\%$), then the heterogeneity among literatures is small, so the fixed effect model is opted. If $p < 0.1$ and $I^2 > 50\%$, then a large heterogeneity exists among the literatures, so the random effect model is opted. If heterogeneity exists, then sub-

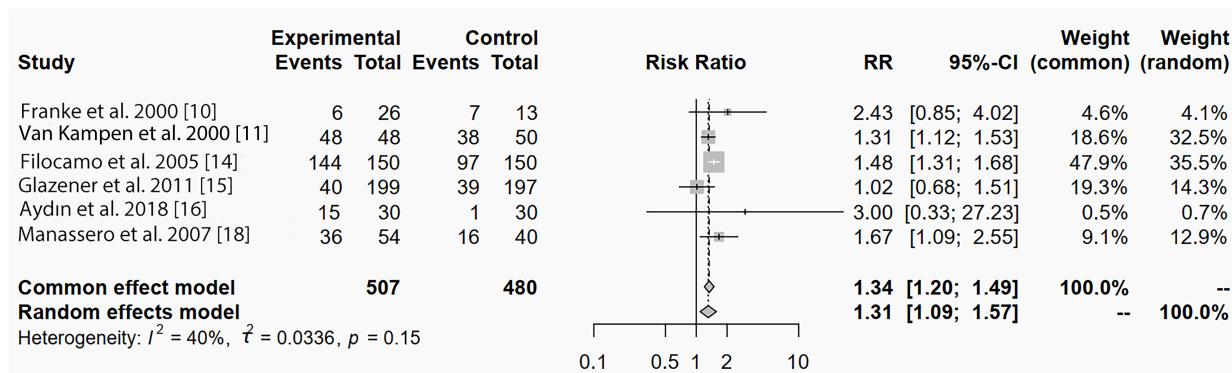


Fig. 5. Forest map of effectiveness analysis of urinary incontinence intervention in two groups of patients 6 months after operation.

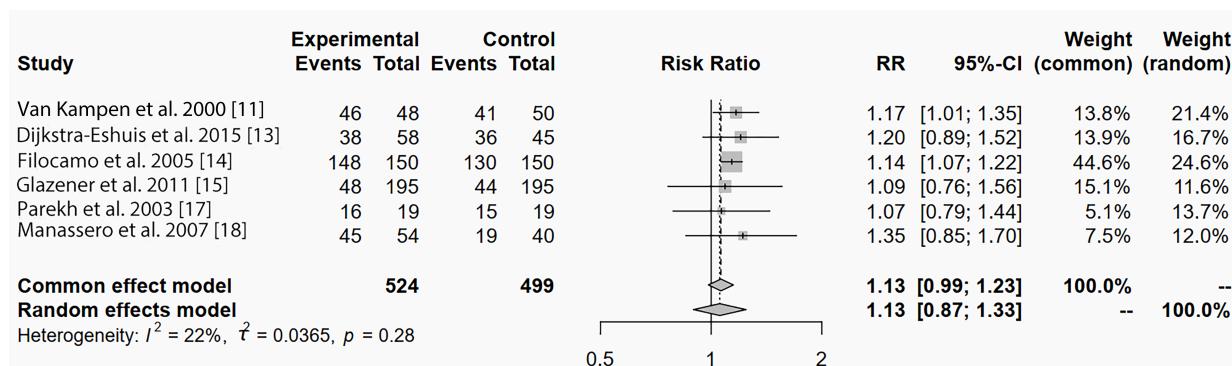


Fig. 6. Forest map of effectiveness analysis of urinary incontinence intervention in two groups of patients 12 months after operation.

group analysis and sensitivity analysis are used to search the origin of heterogeneity.

Results

Document Retrieval Process

A total of 1020 articles were preliminarily retrieved. Repeatedly retrieved literatures, case reports, animal experiments and basic experiments were excluded. The headline, abstract and the whole text of the literature were read, 620 unrelated articles were eliminated and 9 articles were obtained [10–18]. The flow chart of literature retrieval is shown in Fig. 2.

Basic Traits of Inclusion in the Literature

Nine articles were included in the survey, which were published from 2000 to 2018 and all of which were RCT. The articles included 1208 patients with urinary incontinence after radical prostatectomy from six countries: USA, Italy, Spain, UK, Turkey and Brazil; Of which, 627 were treated with PFME intervention and 581 with routine intervention. The fundamental traits included in the articles are shown in Table 1 (Ref. [10–18]).

Quality Evaluation of Included Literature

Among the 9 literatures, 3 articles were evaluated as grade A and 6 articles as grade B. Eight studies reported on the generation of random methods, including computer randomisation, random number table method and grouping randomness, and 7 articles were clear about allocation hiding, all of which involve blind method and have complete data reports and no other sources of bias. The quality assessment of the comprised documents is shown in Table 2 (Ref. [10–18]).

Meta-Analysis

Analysis of the Effectiveness of Intervention on Urinary Incontinence 1 Month after Operation

Three studies investigated the effectiveness of PFME intervention in patients with urinary incontinence 1 month after surgery. The heterogeneity test found that $I^2 = 0\%$ and $p = 0.76$. Heterogeneity was not found among the documents, and the fixed effects model was selected for analysis. The forest plot showed statistically significant difference in the incidence of urinary incontinence between the experimental group and the control group 1 month after the surgery ($RR = 3.38$, 95% CI (1.83; 6.25), $p < 0.05$; Fig. 3, Ref. [11,16,18]).

Table 1. Fundamental traits included in literature.

Literature	Type	Nation	Sample size		Treatment method		Intervention frequency
			Experimental group	Control group	Experimental group	Control group	
Franke <i>et al.</i> , 2000 [10]	RCT	USA	13	10	PFME (guided by therapist)	Routine intervention	3 times daily for 6 months
Van Kampen <i>et al.</i> , 2000 [11]	RCT	Canada	48	50	PFME + BF (oral guidance)	Routine intervention	Once a week for 1 year
Pedriali <i>et al.</i> , 2016 [12]	RCT	Brazil	52	31	PFME + ES (guided by therapist)	Routine intervention	10 times a week for 3 months
Dijkstra-Eshuis <i>et al.</i> , 2015 [13]	RCT	Netherlands	65	56	PFME + BF (guided by therapist)	Routine intervention	Once a week for 12 months
Filocamo <i>et al.</i> , 2005 [14]	RCT	Italy	150	150	PFME (guided by therapist)	Routine intervention	3 groups daily for 12 months
Glazener <i>et al.</i> , 2011 [15]	RCT	UK	196	195	PFME + BF (guided by therapist)	Routine intervention	Lasting 12 months
Aydin <i>et al.</i> , 2018 [16]	RCT	Turkey	30	30	PFME (guided by therapist)	Routine intervention	3 times daily for 6 months
Parekh <i>et al.</i> , 2003 [17]	RCT	USA	19	19	PFME + BF (guided by therapist)	Routine intervention	Every 3 weeks for 12 months
Manassero <i>et al.</i> , 2007 [18]	RCT	Italy	54	40	PFME + ES + BF (oral guidance)	Routine intervention	Lasting 12 months

Effectiveness of Intervention on Urinary Incontinence 3 Months after Operation

Six documents studied the effectiveness of PFME intervention in patients with urinary incontinence 3 months after the surgery. The heterogeneity test found $I^2 = 43\%$ and $p = 0.12$. Heterogeneity was not found among the documents, and the fixed effects model was selected for analysis. The forest plot showed statistically significant difference in the incidence of urinary incontinence in the experimental group 3 months after the surgery compared with the control group ($RR = 1.99$, 95% CI (1.67; 2.38), $p < 0.05$; Fig. 4, Ref. [10,11,14–16,18]).

Effectiveness of Intervention on Urinary Incontinence 6 Months after Operation

Six documents studied the effectiveness of PFME intervention in patients with urinary incontinence 6 months after the surgery. The heterogeneity test found $I^2 = 40\%$ and $p = 0.15$. Heterogeneity was not found among the documents, and the fixed effects model was selected for analysis. The forest plot showed a statistically significant difference in the incidence of urinary incontinence between the

experimental group and the control group 6 months after the surgery ($RR = 1.34$, 95% CI (1.20; 1.49), $p > 0.05$; Fig. 5, Ref. [10,11,14–16,18]).

Effectiveness of Intervention on Urinary Incontinence 12 Months after Operation

Six documents studied the effectiveness of PFME intervention in patients with urinary incontinence 12 months after the surgery. The heterogeneity test found $I^2 = 22\%$ and $p = 0.28$. Heterogeneity was not found among the documents, and the fixed effects model was selected for analysis. The forest plot showed that the incidence of urinary incontinence in the experimental group and the control group 12 months after the surgery was not statistically significant ($RR = 1.13$, 95% CI (0.99; 1.23), $p > 0.05$; Fig. 6, Ref. [11,13–15,17,18]).

Discussion

A number of literature reports have shown that early PFME exercise can effectively restore urine control function in sufferers with urinary incontinence [19,20]. In re-

Table 2. Quality evaluation of comprised literature.

Included documents	Randomly assigned	Allocation hidden	Blind method		Full data report	Optional results reporting	Other sources of bias	Rating
			Participants and personnel	Outcome assessment				
Franke <i>et al.</i> , 2000 [10]	Unknown	Unknown	Low risk	Low risk	Low risk	Low risk	Low risk	B
Van Kampen <i>et al.</i> , 2000 [11]	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	A
Pedriali <i>et al.</i> , 2016 [12]	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	A
Dijkstra-Eshuis <i>et al.</i> , 2015 [13]	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	A
Filocamo <i>et al.</i> , 2005 [14]	Unknown	Low risk	High risk	Unknown	Low risk	Low risk	Low risk	B
Glazener <i>et al.</i> , 2011 [15]	Low risk	Low risk	High risk	Low risk	Low risk	Low risk	Low risk	B
Aydin <i>et al.</i> , 2018 [16]	Low risk	Unknown	High risk	Low risk	Low risk	Low risk	Low risk	B
Parekh <i>et al.</i> , 2003 [17]	Low risk	Low risk	High risk	Low risk	Low risk	Low risk	Low risk	B
Manassero <i>et al.</i> , 2007 [18]	Low risk	Low risk	High risk	Low risk	Low risk	Low risk	Low risk	B

cent years, studies reported that PFME can improve urinary incontinence after radical prostatectomy, but controversy exists and systematic analysis is lacking. The present study aims to provide new ideas for clinical decision making. PFME can significantly increase the recovery rate of urinary incontinence in sufferers with prostate cancer at 1, 3 and 6 months after radical prostatectomy, but no obvious improvement occurs in the recovery rate of urinary incontinence at 12 months.

This study included nine articles comprising 1208 sufferers with urinary incontinence after radical prostatectomy. The forest plot showed that patients in the experimental group had better postoperative outcomes at 1 month ($RR = 3.38$, 95% CI (1.83; 6.25)), 3 months ($RR = 1.99$, 95% CI (1.67; 2.38)) and 6 months ($RR = 1.34$, 95% CI (1.20; 1.49)). The incidence of urinary incontinence was statistically significant compared with the control group ($p < 0.05$). Patients in the experimental group 12 months after surgery ($RR = 1.13$, 95% CI (0.99; 1.23)) showed no significant difference in the incidence of urinary incontinence compared with the control group ($p > 0.05$). This finding is basically consistent with the research results of Yang *et al.* [21], indicating that PFMT has a good effect on improving urinary incontinence after radical prostatectomy in men, especially for short- and medium-term patients. The outcomes of this study confirmed that PFME can effectively reduce the hazard of urinary incontinence after radical prostatectomy. This finding is basically consistent with the research results of Wu *et al.* [22]. However, Wang *et al.* [23] and other surveys showed that PFME has no obvious improvement in the recovery rate of urinary incontinence in patients with prostate cancer at 1, 3, 6 and 12 months after radical prostatectomy, which may be due to the less frequency of PFME intervention. Regardless of the regimen used, a higher frequency of PFME intervention indicates better intervention effect. PFME needs to be trained under the guidance of a professional physiotherapist. The structure of the pelvic floor muscle is very complex. If you exercise only under oral or written guidance, then the patient may not be able to judge whether the muscle con-

traction is correct [24,25]. In addition, abdominal muscle contraction poses a great difficulty for patients in the stage of PFME [26,27]. Urinary incontinence is one of the most common complications of various surgical procedures, and its incidence caused by different surgical procedures varies. Radical prostatectomy is one of the effective methods for treating prostate cancer. It is mainly based on open surgery and laparoscopic surgery. Laparoscopy can carry out surgical treatment in a narrow space, providing surgeons with a highly clear operating field of view, which is accurate and clear. It displays blood vessels, nerves and sphincter around the prostate, which improves the efficiency of surgical operations and avoids damage to other tissues during surgery. Compared with open surgery, it has less impact on the tissues around the prostate and helps reduce urinary incontinence. However, a certain risk of urinary incontinence may exist. Although urinary incontinence does not directly threaten the patient's life, health and safety, it will have a huge effect on patients' daily life and recovery [28–30]. PFME can promote changes in the pelvic floor nerves, enhance muscle contraction and tension, provide support for the urethra and bladder and improve the strength of the urethral sphincter. Bladder exercises gradually extend the urination interval, promote the bladder to return to its normal physiological position, ensure urinary control and improve bladder compliance [31]. Although PFME is used for training in the included literature, the nursing methods in 6 of the literature are combined with ES and/or BF treatment on the basis of PFME training. In terms of actual content, the difference is not too big but this will also lead to differences in the results. In addition, various literatures have different diagnostic criteria for postoperative urinary incontinence, which will also lead to certain biases.

However, this study has some shortcomings. (1) The follow-up time of some of the comprised literature is relatively short, which will lead to poor objectivity in the evaluation and detection of related indicators. (2) This study includes more English literature, so some non-English literature cannot be included in the study, resulting in biased results. (3) The overall sample size of the study is insufficient,

the source of the case is relatively single and PFME intervention has failed to form a standard scheme for the application of urinary incontinence after radical prostatectomy. (4) Few studies were conducted in the past 5 years, which may influence the comprehensiveness of meta-analysis. (5) Among the literature included, the treatment plan and type as well as the way and frequency of exercise guided by PFME are different. Differences in the evaluation of urinary incontinence in different studies exist, which leads to some bias in the outcomes of the meta-analysis. Therefore, in the future research, we should further increase the sample size and follow-up time, standardise the follow-up procedures and carry out high-frequency PFME exercise under the guidance of professional physiotherapists, which can offer a basis to clinical treatment and decision-making.

Conclusions

PFME can significantly increase the recovery rate of urinary incontinence in sufferers with prostate cancer at 1, 3 and 6 months after radical prostatectomy, but no obvious improvement occurs in the recovery rate of urinary incontinence at 12 months. Urodynamic analysis may be needed for patients with long-term urinary incontinence. The inclusion of literature has a long time span, which can reveal the overall research context of PMFE intervention on the efficacy of postoperative prostate cancer patients worldwide and provide reference for future research.

Availability of Data and Materials

The datasets used and/or analyzed during the current study were available from the corresponding author on reasonable request.

Author Contributions

YZ—designed the study; JW—collected and analyzed the data; YZ and JW—participated in drafting the manuscript. All authors conducted the study and contributed to critical revision of the manuscript for important intellectual content. All authors gave final approval of the version to be published. All authors participated fully in the work, took public responsibility for appropriate portions of the content, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or completeness of any part of the work were appropriately investigated and resolved.

Ethics Approval and Consent to Participate

Our study is based on open source data and relevant published studies, so there are no ethical or informed consent issues.

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Conflict of Interest

The authors declare no conflict of interest.

References

- [1] Sekhoacha M, Riet K, Motloung P, Gumenku L, Adegoke A, Mashele S. Prostate Cancer Review: Genetics, Diagnosis, Treatment Options, and Alternative Approaches. *Molecules: A Journal of Synthetic Chemistry and Natural Product Chemistry*. 2022; 27: 5730.
- [2] 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: A Cancer Journal for Clinicians*. 2021; 71: 209–249.
- [3] Milios JE, Ackland TR, Green DJ. Pelvic floor muscle training in radical prostatectomy: a randomized controlled trial of the impacts on pelvic floor muscle function and urinary incontinence. *BMC Urology*. 2019; 19: 116.
- [4] van der Slot MA, Remmers S, van Leenders GJLH, Busstra MB, Gan M, Klaver S, et al. Urinary Incontinence and Sexual Function After the Introduction of NeuroSAFE in Radical Prostatectomy for Prostate Cancer. *European Urology Focus*. 2023; 9: 824–831.
- [5] Matsukawa Y, Yoshino Y, Fujita T, Funahashi Y, Majima T, Ishida S, et al. Daily urine loss immediately after urethral catheter removal may be an effective predictor of long-term urinary incontinence following robot-assisted laparoscopic radical prostatectomy. *International Journal of Clinical Practice*. 2021; 75: e13736.
- [6] Hagen S, Elders A, Stratton S, Sergenson N, Bugge C, Dean S, et al. Effectiveness of pelvic floor muscle training with and without electromyographic biofeedback for urinary incontinence in women: multicentre randomised controlled trial. *BMJ: British Medical Journal/British Medical Association*. 2020; 371: m3719.
- [7] Stafne SN, Dalbye R, Kristiansen OM, Hjelle YE, Salvesen KÅ, Mørkved S, et al. Antenatal pelvic floor muscle training and urinary incontinence: a randomized controlled 7-year follow-up study. *International Urogynecology Journal*. 2022; 33: 1557–1565.
- [8] Giraudo D, Lamberti G, Ciardi G. Pelvic Floor Muscle Training for Urinary Incontinence after Radical Prostatectomy: a Narrative Review. *Urologia*. 2023; 90: 445–453.
- [9] Geng E, Yin S, Yang Y, Ke C, Fang K, Liu J, et al. The effect of perioperative pelvic floor muscle exercise on urinary incontinence after radical prostatectomy: a meta-analysis. *International Braz J Urol: Official Journal of the Brazilian Society of Urology*. 2023; 49: 441–451.
- [10] Franke JJ, Gilbert WB, Grier J, Koch MO, Shyr Y, Smith JA Jr. Early Post-Prostatectomy Pelvic Floor Biofeedback. *The Journal of Urology*. 2000; 163: 191–193.
- [11] Van Kampen M, de Weerd W, Van Poppel H, De Ridder D, Feys H, Baert L. Effect of pelvic-floor re-education on dura-

- tion and degree of incontinence after radical prostatectomy: a randomised controlled trial. *Lancet.* 2000; 355: 98–102.
- [12] Pedriali FR, Gomes CS, Soares L, Urbano MR, Moreira ECH, Averbeck MA, *et al.* Is pilates as effective as conventional pelvic floor muscle exercises in the conservative treatment of post-prostatectomy urinary incontinence? A randomised controlled trial. *Neurourology and Urodynamics.* 2016; 35: 615–621.
- [13] Dijkstra-Eshuis J, Van den Bos TW, Splinter R, Bevers RF, Zonneveld WC, Putter H, *et al.* Effect of preoperative pelvic floor muscle therapy with biofeedback versus standard care on stress urinary incontinence and quality of life in men undergoing laparoscopic radical prostatectomy: a randomised control trial. *Neurourology and Urodynamics.* 2015; 34: 144–150.
- [14] Filocamo MT, Li Marzi V, Del Popolo G, Cecconi F, Marzocco M, Tosto A, *et al.* Effectiveness of Early Pelvic Floor Rehabilitation Treatment for Post-Prostatectomy Incontinence. *European Urology.* 2005; 48: 734–738.
- [15] Glazener C, Boachie C, Buckley B, Cochran C, Dorey G, Grant A, *et al.* Urinary incontinence in men after formal one-to-one pelvic-floor muscle training following radical prostatectomy or transurethral resection of the prostate (MAPS): two parallel randomised controlled trials. *Lancet.* 2011; 378: 328–337.
- [16] Aydin Sayilan A, Özbaş A. The Effect of Pelvic Floor Muscle Training on Incontinence Problems after Radical Prostatectomy. *American Journal of Men's Health.* 2018; 12: 1007–1015.
- [17] Parekh AR, Feng MI, Kirages D, Bremner H, Kaswick J, Abosseif S. The Role of Pelvic Floor Exercises on Post-Prostatectomy Incontinence. *The Journal of Urology.* 2003; 170: 130–133.
- [18] Manassero F, Traversi C, Ales V, Pistolesi D, Panicucci E, Valent F, *et al.* Contribution of early intensive prolonged pelvic floor exercises on urinary continence recovery after bladder neck-sparing radical prostatectomy: Results of a prospective controlled randomized trial. *Neurourology and Urodynamics.* 2007; 26: 985–989.
- [19] Brennen R, Frawley HC, Martin J, Haines TP. Group-based pelvic floor muscle training for all women during pregnancy is more cost-effective than postnatal training for women with urinary incontinence: cost-effectiveness analysis of a systematic review. *Journal of Physiotherapy.* 2021; 67: 105–114.
- [20] Molina-Torres G, Moreno-Muñoz M, Rebullido TR, Castellote-Caballero Y, Bergamin M, Gobbo S, *et al.* The effects of an 8-week hypopressive exercise training program on urinary incontinence and pelvic floor muscle activation: a randomized controlled trial. *Neurourology and Urodynamics.* 2023; 42: 500–509.
- [21] Yang J, Ye H, Long Y, Zhu Q, Huang H, Xie H, *et al.* Effect of pelvic floor muscle training on urinary incontinence after radical prostatectomy: an umbrella review of meta-analysis and systematic review. *Clinical Rehabilitation.* 2023; 37: 494–515.
- [22] Wu ML, Wang CS, Xiao Q, Peng CH, Zeng TY. The therapeutic effect of pelvic floor muscle exercise on urinary incontinence after radical prostatectomy: a meta-analysis. *Asian Journal of Andrology.* 2019; 21: 170–176.
- [23] Wang W, Huang QM, Liu FP, Mao QQ. Effectiveness of preoperative pelvic floor muscle training for urinary incontinence after radical prostatectomy: a meta-analysis. *BMC Urology.* 2014; 14: 99.
- [24] Huaqi Y, Zheng D, Yongkang M, Shiming Z, Zhenghui S, Zhiwei W, *et al.* The significance of transrectal ultrasound and urologist_dually guided pelvic floor muscle exercise in improving urinary continence after radical prostatectomy. *European Journal of Medical Research.* 2023; 28: 171.
- [25] Hodges P, Stafford R, Coughlin GD, Kasza J, Ashton-Miller J, Cameron AP, *et al.* Efficacy of a personalised pelvic floor muscle training programme on urinary incontinence after radical prostatectomy (MaTchUP): protocol for a randomised controlled trial. *BMJ Open.* 2019; 9: e028288.
- [26] Hagen S, Bugge C, Dean SG, Elders A, Hay-Smith J, Kilonzo M, *et al.* Basic versus biofeedback-mediated intensive pelvic floor muscle training for women with urinary incontinence: the OPAL RCT. *Health Technology Assessment: HTA/NHS R&D HTA Programme.* 2020; 24: 1–144.
- [27] Baumann FT, Reimer N, Gockeln T, Reike A, Hallek M, Ricci C, *et al.* Supervised pelvic floor muscle exercise is more effective than unsupervised pelvic floor muscle exercise at improving urinary incontinence in prostate cancer patients following radical prostatectomy—a systematic review and meta-analysis. *Disability and Rehabilitation.* 2022; 44: 5374–5385.
- [28] Lardas M, Grivas N, Debray TPA, Zattoni F, Berridge C, Cumbebatch M, *et al.* Patient- and Tumour-related Prognostic Factors for Urinary Incontinence after Radical Prostatectomy for Nonmetastatic Prostate Cancer: a Systematic Review and Meta-analysis. *European Urology Focus.* 2022; 8: 674–689.
- [29] Sirisopana K, Jenjiranant P, Sangkum P, Kijvikai K, Pacharatakul S, Leenanupunth C, *et al.* Radical prostatectomy outcomes in renal transplant recipients: a retrospective case series of Thai patients. *BMC Urology.* 2021; 21: 97.
- [30] Piana A, Pecoraro A, Sidoti F, Checcucci E, Dönmez M, Prudhomme T, *et al.* Robot-Assisted Radical Prostatectomy in Renal Transplant Recipients: A Systematic Review. *Journal of Clinical Medicine.* 2023; 12: 6754.
- [31] Dumoulin C, Morin M, Danieli C, Cacciari L, Mayrand M, Toussaint M, *et al.* Group-Based vs Individual Pelvic Floor Muscle Training to Treat Urinary Incontinence in Older Women: A Randomized Clinical Trial. *JAMA Internal Medicine.* 2020; 180: 1284–1293.