UDC 616.65-006.6-089.87-089.12-089.168

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Vesicourethral anastomosis modified posterior support efficiency in extraperitoneoscopic radical prostatectomy

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Paediatric Surgery (Ukraine). 2026. 1(90): 94-100. doi: 10.15574/PS.2026.1(90).94100

For citation: Fofanov OD, Didukh IM, Matiyash OYa, Fofanov VO. (2026). Non-Hodjkin's lymphoma of the appendix in children (clinical case). Paediatric Surgery (Ukraine). 1(90): 94-100. doi: 10.15574/PS.2026.1(90).94100.

Early recovery of urinary continence (UC) remains one of the major functional challenges after radical prostatectomy (RP). Posterior support of the vesicourethral anastomosis has been proposed to improve early continence outcomes. However, its effectiveness in extraperitoneoscopic RP (ERP), particularly in patients with excess body weight, remains insufficiently defined.

Aim – to evaluate the impact of a modified posterior support technique of the vesicourethral anastomosis (PS-VUA) on UC recovery after ERP, stratified by waist circumference (WC).

Materials and methods. This prospective study included 106 patients with non-metastatic prostate cancer (PCa) who underwent ERP. Patients were divided into two groups according to the use of PS-VUA: PS-0 (no posterior support, n=53) and PS-1 (posterior support performed, n=53). A predefined subgroup analysis was conducted according to WC: <102 cm (WC-0) and ≥102 cm (WC-1). UC was evaluated over a 12-month follow-up period after surgery.

Results. The PS-1 group demonstrated significantly higher UC rates at 1, 3, and 6 months postoperatively compared with the PS-0 group. Among patients with WC-1, the PS-VUA was associated with significantly improved UC rates at 1, 3, 6, and 9 months. In contrast, no significant differences were observed in patients with WC-0.

Conclusions. PS-VUA accelerates early UC recovery after ERP, particularly in patients with WC-1.

The study was performed in accordance with the principles of the Declaration of Helsinki. The study protocol was approved by the Local Ethics Committee of the institution mentioned in the work.

The authors declare no conflict of interest.

Keywords: radical prostatectomy, posterior support of the vesicourethral anastomosis, waist circumference, prostate cancer.

Ефективність модифікованої задньої підтримки везикоуретрального ананстомозу при екстраперитонеоскопічній радикальній простатектомії

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Раннє відновлення утримання сечі (UC) залишається однією з головних функціональних проблем після радикальної простатектомії. Задня підтримка везикоуретрального анастомозу пропонується для покращення ранніх результатів континенції. Проте її ефективність під час екстраперитонеоскопічної радикальної простатектомії (ERP), особливо в пацієнтів із надлишковою вагою, досі недостатньо визначена.

Мета – оцінити вплив модифікованої техніки задньої підтримки везикоуретрального анастомозу (PS-VUA) на UC після ERP зі стратифікацією за окружністю талії (WC).

Матеріали та методи. Проспективне дослідження охопило 106 хворих із неметастатичним раком простати (PCa), яким проводили ERP. Пацієнтів розподілили на дві групи залежно від виконання PS-VUA: PS-0 (без задньої підтримки, n=53) та PS-1 (із задньою підтримкою, n=53). Підгруповий аналіз проведено за WC: <102 см (WC-0) та ≥102 см (WC-1). UC оцінювали протягом 12 місяців після операції.

Результати. У групі PS-1 показники UC на 1, 3 та 6 місяцях після втручання були статистично значущо вищими щодо групи PS-0. Серед пацієнтів із WC-1, PS-VUA забезпечувала достовірно вищі рівні UC на 1, 3, 6 та 9 місяцях. Натомість у хворих із WC-0 вірогідних відмінностей не спостерігали.

Висновки. PS-VUA прискорює раннє відновлення UC після ERP, особливо в пацієнтів із WC-1.

Дослідження виконано відповідно до принципів Гельсінської декларації. На проведення дослідження отримано інформовану згоду пацієнтів.

Автори заявляють про відсутність конфлікту інтересів.

Ключові слова: радикальна простатектомія, задня підтримка везикоуретрального анастомозу, окружність талії, рак простати.

Introduction

Early recovery of urinary continence (UC) remains one of the most important functional goals following radical prostatectomy, as postoperative incontinence substantially impairs quality of life. Despite continuous refinements in surgical technique and increasing emphasis on anatomical preservation, delayed continence recovery remains a frequent and clinically relevant problem [3]. Anatomical and reconstructive strategies aimed at optimizing vesicourethral anastomosis (VUA) stability and sphincteric support have been shown to influence early functional recovery after radical prostatectomy [3,6,8,10,14,22]. However, the clinical benefit of these reconstructive maneuvers remains heterogeneous across patient populations. Our previous experience demonstrated that the posterior support technique of the VUA (PS-VUA) primarily accelerates early UC recovery without affecting long-term continence rates [12]. Notably, patients in that cohort had relatively higher body mass index (BMI) and prostate volume (PV), suggesting that patient-specific anatomical or biomechanical factors may modulate the effectiveness of posterior support. Obesity is a well-recognized risk factor for inferior functional outcomes following prostate cancer surgery. Increased BMI has been associated with prolonged operative time (OT), higher complication rates, and delayed UC recovery [2,5,18]. However, BMI alone is an imprecise surrogate for surgical complexity and functional risk. Emerging evidence suggests that abdominal adiposity, rather than total body weight, may be a more relevant determinant of pelvic floor mechanics, bladder outlet function, and postoperative urinary incontinence [7,9,21]. Waist circumference (WC) has therefore gained increasing attention as a clinically accessible marker of abdominal obesity and pelvic biomechanical stress. Against this background, we hypothesized that the functional benefit of PS-VUA may be particularly pronounced in patients with abdominal adiposity, in whom increased intra-abdominal pressure and pelvic floor strain may adversely affect early continence recovery. The present prospective study was designed to evaluate the impact of PS-VUA on UC after extraperitoneoscopic radical prostatectomy (ERP), with predefined subgroup analyses according to WC.

Aim – to evaluate the impact of a PS-VUA on UC recovery after ERP, with stratification according to WC.

Material and methods of the study

This prospective study included 106 patients with non-metastatic prostate cancer (PCa) who underwent ERP between 2022 and 2024 at the University Clinic of Danylo Halytskyi Lviv National Medical University. Magnetic resonance imaging (MRI) with assessment according to the Prostate Imaging Reporting and Data System (PI-RADS) score was used for precise surgical planning and a personalized preservation approach, as described previously [13,14]. Preservation of the posterior wall of the bladder-neck outlet (PW-BNO-P), arcus tendineus (AT-P), endopelvic fascia (EF-P), puboprostatic ligaments (PPL-P), distal portion of the dorsal vascular complex (DP-DVC-P), and maximal functional urethral length (MFUL-P) was performed in all cases. In addition, VUA with single-layer anatomical reconstruction and preservation of the anterior smooth muscle urethral sphincter was consistently applied [11].

PS-VUA were done in 53 patients (PS-1), and the results were compared with the group where modifications were not performed (PS-0).

Exclusion criteria consisted of metastatic PCa, finasteride use, and neoadjuvant or adjuvant androgen deprivation therapy. UC outcomes were evaluated at 1, 3, 6, 9, and 12 months after the surgery.

The surgical technique of the procedure was previously described [12]. Additionally, subgroup analyses were performed according to WC, dichotomized as ≥102 cm (WC-1) and <102 cm (WC-0). WC was estimated using a measuring tape.

UC was considered present if the patient had a voided volume ≥250 ml and no leakage during a cough stress test, which was confirmed by objective examination results using ultrasound. UC, according to these criteria was preserved in all cases before surgery.

Statistical analysis was performed using MedCalc free statistical calculators and STATISTICA version 10 (64-bit). Numerical data are presented as median (Me), lower

Table 1
Baseline clinical and perioperative characteristics of the study groups, Me (Q1; Q3)

Parametr	All (n=106)	PS-0 (n=53)	PS-1 (n=53)
Age, years	66 (61; 72)	67 (64; 71)	66 (61; 72)
BMI, kg/m²	29.81 (25.8; 34.45)	29.65 (25.6; 35.4)	29.82 (26.07; 35.5)
PSA, ng/ml	10.65 (7.4; 17.89)	9.86 (7.74; 17.2)	11.14 (7.14; 18)
PV, ml	48.0 (36.4; 62.2)	48.2 (35.8; 62.2)	47.8 (36.7; 62)
PI-RADS	4 (4; 5)	4 (4; 5)	4 (4; 4)
T-stage	2a (2a; 3b)	2a (2a; 2c)	2a (2a; 3b)
pT-stage	2c (2a; 3b)	2c (2b; 3b)	2c (2c; 3a)
ISUP	2 (1; 2)	2 (1; 2)	2 (1; 3)
pISUP	2 (2; 4)	2 (2; 4)	2 (2; 4)
OT, min	141 (129; 155)	140 (130; 152)	142 (128; 156)
VUAT, min	19.9 (18.4; 22.3)	19.8 (18.4; 22.3)	21.0 (19.2; 23.1)
EBL, ml	330 (265; 415)	330 (265; 405)	330 (250; 420)
HS, days	8 (7; 9)	8 (7; 9)	8 (7; 9)
UC-R, day	7 (7; 8)	7 (7, 8)	7 (7; 8)

Notes: PS-1 – posterior support applied, PS-0 – no posterior support, WC-1 – waist circumference ≥102 cm, WC-0 – waist circumference <102 cm, PSA – prostate-specific antigen, PV – prostate volume, PI-RADS – Prostate Imaging Reporting and Data System score, T-stage – clinical stage, pT-stage – pathological stage, ISUP – International Society of Urological Pathology, OT – operative time, VUAT – vesicourethral anastomosis time, EBL – estimated blood loss, HS – length of hospital stay, UC-R – catheter removal time.

Table 2
Baseline clinical and perioperative characteristics of the study subgroups, Me (Q1; Q3)

Parametr	WC-1, PS-0 (n=34)	WC-0, PS-1 (n=36)	WC-1, PS-0 (n=19)	WC-0, PS-1 (n=17)
Age, years	66.5 (64; 71)	66.5 (61; 73.5)	67.0 (67; 75)	61.0 (59; 67)
BMI, kg/m²	31.3 (29.7; 35.7)	33.1 (29.8; 37.7)	24.9 (23.2; 26.7)	25.1 (24.5; 25.8)
PSA, ng/ml	11.6 (8.2; 17.6)	11.9 (8.4; 18.4)	8.3 (7.1; 16.5)	10.7 (7.1; 18)
PV, ml	51.4 (38.4; 62.7)	48.2 (38.3; 61.3)	42.7 (32.5; 58.9)	47.8 (30.8; 68.9)
PI-RADS	4 (4; 5)	4 (4; 4)	4 (4, 5)	4 (4, 5)
T-stage	2a (2a; 2c)	2a (2a; 2c)	2c (2a; 3a)	2c (2a; 3b)
pT-stage	2c (2a; 3b)	2c (2c; 3b)	2c (2b; 3a)	3b (2c; 3a)
ISUP	2 (1; 2)	2 (1; 3.5)	1 (1; 2)	2 (1; 2)
pISUP	3 (2; 4)	3 (2; 4)	2 (2; 3)	2 (2; 3)
OT, min	138.0 (129; 152)	143.5 (126; 158)	144.0 (136; 152)	141.0 (129; 155)
VUAT, min	19.8 (17.9; 21.8)	21.0 (18.7; 22.6)	20.5 (18.4; 23.4)	21.5 (19.9; 23.1)
EBL, ml	325 (240; 395)	330 (247.5; 420)	370 (300; 440)	345 (265; 410)
HS, days	8 (7; 9)	8 (7; 9)	8 (7; 9)	8 (7; 8)
UC-R, day	7.5 (7, 8)	7.5 (7, 8)	7.0 (7, 9)	7.0 (7, 8)

Notes: WC-0 – waist circumference <102 cm; WC-1 – waist circumference ≥102 cm; PS-1 – posterior support applied, PS-0 – no posterior support, WC-1 – waist circumference ≥102 cm, WC-0 – waist circumference <102 cm, PSA – prostate-specific antigen, PV – prostate volume, PI-RADS – Prostate Imaging Reporting and Data System score, T-stage – clinical stage, pT-stage – pathological stage, ISUP – International Society of Urological Pathology, OT – operative time, VUAT – vesicourethral anastomosis time, EBL – estimated blood loss, HS – length of hospital stay, UC-R – catheter removal time.

quartile (LQ), and upper quartile (UQ). The Mann–Whitney U test was used to compare quantitative variables between independent groups. Statistical significance was set at $p<0.05$.

The study was conducted in accordance with the principles of the Declaration of Helsinki. The study protocol was approved by the Local Ethics Committee, and written informed consent was obtained from all participants. The informed consent of the patient was obtained for conducting the studies.

Results of the study and discussion

A total of 106 patients with localized or locally advanced PCa were included in the analysis.

Patients were evenly distributed between the groups with PS-VUA not performed (PS-0, n=53) and per-

Table 3
Preservation characteristics of the study groups, % (n)

Parametr	All (n=106)	PS-0 (n=53)	PS-1 (n=53)
BN-P	48 (51)	51 (27)	45 (24)
NS-none	9 (10)	7 (4)	11 (6)
NS-partial-none	25 (26)	23 (12)	27 (14)
NS-partial	20 (21)	19 (10)	21 (11)
NS-partial-full	31 (33)	34 (18)	28 (15)
NS-full	15 (16)	17 (9)	13 (7)

Notes: BN-P – bladder neck preservation, NS – nerve sparing, PS-1 – posterior support applied, PS-0 – no posterior support,

Table 4
Preservation volume data of the study subgroups, % (n)

Parametr	WC-1, PS-0 (n=34)	WC-0, PS-1 (n=36)	WC-1, PS-0 (n=19)	WC-0, PS-1 (n=17)
BN-P	47 (16)	44 (16)	58 (11)	47 (8)
NS-none	6 (2)	8 (3)	11 (2)	18 (3)
NS-partial-none	23 (8)	28 (10)	21 (4)	23 (4)
NS-partial	21 (7)	25 (9)	16 (3)	12 (2)
NS-partial-full	38 (13)	22 (8)	26 (5)	41 (7)
NS-full	12 (4)	17 (6)	26 (5)	6 (1)

Notes: BN-P – bladder neck preservation, NS – nerve sparing, PS-1 – posterior support applied, PS-0 – no posterior support, WC-0 – waist circumference <102 cm; WC-1 – waist circumference ≥102 cm.

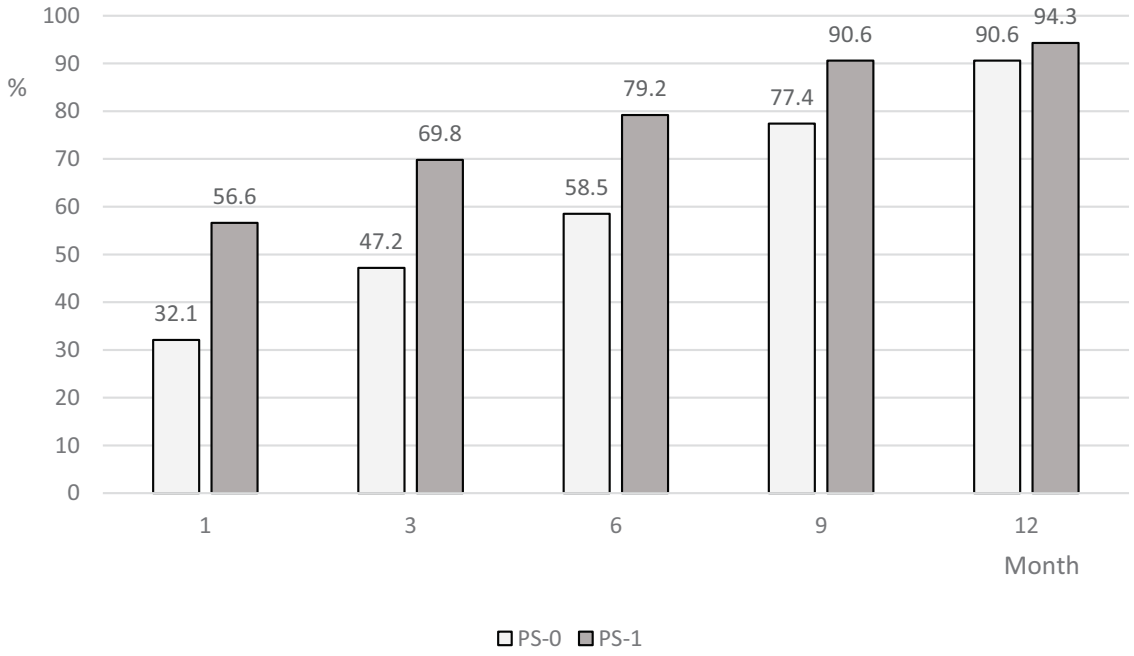
Table 5
Post-intervention urinary continance outcomes in study group and subgroup

Parametr	Month after surgery, % (n)				
	1	3	6	9	12
All (n=106):	49 (52)	61 (65)	72 (76)	84 (89)	93 (99)
PS-0 (n=53)	37 (20)	51 (27)	62 (33)	77 (41)	92 (49)
PS-1 (n=53)	60 (32)	72 (38)	81 (43)	91 (48)	94 (50)
p (PS-0 vs PS-1)	0,021	0,029	0,032	0,066	0,703
PS-0 (n=34) WC-1	32 (11)	47 (16)	59 (20)	74 (25)	91 (31)
PS-1 (n=36) WC-1	58 (21)	72 (26)	80 (29)	92 (33)	94 (34)
p (PS-0 vs PS-1)	0,031	0,034	0,049	0,047	0,608
PS-0 (n=19) WC-0	47 (9)	58 (11)	68 (13)	84 (16)	95 (18)
PS-1 (n=17) WC-0	65 (11)	71 (12)	82 (14)	88 (15)	94 (16)
p (PS-0 vs PS-1)	0.311	0.446	0.353	0.751	0.968

Notes: PS-1 – posterior support applied, PS-0 – no posterior support, WC-0 – waist circumference <102 cm; WC-1 – waist circumference ≥102 cm.

formed (PS-1, n=53). Baseline demographic, clinical, radiologic, and perioperative characteristics are summarized in Table 1.

The specified parameters in the group and subgroup analyses did not differ significantly from each other according to the results of the Mann–Whitney test (U-test). The median age of the entire cohort was 66 years (61; 72), and the median prostate-specific antigen (PSA) level was 10.65 ng/mL (7.4; 17.89). Median of PV was 48 ml (36.4; 62.2). The predominant clinical stage was cT2a, while pathological staging ranged from pT2a to pT3b, with a median of pT2c. Biopsy ISUP grade was 2 (1; 2), whereas pathological ISUP grades were 2 (2; 4). Most patients were overweight, with a median BMI of 29.8 kg/m² (25.8; 34.5). No statistically significant differences were observed between PS-0 and PS-1 groups regarding age, BMI, PSA level, PV, PI-RADS score, clinical or pathological stage, ISUP grade, OT, VUA time (VUAT), estimated blood loss (EBL), length of hospital stay (HS), or catheter removal time (UC-R), all p>0.05. A predefined subgroup analysis comparing WC-1 and WC-0 was performed. Clinical and perioperative characteristics of the subgroups are presented in Table 2.



Notes: PS-1 – posterior support applied, PS-0 – no posterior support.

Fig. 1. Groups comparison of postoperative urinary continence outcomes

No statistically significant differences within subgroups regarding age, BMI, PSA level, PV, PI-RADS score, clinical or pathological stage, ISUP grade, OT, VUAT, EBL, HS, or UC-R, all p>0.05. Bladder-neck preservation (BN-P) was performed in 48% of patients overall. The distribution of nerve-sparing (NS) techniques was as follows: NS-none in 9%, NS-partial-none in 25%, NS-partial in 20%, NS-partial-full in 31%, and NS-full in 15% of patients. No significant differences were observed between PS-0 and PS-1 groups regarding BN-P or the extent of nerve-sparing (Table 3).

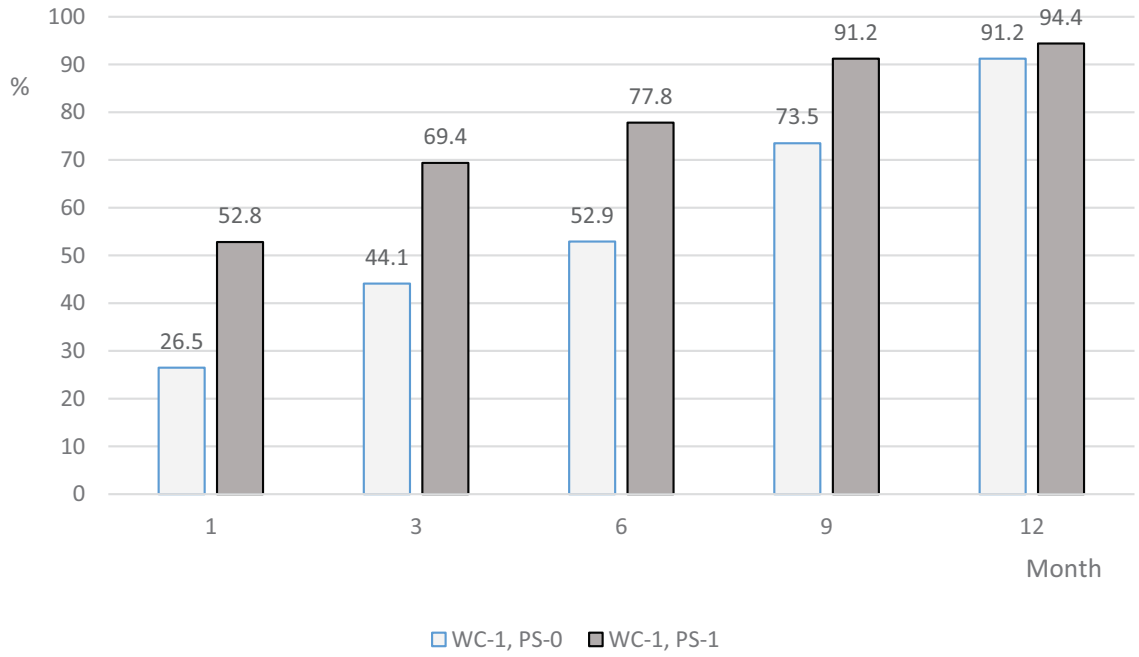
Similarly, within the subgroups, no statistically significant differences were observed in the frequency or distribution of BN-P and NS techniques (Table 4).

All perioperative complications were limited to Clavien–Dindo grades I–II. No cases of VUA stricture were observed during the 12-month follow-up period. UC improved progressively over the follow-up period in all groups. Overall continence rates increased from 49% at 1 month to 93% at 12 months postoperatively (Table 5, Figure 1).

PS-1 group demonstrated significantly faster continence recovery. Continence rates at 1, 3, and 6 months were significantly higher in PS-1 compared with PS-0 (p=0.021, p=0.029, and p=0.032, respectively). Differences diminished by 9 months and were no longer significant at 12 months (p=0.703). WC-1, PS-1 subgroup demonstrated significantly faster continence recovery during the first 9 postoperative months than WC-1, PS-0 subgroup (Table 5, Figure 2).

Continence rates were significantly higher in WC-1 PS-1 at 1 month (p=0.031), 3 months (p=0.034), 6 months (p=0.049), and 9 months (p=0.047). No difference was observed at 12 months (p=0.608). In contrast, among WC-0 patients, continence recovery was numerically higher during the first 9 months but did not differ significantly between the PS-0 and PS-1 groups at any time point, suggesting that the benefit of PS-VUA may be more pronounced in patients with abdominal adiposity.

Early UC remains one of the key functional goals after radical prostatectomy. Despite substantial advances in surgical technique, delayed continence recovery continues to negatively affect postoperative quality of life [3]. Our previous work demonstrated that PS-VUA primarily influences the speed of functional recovery rather than ultimate long-term continence outcomes [12]. Notably, patients in that earlier series had a higher BMI and prostate PV than average. Consequently, the present study aimed to further evaluate the efficiency of PS-VUA in patients with elevated BMI, with particular emphasis on those with abdominal adiposity. The current study demonstrates that PS-VUA significantly accelerates early UC recovery, especially in patients with WC-1. High BMI is a well-recognized risk factor for adverse perioperative and functional outcomes in prostate cancer surgery [8,15]. Obesity complicates surgical performance itself; increased BMI and visceral or periprostatic fat have been shown to independently predict prolonged operative time and higher complication rates [2,5].



Notes: PS-1 – posterior support applied, PS-0 – no posterior support, WC-0 – waist circumference <102 cm; WC-1 – waist circumference ≥102 cm.

Fig. 2. Subgroup comparison of postoperative urinary continence outcomes

However, BMI alone may not be the most precise indicator of surgical difficulty or postoperative functional risk. Our findings underscore the clinical relevance of WC as a marker of abdominal adiposity. This observation is consistent with emerging evidence suggesting that fat distribution parameters such as abdominal subcutaneous fat thickness or relative fat mass are superior predictors of lower urinary tract dysfunction and stress urinary incontinence compared with BMI alone [9,21]. Moreover, Ku et al. demonstrated that body shape index – but not BMI – was associated with worse outcomes in the US NHANES cohort (National Health and Nutrition Examination Survey) [7]. Furthermore, abdominal obesity defined by WC≥102 cm has been associated with higher-grade prostate cancer and inferior functional recovery following surgery [1,17]. A key finding of our predefined subgroup analysis is that the continence benefit of PS-VUA was predominantly driven by patients with abdominal adiposity (WC-1). In this subgroup, PS-1 resulted in significantly faster continence recovery for up to 9 months postoperatively. In the WC-0 subgroup, recovery speed did not differ significantly between PS-0 and PS-1 groups, despite numerically higher rates in the PS-1 group. Importantly, PS-0 and PS-1 groups did not differ significantly in terms of bladder neck preservation or nerve-sparing extent, and this finding was consistent in the WC-0 versus WC-1 subgroup analysis. Moreover, the application of PS-VUA did not significantly increase OT or VUAT, even in obese patients. These findings are clinically relevant, as high BMI has been associated with more severe and prolonged urinary incontinence after robot-assisted radical prostatectomy [18], and obesity has consistently been linked to worse long-term continence outcomes in meta-analyses [19,20], as well as adverse oncological outcomes [16]. Recent anatomical studies emphasize the pivotal role of the external urethral sphincter (EUS) and its supporting structures in continence preservation following radical prostatectomy [3,10]. Our data reinforce the emerging consensus that BMI is a relatively imprecise surrogate for functional risk compared with markers reflecting fat distribution. Increased abdominal and subcutaneous fat thickness has been associated with reduced bladder voiding efficiency and higher urinary leakage rates [9,21]. Abdominal obesity increases intra-abdominal pressure and pelvic floor strain, thereby amplifying downward traction on the VUA; in such cases, clinical outcomes tend to be less favourable [9]. In this unfavorable biomechanical environment, PS-VUA appears to act as a selective reconstructive adjunct that counterbalances these forces and facilitates earlier functional recovery. Several limitations of this study should be acknowledged. First, the single-surgeon design and relatively limited sample size may restrict generalizability. Second, UC was not assessed using standardized outcome measures, although objective parameters were applied. Third, a longer follow-up is required to assess late functional outcomes and potential deterioration.

Additionally, continence outcomes may have been influenced by prostate volume and patient age within this cohort, factors that can impact functional recovery [4]. Nevertheless, the prospective design, balanced baseline characteristics, and predefined subgroup analysis strengthen the validity of the present findings. Further studies are warranted to identify the true UC benefits in selected patient populations.

Conclusions

PS-VUA facilitates early UC recovery following ERP, with the greatest benefit observed in patients with a WC-1. Further prospective studies are needed to optimize patient selection and standardize reconstructive strategies to improve functional outcomes.

The authors declare no conflict of interest.

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Стаття надійшла до редакції 11.11.2025 р., прийнята до друку 16.03.2026 р.