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Preservation of endopelvic fascia, puboprostatic ligaments, dorsal venous complex and hydrodissection of the neurovascular bundles during robot-assisted radical prostatectomy: a video demonstration and propensity score matched outcomes

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ABSTRACT

Introduction: : We sought to report the oncologic and functional outcomes of endopelvic fascia (EPF), puboprostatic ligaments (PPL), and dorsal venous complex (DVC) preservation with hydrodissection of the neurovascular bundles (NVB) during robot-assisted radical prostatectomy (RARP).

Materials and Methods: A retrospective review of our prospectively maintained prostate cancer database was performed. Patients who underwent bilateral or unilateral nerve sparing were identified. Propensity score matching was performed in a ratio of 1:1.6 between new technique (Group 1) and a historical group (Group 2). Data were reviewed for perioperative, oncologic, and functional outcomes. Cumulative incidence curves were used to depict perfect continence (0 pads), social continence (0-1 pads), and potency (SHIM≥17 with or without erectile aids). Multivariate models were used to elicit variables associated with continence and potency.

Results: : 76 patients in Group 1 and 126 patients in Group 2 were included. Median follow up was 17 months. Group 1 showed higher perfect continence rates at 1 month (9% vs 3%), 3 months (24% vs 19%), and 6 months (54% vs 34%) compared to Group 2 respectively (log rank $p<0.01$). Group 1 also showed higher social continence rates at 1 month (15% vs 3%), 3 months (77% vs 32%), and 6 months (87% vs 53%) compared to Group 2 respectively (log rank $p<0.01$). Group 1 had a similar potency rate compared to Group 2 (log rank $p=0.25$). Multivariate analysis showed that Group 1 was associated with improved perfect (Possibility ratio (PR) 1.82, 95% CI 1.29–2.58, $p<0.01$) and social continence (PR 2.54, 95% CI 1.83 – 3.52, $p<0.01$), but not potency.

Conclusions: : EPF, PPL, and DVC preservation with hydrodissection of the NVB offered similar oncological outcomes, but earlier and improved urinary continence rates compared to standard dissection.

Introduction

Prostate cancer (PCa) is the most common cancer in men with an estimated incidence of 191,930 new cases and 33,330 deaths in 2020 [1]. The use of robot-assisted surgery in the treatment of PCa has significantly expanded owing to improved ergonomics, dexterity, and 3-dimensional vision. In 2009, 70% of radical prostatectomies (RP) in the US were done with robot-assistance [2 3]. Safety and efficacy of

Abbreviations: Endopelvic fascia, EPF; Puboprostatic ligaments, PPL; Dorsal Venous complex, DVC; Robot-assisted radical prostatectomy, RARP; Prostate cancer, PCa; Radical prostatectomy, RP; Neurovascular bundle, NVB; Nerve Sparing, NS; Sexual Health Inventory For Men , SHIM; Biochemical Recurrence Free Survival , BRFS; Possibility Ratio, PR; Retzius Sparing , RS.

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robot-assisted radical prostatectomy (RARP) has been confirmed in multiple studies [4–6]. Like open RP, urinary incontinence and erectile dysfunction are well established complications, both often lead to significant ramifications on patients' quality of life.

As a surgeon's experience increases, cancer control after RP improves, presumably because of improved surgical technique. Recurrence rates have dramatically dropped from 17.9% to 10.7% with improved surgical experience [7]. Urinary incontinence after RARP is influenced by many factors such as baseline urinary function, adequate bladder capacity, bladder compliance, and the absence of urethral pathology. Surgical factors include surgeon's experience and surgical technique [8]. Preservation of the neurovascular bundle (NVB) has been associated with improved rates of potency and suggested improvement to urinary continence [9]. Avoiding thermal or stretch injury to the NVB is key. Several series have described collateral damage to the NVB from heat associated with monopolar or bipolar usage as major culprits in non-expected postoperative urinary incontinence. Various techniques have been described to reduce these complications, including nerve sparing (NS), Veil of Aphrodite (Vattikuti Institute Prostatectomy [VIP]), modified prostate fascia-preserving (veil) nerve sparing or Super Veil, Retzius sparing, NeuroSAFE, and extended prostatic urethra preservation [10–14].

In 2008, the hydrodissection technique as an athermal technique to facilitate NVB dissection and preservation during RARP was described [15]. We sought to review our experience with hydrodissection of the NVB in addition to endopelvic fascia (EPF), puboprostatic ligaments (PPL), dorsal venous complex (DVC) preservation presenting a thorough assessment of the oncologic and functional outcomes.

Methodology and materials

A retrospective review of our prospectively maintained database was performed (IRB approval-198211). All patients included were preoperatively continent and potent (Sexual Health Inventory for Men (SHIM) $\geq$ 17). Patients who were impotent, those who had non-NS RARP, as well as those with incomplete functional follow up were excluded from the study.

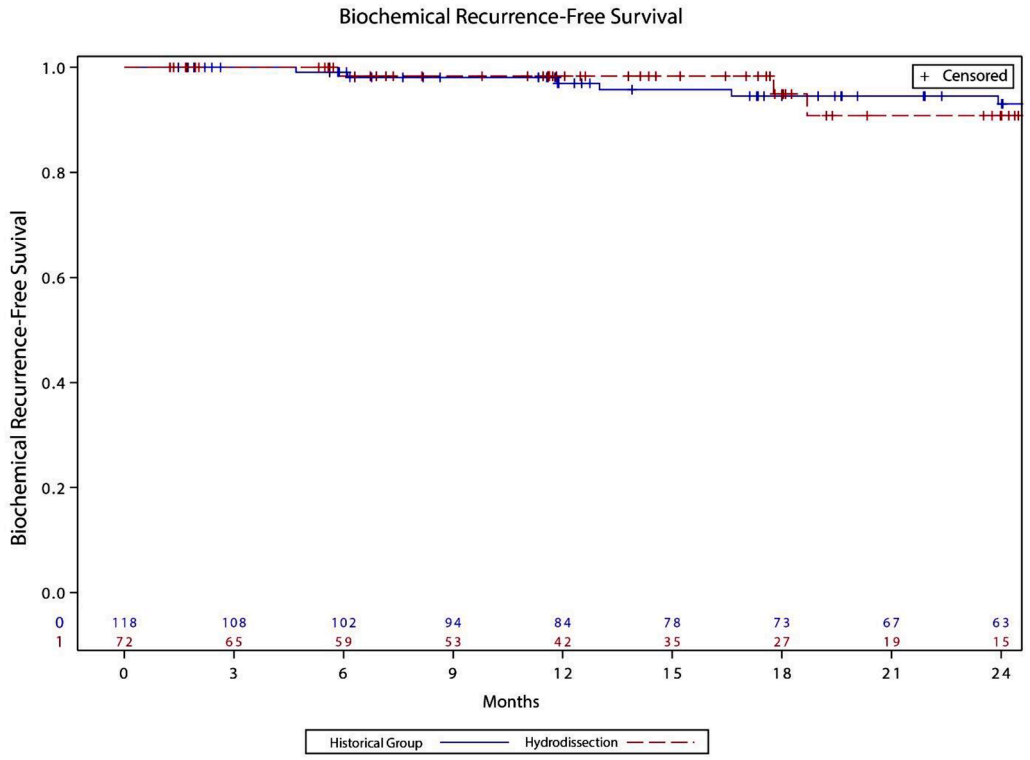
We incorporated the EPF, PPL, and DVC preservation with hydrodissection of the NVB starting from October 2017, while the standard dissection occurs without EPF, PPL, DVC preservation, and without hydrodissection of the NVB. Patients were divided into 2 groups: the EPF, PPL, and DVC preservation with hydrodissection of the NVB (Group 1) and those who underwent NS-RARP with standard dissection of NVB and without EPF, PPL, DVC preservation and without hydrodissection of the NVB (Group 2) in a ratio of 1:1.6. Both groups were matched using propensity score in terms of age, race, body mass index (BMI), Charlson comorbidity index (CCI), American Society of Anesthesiology scores (ASA), prior abdominal/pelvic surgery, prostate volume, preoperative SHIM score, NS status and laterality, and National Comprehensive Cancer Network (NCCN) risk group. All surgeries were performed by a single surgeon (K.G).

We have illustrated our step-by-step technique by a video demonstration **(Supplementary Video).** In brief, the EPF is completely spared from dissection. The superficial dorsal venous complex (DVC) and puboprostatic ligaments are encountered and preserved during defattening of the prostate. For preservation of NVB, we used a Cook® Williams cystoscopic injection needle (Bloomington, Indiana, USA) to inject 10 ml of saline into the plane between the prostatic pedicle and the NVB. The NVB was bluntly dissected at the prostate base, and the vascular pedicle was controlled with Hemolock® clips near the prostate base. Apical dissection was started after increasing the pneumoperitoneum pressure to 20 mmHg. The PPL were released and the DVC was cut using cold scissors. The DVC complex was controlled using a running 3/0 Vicryl suture [15]. Bladder neck reconstruction was not performed in any of the cases. Catheter was removed 7-10 days postoperatively. All patients were instructed to perform pelvic floor muscle training postoperatively. PDE5Is were recommended as needed prior to sexual activity.

Table 1
Patient demographics, clinical and intraoperative information.

	Non EPF preservation	EPF Preservation	All	P Value
Matched variables				
Number of Patients, # (%)	126 (62)	76 (38)	202	
Age, yrs mean ± SD	61 ± 7	61 ± 7	61 ± 7	0.68
BMI kg/m^2 mean ± SD	30 ± 5	30 ± 9	30 ± 7	0.99
ASA ≥3, # (%)	19 (15)	9 (12)	28 (14)	0.68
African American race, # (%)	7 (6)	6 (8)	13 (6)	0.47
Caucasian race, # (%)	117 (93)	67 (88)	184 (91)	0.47
Another race, # (%)	2 (2)	3 (4)	5 (2)	0.47
Prostate volume gm, mean ± SD	36 ± 18	39 ± 19	37 ± 18	0.13
CCI, mean ± SD	4 ± 1	4 ± 1	4 ± 1	0.89
NCCN high risk, # (%)	28 (22)	18 (24)	46 (23)	0.86
Prior abdominal surgery, # (%)	44 (35)	28 (37)	72 (36)	0.76
Bilateral nerve sparing, # (%)	77 (61)	44 (58)	121 (60)	0.66
Preoperative SHIM, median (IQR)	23 (20,25)	23 (19.5,24.25)	23 (20,25)	0.944
Perioperative Variables				
Operative time minutes, median (IQR)	179 (150-201)	133 (117-151)	160 (130-188)	< **0.01**
EBL ml, median (IQR)	100 (75-200)	100 (75-200)	100 (75-200)	0.93
Any complications, # (%)	26 (21)	16 (21)	42 (21)	1
High grade complications, # (%)	5 (4)	1 (1)	6 (3)	0.41
Pathological Outcomes				
Biochemical recurrence, # (%)	8 (7)	3 (4)	11 (6)	0.54
≥pT3	61 (48)	38 (50)	99 (49)	0.89
Positive margins, # (%)	28 (22)	16 (21)	44 (22)	1.00
pN+Ve, # (%)	4 (4)	1 (2)	5 (3)	0.66
Adjuvant radiation, # (%)	17 (13)	5 (7)	22 (11)	0.16
Functional Outcomes				
Zero Pads, # (%)	80 (65)	59 (80)	139 (71)	**0.04**
One security Pad, # (%)	101 (82)	70 (95)	171 (87)	**0.02**
Postoperative SHIM, median (IQR)	9 (5,13)	10 (6,16)	9 (6,15)	0.37
Postoperative SHIM ≥17, # (%)	39 (40)	32 (47)	71 (43)	0.43

We utilized the matched cohorts for all statistical analysis. Patient characteristics were reported using descriptive statistics. Patients were compared in terms of demographics, perioperative, oncologic, and functional outcomes. The NCCN definition of biochemical recurrence were used as a proxy for oncologic outcome. Continence and potency were assessed at catheter removal (7-10 days postoperatively), 6 weeks, and every six months postoperatively. The patient was also asked to report the exact timing of recovery of continence and potency in between these time periods. Urinary continence was assessed using the University of California at Los Anglos- Prostate cancer index-short form (UCLA – PCI SF-12 v2) Urinary Function questionnaire. Continence was stratified into patients who did not require the use of pads at all (perfect continence) and patients using one pad daily for assurance (social continence). Potency recovery was evaluated using the SHIM questionnaires. Potency was defined as a SHIM score of 17 or more with or without the use of phosphodiesterase inhibitors (PDE5Is). Median time



		1	6	12	24
Non-Endopelvic Fascia Sparing	Survival Rate, (%)	100	99	97	93
	Failed	0	0	1	1
	Sample Size	118	107	94	64
Endopelvic Fascia Sparing	Survival Rate, (%)	100	98	98	91
	Failed	0	1	0	0
	Sample Size	72	65	52	19

Fig. 1. Kaplan - Meier Curve Depicting Biochemical recurrence free survival (p=0.98).

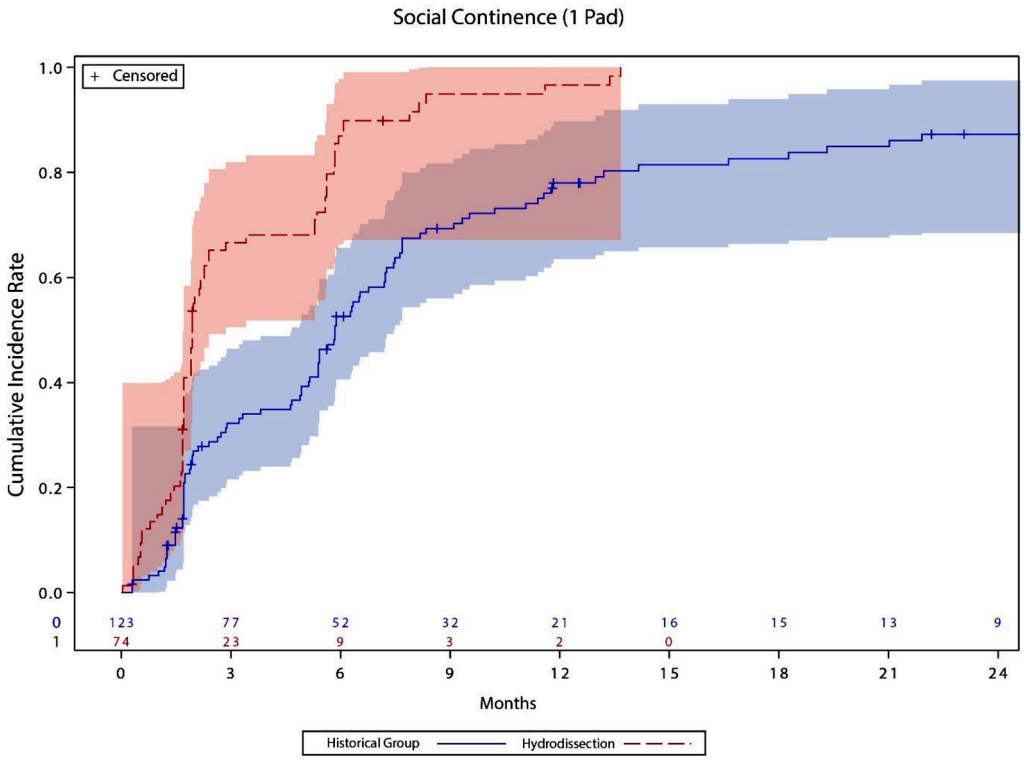
to urinary continence was reported. Kaplan-Meier curve was used to depict biochemical recurrence free survival (BRFS). Cumulative incidence curves were used to depict urinary continence (perfect and social) and potency. Multivariate Cox regression models were used to determine variables significantly associated with perfect continence, social continence, and potency. All tests were 2-sided and statistical significance was considered as $p \leq 0.05$. All statistical analyses were performed using SAS® (version 9.4, SAS Institute Inc., Cary, NC).

Results

Two hundred and two patients were identified (76 in Group 1 and 126 in Group 2), with a median follow up of 17 months (interquartile range 6-26 months). Overall mean age was 61 ± 7 years, mean CCI was 4 ± 1 and 14% of the patients had an ASA score (≥3). In terms of NCCN risk stratification, 46 (23%) were in the high-risk group. Mean prostate volume was 37 ± 18 gm and mean PSA was 8 ± 6 ng/dl. All patients were continent and potent preoperatively with a median pre-operative SHIM score of 23 for both groups. Only 60% of the study cohort underwent bilateral NS and the rest underwent unilateral NS. Both groups were matched in terms of baseline patient and disease characteristics and in terms of NS status **(Table 1).**

Both groups had a similar median estimated blood loss (p=0.93), and none of the patients required blood transfusion. Twenty-one percent of the patients developed complications, 3% developed high-grade complications with no statistical difference between both groups. On final pathology, both groups had similar ≥pT3 (p=0.89), node positive disease (pN+) (p=0.66) and positive soft tissue surgical margins (PSTSM) (p=1.00) **(Table 1).** Both groups showed similar BRFS at 12 months (98% vs 97%) and 24 months (91% vs 93%) for Group 1 vs Group 2, respectively (log rank p=0.98) **(Fig. 1).**

Group 1 showed higher perfect continence rates at 4 weeks (9% vs 3%), 3 months (24% vs 19%), and 6 months (54% vs 34%) compared to Group 2 respectively. Group 1 also showed higher social continence rates at 4 weeks (15% vs 3%), 3 months (77% vs 32%), and 6 months (87% vs 53%) compared to Group 2 respectively. The perfect and social continence rates were significantly higher for Group 1 compared to Group 2 (log rank p<0.01 for both comparisons) **(Fig. 2).** Median time to perfect continence was 5.8 vs 6.4 months (p=0.03) for Group 1 vs Group 2, respectively. Median time to social continence was 1.9 vs 5.4 months (p<0.01) for Group 1 vs Group 2, respectively. Group 1 showed higher potency rates at 1 month (2% vs %), 3 months (30% vs 24%), 6 months (35% vs 29%), and 12 months (42% vs 32%) compared to Group 2, respectively. The potency rates did not reach statistical significance



Level		1	3	6	9	12
Non-Endopelvic Fascia Sparing	Event Rate, (%)	3	32	53	69	78
	Failed	4	6	15	2	5
	Sample Size	123	84	69	35	28
Endopelvic Fascia Sparing	Event Rate, (%)	15	67	87	95	97
	Failed	11	8	13	2	1
	Sample Size	74	31	22	5	3

Fig. 2. (a) Cumulative Incidence rate to 0-1 Pad ($p<0.01$).
(b) Cumulative Incidence Rate to 0 Pad ($p<0.01$).

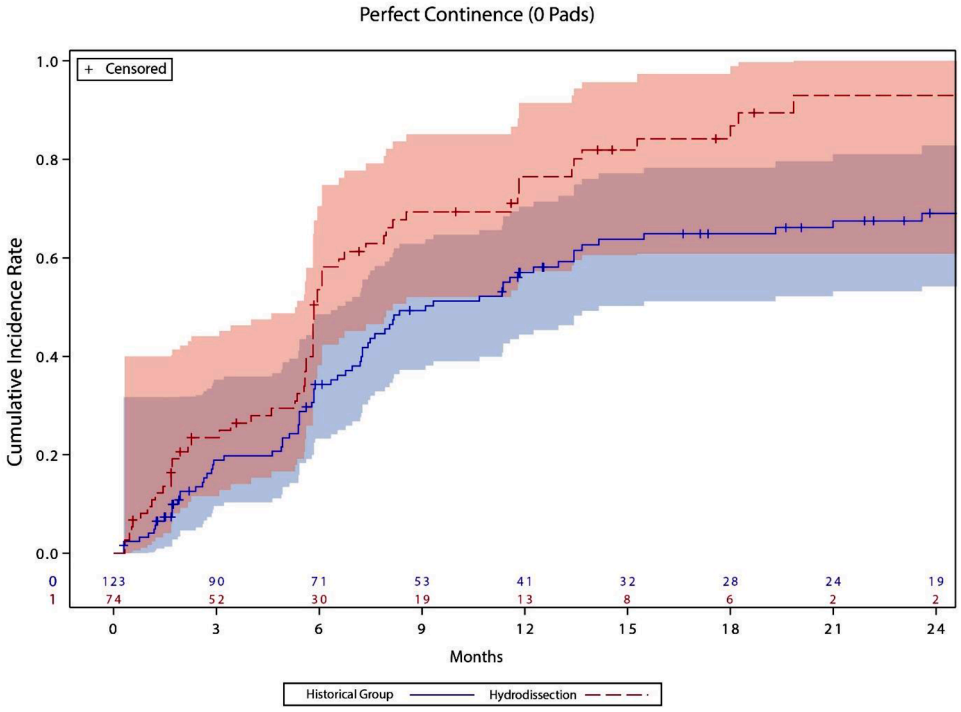
(log rank p=0.25) (**Fig. 3**).

On multivariate analysis, age was significantly associated with social continence (Possibility ratio (PR) 0.98, 95% CI 0.95-0.99, p=0.03). High ASA (≥3) was negatively associated with perfect continence (PR 0.52, 95% CI 0.30 – 0.90, p<0.01). EPF, PPL, and DVC preservation and hydrodissection of the NVB was significantly associated with perfect (PR 1.82, 95% CI 1.29 – 2.58, p<0.01) and social continence (PR 2.54, 95% CI 1.83 – 3.52, p<0.01). Preoperative SHIM score was the only predictor for postoperative potency (PR 1.16, 95% CI, 1.03 – 1.30, p=0.01) (**Table 2**).

Discussion

Functional outcomes are critical for maintaining quality of life of patients after RARP. The objective of RARP has thus expanded to maximize functional outcomes through technical modifications and methodological innovations. In 1982, Walsh et al. first postulated the relation between retention of NVB in the prostatic pedicles and enhanced continence and erectile function post-operatively [16].

Thus, technical modifications are continuously proposed to improve rates and earlier return of continence and potency after RARP. However, the oncologic safety remains the primary outcome after RARP and should not be compromised. Also, there is no consensus within the literature on the best NS technique. The present study reports our experience with EPF, PPL, and DVC preservation and hydrodissection of the NVB on postoperative continence and potency. In comparison the VIP spares the nerve fibers between the 1-o'clock and the 5-o'clock positions, and between the 6-o'clock and the 11-o'clock positions, but not between the 11-o'clock position and 1-o'clock position, where the prostatic fascia is adherent to the capsule. In the Super Veil, dissection is extended anteriorly, preserving the tissue between 11 and 1-o'clock, the pubovesical ligaments, and the dorsal venous plexus. Few differences exist between our technique and both techniques mentioned above. The VIP utilizes a suture to control the DVC before cutting it. The EPF is not always preserved in the VIP and Super Veil. Lastly, both the VIP and Super Veil do not utilize hydrodissection of the NVB. We believe that hydrodissection helps in the delineation and dissection of the planes and avoids the need for thermal dissection [13 14 17 18]. Our study has



		1	3	6	9	12	18	24
Non-Endopelvic Fascia Sparing	Event Rate, (%)	3	19	34	49	57	65	69
	Failed	4	7	12	4	5	0	1
	Sample Size	123	98	85	58	50	30	22
Endopelvic Fascia Sparing	Event Rate, (%)	9	24	54	69	76	84	93
	Failed	7	2	16	2	4	0	0
	Sample Size	74	55	47	21	18	7	2

Fig. 2. (*continued*).

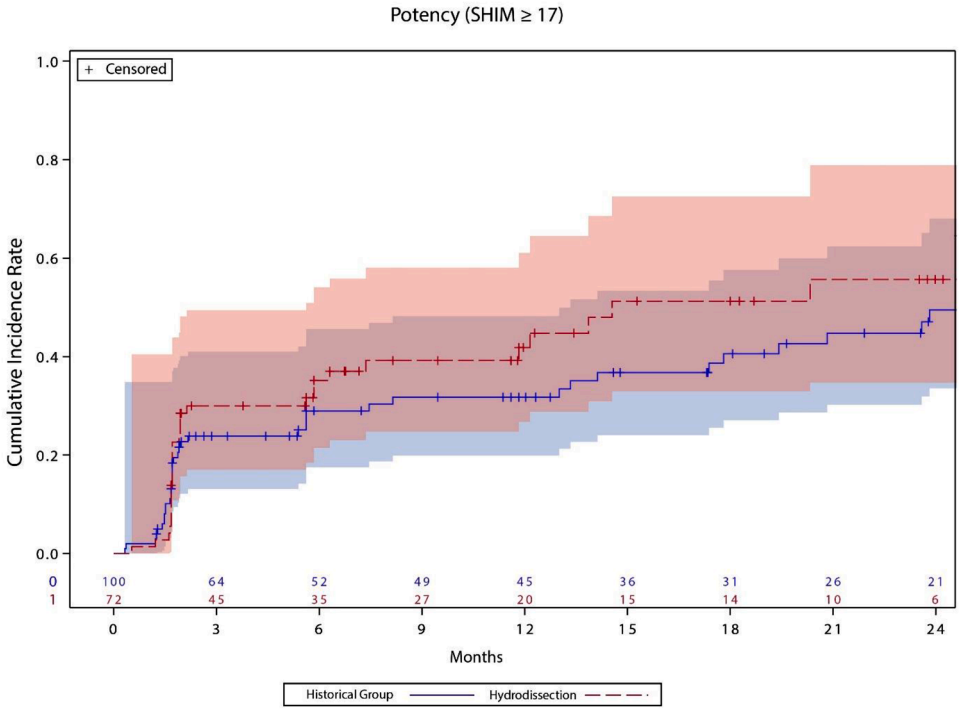
showed that EPF, PPL and DVC preservation and hydrodissection of the NVB was associated with improved rates and time to continence without compromising oncologic outcomes.

Hydrodissection is an athermal NS technique. Similar techniques are used in neurosurgery and in ophthalmic, plastic, and general surgeries to minimize tissue damage, limit manipulation of the tissue, and enhance visualization of correct tissue planes. This technique was first described by Guru et al. on ten patients undergoing NS RARP without reporting oncologic or functional outcomes [15]. Later, Patel et al. found that hydrodissection of the NVB during open RP improves postoperative erectile function and time to intercourse compared with standard dissection [19]. The technique was reproduced during RARP and has shown significantly improved erectile function at 6 months and 1 year after surgery [20]. None of the above studies has assessed oncologic and continence outcomes. Our study has shown improved time to continence and rates of continence but failed to demonstrate improved potency rates. This may be explained as 40% of our patient cohort had only unilateral NS. Also, the short-term follow-up of our study cohort compared to historical cohort.

Bladder neck preservation (BNP) has been proposed to accelerate continence recovery, although this remains controversial [21 22]. In addition, a large bladder neck reconstruction is time-consuming and may be more susceptible to anastomotic leak. Freire et al. has compared BNP versus standard technique during RARP. BNP was associated with quicker recovery of urinary function and similar cancer control [23]. Our cut down technique of bladder neck dissection was similar between both groups and was effective where none of our patients required bladder neck reconstruction.

Retrospective studies investigating EPF preservation showed improved continence rates following RARP [24–26]. However, a recent randomized controlled trial investigated EPF preservation showed no benefit on continence and sexual outcomes [27]. Our study cohort has showed statistically significant improvement in continence outcomes and improved sexual function but was not statistically significant. These improvements may be multifactorial in our study as several changes were implemented simultaneously. Additionally, other key factors such as less disturbance of the anatomy, judicious use of cautery may have also contributed.

Full functional-length urethral sphincter preservation was reported in 2012 and has shown a statistically significant higher rate of continence at 1 week after catheter removal compared to non-urethral sparing technique (50% vs 31%, $p<0.01$). Extended preservation of the prostatic urethra (EPUP) has been performed by Bragayrac et al. on 48 consecutive patients aiming to improve time to continence. They compared EPUP vs non-EPUP cohorts. Their immediate continence (within two days of catheter removal) (0-1 pad) rate was 35% vs 0% for patients with no EPUP. Continence rates were 67% vs 40% and 83% vs 71% at 7 weeks and 6 months for EPUP vs no EPUP, respectively.



		1	3	6	9	12	18	24
Non-Endopelvic Fascia Sparing	Event Rate, (%)	2	24	29	32	32	41	49
	Failed	2	1	4	1	0	2	2
	Sample Size	100	69	62	50	48	36	25
Endopelvic Fascia Sparing	Event Rate, (%)	1	30	35	39	42	51	56
	Failed	1	1	3	0	1	0	0
	Sample Size	72	47	44	28	26	14	10

Fig. 3. Cumulative Incidence Time to Potency (SHIM≥17) (p=0.25)

Table 2
Multivariate Cox model to elicit predictors of continence and potency.

Variable	Possibility Ratio	Lower CI	Upper CI	P-value
		Social Contienence (0-1 pad)		
Age	0.98	0.95	1.00	0.03
EPF, PPL and DVC preservation with hydrodissection of the NVB	2.54	1.83	3.52	<0.01
		Perfect Conteience (0 pad)		
ASA ≥3	0.51	0.30	0.90	0.02
EPF, PPL, and DVC preservation with hydrodissection of the NVB	1.82	1.29	2.58	<0.01
		Potency (SHIM≥17)		
Preoperative SHIM	1.16	1.03	1.30	0.01

EPF: Endopelvic fascia, PPL: Puboprostatic ligamnet, DVC: Dorsal venous complex, NVB: Neurovascular bundle, SHIM: Sexual health inventory for men.

Continence rates at 6 months did not significantly differ between both groups. Our social continence rates were 87% at 6 months which is higher than EPUP cohort at 6 months. 4% of the EPUP cohort developed an anastomotic leak and 4% required blood transfusion compared to non-in our study. Limited by short term follow up for both studies, positive margins rates and BRFS were similar [10].

Another study described retrograde release of the NVB with preservation of the DVC during RARP on 128 patients by a single surgeon. Eighty six percent were continent immediately after the catheter removal and 98% after one year. Fifty three percent of the patients were potent one month after the procedure and 86% at 1 year. All patients underwent penile rehabilitation with regular use of PDE5Is starting 7 days after surgery, until recovery of sexual function. This study showed that anatomical preservation is associated with improved functional outcomes. Our technique allows for more anatomical preservation by preserving the PPL and EPF. The reported potency and continence rates are higher than our study which may be explained by only 60% of our patients had bilateral NS procedure and penile rehabilitation was not done routinely for our patients [28].

Retzius sparing (RS) RARP has been introduced to improve the time to continence. A propensity score matched study between RS-RARP and conventional RARP has shown a higher continence rate at 1-month (45% vs 9%) and 6-month (98% vs 77%) for RS-RARP. Also, RS-RARP had a significantly shorter operative time (149 mins vs 194 mins) [29]. RS-RARP seems to provide earlier continence rates but the differences diminish at 6 months and longer follow up [30]. The posterior approach was not found to have any advantage regarding time to potency and potency rates [30]. Despite these advantages, adoption of RS technique

remains limited. The main advantage of RS is preservation of key anatomical structures, such as PBL, which may improve recovery of continence. Similar to RS, our technique spares key anatomical structures, and is likely easier to adopt.

Rocco stitch was introduced in 2007 and has shown improved time and continence rates [31]. An update from Patel et al. utilized the Rocco stitch and prospectively analyzed 331 patients who underwent RARP, 94 without the placement of a suspension stitch (group 1) and 237 with the application of the suspension (puboperiurethral) stitch (group 2). In group 1, the continence rate at 1, 3, 6, and 12 months postoperatively was 33%, 83%, 94.7%, and 95.7%, respectively; in group 2, the continence rate was 40%, 92.8%, 97.9%, and 97.9%, respectively. The suspension technique resulted in significantly greater continence rates at 3 months after RARP (p=0.01). The median interval to recovery of continence was also significantly shorter in the suspension group (median: 6 weeks) versus the non-suspension group (median: 7 weeks, p = 0.02) [32]. The suspension stitch seems to improve time to and continence rates by restoring pelvic floor anatomy.

The current study has several limitations, including the retrospective study design, relatively small sample size and short follow up. The grade of nerve preservation (intrafascial, interfascial and extrafascial) was not captured by our database. Also, several modifications were implemented at once which limits the conclusion about each step.

Conclusion

Endopelvic fascia, puboprostatic ligaments, and dorsal venous complex preservation with hydrodissection of the neurovascular bundle is a technically feasible approach, with similar short term oncological outcomes, earlier time to continence and improved continence rates after robot-assisted radical prostatectomy.

The video related to this article can be found online at: doi:10.1016/j.urolvj.2022.100143.

CRediT authorship contribution statement

Ahmed S. Elsayed: Writing – original draft, Data curation. **Hannah B. Ely:** Writing – review & editing. **Mahmoud A. Abdelhakim:** Writing – review & editing. **Ismail R. Saad:** Writing – review & editing. **Zhe Jing:** Writing – review & editing. **Umar Iqbal:** Writing – review & editing. **Yousuf Ramahi:** Data curation. **Julian Joseph:** Data curation. **Holly Houenstein:** Data curation. **Gaybrielle James:** Data curation. **James O. Peabody:** Writing – review & editing. **Omar Abdel Razzak:** Writing – review & editing. **Ahmed A. Hussein:** Conceptualization, Writing – review & editing. **Khurshid A. Guru:** Conceptualization, Validation, Resources, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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References

[1] RL Siegel, KD Miller, A. Jemal, Cancer statistics, 2020, CA: a cancer journal for clinicians 70 (1) (2020) 7–30, doi: 10.3322/caac.21590[published Online First: Epub Date]|.
[2] M Menon, A Shrivastava, A Tewari, et al., Laparoscopic and robot assisted radical prostatectomy: establishment of a structured program and preliminary analysis of outcomes, The Journal of urology 168 (3) (2002) 945–949.
[3] P Dasgupta, RS. Kirby, The current status of robot-assisted radical prostatectomy, Asian journal of andrology 11 (1) (2009) 90.
[4] H-J Seo, NR Lee, SK Son, DK Kim, KH Rha, SH. Lee, Comparison of robot-assisted radical prostatectomy and open radical prostatectomy outcomes: a systematic review and meta-analysis, Yonsei medical journal 57 (5) (2016) 1165–1177.
[5] SH Lee, HJ Seo, NR Lee, SK Son, DK Kim, KH. Rha, Robot-assisted radical prostatectomy has lower biochemical recurrence than laparoscopic radical prostatectomy: Systematic review and meta-analysis, Investig Clin Urol 58 (3) (2017) 152–163, https://doi.org/10.4111/icu.2017.58.3.152 [published Online First: Epub Date]|.
[6] PS Moran, M O'Neill, C Teljeur, et al., Robot-assisted radical prostatectomy compared with open and laparoscopic approaches: a systematic review and meta-analysis, Int J Urol 20 (3) (2013) 312–321, https://doi.org/10.1111/iju.12070 [published Online First: Epub Date]|.
[7] AJ Vickers, FJ Bianco, AM Serio, et al., The Surgical Learning Curve for Prostate Cancer Control After Radical Prostatectomy, JNCI: Journal of the National Cancer Institute 99 (15) (2007) 1171–1177, https://doi.org/10.1093/jnci/djm060 [published Online First: Epub Date]|.
[8] H Lavigueur-Blouin, AC Noriega, R Valdivieso, et al., Predictors of early continence following robot-assisted radical prostatectomy, Can Urol Assoc J 9 (1-2) (2015) e93–e97, https://doi.org/10.5489/cuaj.2086 [published Online First: Epub Date]|.
[9] CG Rogers, L-M Su, RE Link, W Sullivan, A Wagner, CP. Pavlovich, Age stratified functional outcomes after laparoscopic radical prostatectomy, The Journal of urology 176 (6) (2006) 2448–2452.
[10] LAN Bragayrac, AA Hussein, K Attwood, et al., Feasibility and continence outcomes of extended prostatic urethral preservation during robot-assisted radical prostatectomy, Prostate cancer and prostatic diseases (2019) 1–9.
[11] C Phukan, A Mclean, A Nambiar, et al., Retzius sparing robotic assisted radical prostatectomy vs. conventional robotic assisted radical prostatectomy: a systematic review and meta-analysis, World journal of urology (2019) 1–12.
[12] T Schlomm, P Tennstedt, C Huxhold, et al., Neurovascular structure-adjacent frozen-section examination (NeuroSAFE) increases nerve-sparing frequency and reduces positive surgical margins in open and robot-assisted laparoscopic radical prostatectomy: experience after 11 069 consecutive patients, European urology 62 (2) (2012) 333–340.
[13] M Menon, A Shrivastava, S Kaul, et al., Vattikuti Institute prostatectomy: contemporary technique and analysis of results, Eur Urol 51 (3) (2007) 648–657, https://doi.org/10.1016/j.eururo.2006.10.055, discussion 57-8[published Online First: Epub Date]|.
[14] M Menon, A Shrivastava, M Bhandari, R Satyanarayana, S Siva, PK. Agarwal, Vattikuti Institute prostatectomy: technical modifications in 2009, Eur Urol 56 (1) (2009) 89–96, https://doi.org/10.1016/j.eururo.2009.04.032 [published Online First: Epub Date]|.
[15] KA Guru, AE Perlmutter, ZM Butt, JO. Peabody, Hydrodissection for preservation of neurovascular bundle during robot-assisted radical prostatectomy, Canadian journal of urology 15 (2) (2008) 4000.
[16] PC Walsh, PJ. Donker, Impotence following radical prostatectomy: insight into etiology and prevention, The Journal of urology 197 (2S) (2017) S165–SS70.
[17] S KAUL, A SAVERA, K BADANI, M FUMO, A BHANDARI, M MENON, Functional outcomes and oncological efficacy of Vattikuti Institute prostatectomy with Veil of Aphrodite nerve-sparing: an analysis of 154 consecutive patients, BJU International 97 (3) (2006) 467–472, https://doi.org/10.1111/j.1464-410X.2006.05990.x [published Online First: Epub Date]|.
[18] M Menon, A Shrivastava, S Kaul, A Bhandari, R Sarle, AK. Hemal, V342: A Quest for Better Nerve Preservation in Vattikuti Institute Prostatectomy (VIP): The Veil of Aphrodite, Journal of Urology 173 (4S) (2005) 93–94, https://doi.org/10.1016/S0022-5347(18)35852-X, doi: doi:[published Online First: Epub Date]|.
[19] MI Patel, D Spernat, E. Lopez-Corona, Hydrodissection of neurovascular bundles during open radical prostatectomy improves postoperative potency, The Journal of urology 186 (1) (2011) 233–237.
[20] H Wenger, A Razmaria, S Eggener, JD. Raman, Nerve Bundle Hydrodissection and Sexual Function after Robot Prostatectomy, JSLS: Journal of the Society of Laparoendoscopic Surgeons 21 (2017) 4.
[21] X Ma, K Tang, C Yang, et al., Bladder neck preservation improves time to continence after radical prostatectomy: a systematic review and meta-analysis, Oncotarget 7 (41) (2016) 67463–67475, https://doi.org/10.18632/oncotarget.11997 [published Online First: Epub Date]|.
[22] EA. Klein, Early continence after radical prostatectomy, The Journal of urology 148 (1) (1992) 92–95.
[23] MP Freire, AC Weinberg, Y Lei, et al., Anatomic bladder neck preservation during robotic-assisted laparoscopic radical prostatectomy: description of technique and outcomes, European urology 56 (6) (2009) 972–980.
[24] HG van der Poel, W de Blok, N Joshi, E. van Muilekom, Preservation of lateral prostatic fascia is associated with urine continence after robotic-assisted prostatectomy, Eur Urol 55 (4) (2009) 892–900, https://doi.org/10.1016/j.eururo.2009.01.021 [published Online First: Epub Date]|.
[25] SY Kwon, JN Lee, HT Kim, et al., Endopelvic fascia preservation during robot-assisted laparoscopic radical prostatectomy: does it affect urinary incontinence? Scand J Urol 48 (6) (2014) 506–512, https://doi.org/10.3109/21681805.2014.913259 [published Online First: Epub Date]|.
[26] Tasci AI, Simsek A, Torer BD, Sokmen D, Sahin S, Tugcu V. Fascia-sparing intrafascial nerve-sparing robot-assisted radical prostatectomy and anatomic vesicourethral anastomosis: point of technique.
[27] A Siltari, J Riikonen, TJ. Murtola, Preservation of Endopelvic Fascia: Effects on Postoperative Incontinence and Sexual Function - A Randomized Clinical Trial,

J Sex Med 18 (2) (2021) 327–338, https://doi.org/10.1016/j.jsxm.2020.11.003 [published Online First: Epub Date]|.
[28] PA de Carvalho, J Barbosa, GB Guglielmetti, et al., Retrograde Release of the Neurovascular Bundle with Preservation of Dorsal Venous Complex During Robot-assisted Radical Prostatectomy: Optimizing Functional Outcomes, Eur Urol (2018), 10.1016/j.eururo.2018.07.003[published Online First: Epub Date]|.
[29] J Lee, HY Kim, HJ Goh, et al., Retzius Sparing Robot-Assisted Radical Prostatectomy Conveys Early Regain of Continence over Conventional Robot-Assisted Radical Prostatectomy: A Propensity Score Matched Analysis of 1,863 Patients, The Journal of urology 203 (1) (2020) 137–144.
[30] M Menon, D Dalela, M Jamil, et al., Functional recovery, oncologic outcomes and postoperative complications after robot-assisted radical prostatectomy: an evidence-based analysis comparing the Retzius sparing and standard approaches, The Journal of urology 199 (5) (2018) 1210–1217.
[31] B Rocco, A Gregori, S Stener, et al., Posterior reconstruction of the rhabdosphincter allows a rapid recovery of continence after transperitoneal videolaparoscopic radical prostatectomy, european urology 51 (4) (2007) 996–1003.
[32] VR Patel, RF Coelho, KJ Palmer, B Rocco, Periurethral suspension stitch during robot-assisted laparoscopic radical prostatectomy: description of the technique and continence outcomes, European urology 56 (3) (2009) 472–478.