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Nightmares in Urology: Open Science

Technical Tips in Managing Large Median Lobes During Robot-assisted Radical Prostatectomy

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Abstract

Prostate cancer surgeons are commonly faced by a technically challenging situation dealing with prostate cancer having large median lobes. Patients with large median lobes often have larger prostates, which makes it difficult to visualize anatomical planes during robot-assisted radical prostatectomy (RARP). Herein, we described our experience in dealing with large median lobes during RARP. We have focused on technical tips to avoid complications and facilitate a smooth procedure in patients with large median lobes during RARP. A total of 2671 patients who underwent RARP were divided into two groups based on the presence or absence of a protruded median lobe (PML): group A (2411 patients without a PML) and group B (260 patients with a PML). All patients underwent preoperative magnetic resonance imaging and final intraoperative confirmation for the presence of a PML. Pre-, intra-, and postoperative parameters were compared in two groups using the Student *t* test and two-proportion *t* test as appropriate. Patients in group B have statistically significantly higher median prostate-specific antigen (PSA; 7.7 vs 5.8 ng/dl), PSA density (0.17 vs 0.09), and International Prostate Symptom Score (19.5 vs 7.2); longer median console time (114 vs 134 min) and surgery time (145 vs 170 min); and higher blood loss (150 vs 175 ml) than those in group A. There were no statistically significant differences in pathological stages (T2, T3; 87%, 13% vs 88%, 12%) and rates of positive surgical margins (7% vs 8.5%) between groups A and B. Single-center and retrospective design was the major limitation of our study. We conclude that understanding the key steps to facilitate bladder neck dissection is vital to avoid serious intraoperative events and to maximize outcomes.

Patient summary: In this report, we looked at our robotic radical prostatectomy cohort with large median lobes. We found that surgery in these patients requires more time and blood loss, but similar cancer control. We conclude that following the key steps are important to avoid complications.

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1. Introduction and context

Owing to wide application of the prostate-specific antigen (PSA) screening program, more men diagnosed with prostate cancer are found to have a larger prostate size and protruded medial lobe (PML) [1]. There is a general consensus in the literature that robotic-assisted radical prostatectomy (RARP) for patients with a PML poses a true technical challenge [2].

A PML causes various degrees of distortion for bladder neck anatomy [3]. A large median lobe causes ball-valve type of obstruction (Fig. 1). It disrupts the laminar flow at the bladder neck and distorts the funneling effect of the normal prostatic-urethral angle, resulting in dyskinetic movement of the bladder during micturition. It may also obscure the posterior border of the prostate and bladder neck, and impair the identification of ureteral orifices. Bladder neck resection in large median lobes involves a higher risk of ureteral orifice injury being too close to the bladder neck edge [4,5]. Additionally, the inability to maintain a proper plan of posterior dissection can end up in buttonholing the bladder or cutting into the prostate.

Sarle et al. [6] first highlighted the challenges encountered in RARP for PMLs. Since then many studies have shown that a PML has been associated with a longer operative time and hospital stay, and more blood loss [7–9]. Moreover, some studies correlated PMLs with poor recovery of urinary continence and higher positive surgical margins (PSMs) [3,10–13].

Consequently, many experts intuitively recommended RARP for a PML to be performed only by surgeons with high robotic expertise [6,14].

The aim of this report is to present our experience in dealing with PMLs as a robotic center of experience with a high RARP volume. We will focus on our technique to avoid complications and how to deal with the complications if these ever incur.

2. Materials, patients, and methods

2.1. Enrollment

Between October 2013 and February 2022, we retrospectively reviewed the charts of all the patients who underwent RARP performed by a single surgeon (A.T.) in the Department of Urology at Mount Sinai, New York, NY, USA. We excluded 230 patients from the study due to various reasons (patients with prior transurethral resection of prostate [80 patients], without preoperative magnetic resonance imaging [MRI; 46 patients], with neoadjuvant androgen deprivation therapy [64 patients], and with salvage prostatectomy [40 patients]). A total of 2671 patients were ultimately included in the analysis.

The study population was further subdivided into two subgroups according to the presence of a PML: group A (2411 patients without a PML) and group B (260 patients with a PML). A PML was described on preoperative MRI, ultrasound, or prior cystoscopy. However, the final confirmation was based on visual evidence of a PML intraoperatively upon opening the bladder neck. Clear documentation of this finding in the operative note was a prerequisite to include the patient in group B in every case.

2.2. Surgical technique and our approach for PML

A four-arm Da Vinci Xi system was used for all cases and was performed by a single experienced surgeon (A.T.).

2.2.1. Position and port placement

The patient was placed in the steep Trendelenberg position. Six laparoscopic trocars were placed according to the procedure published previously [15,16].

2.2.2. Development of the retropubic space

Using camera lens 0° optic, the peritoneum was incised beginning high at midline and laterally at the level of the vasa on both sides.

2.2.3. Bladder neck transection

The bladder neck was incised and deepened till the Foley catheter was seen. The Foley catheter was grasped by the tip with firm anterior traction.

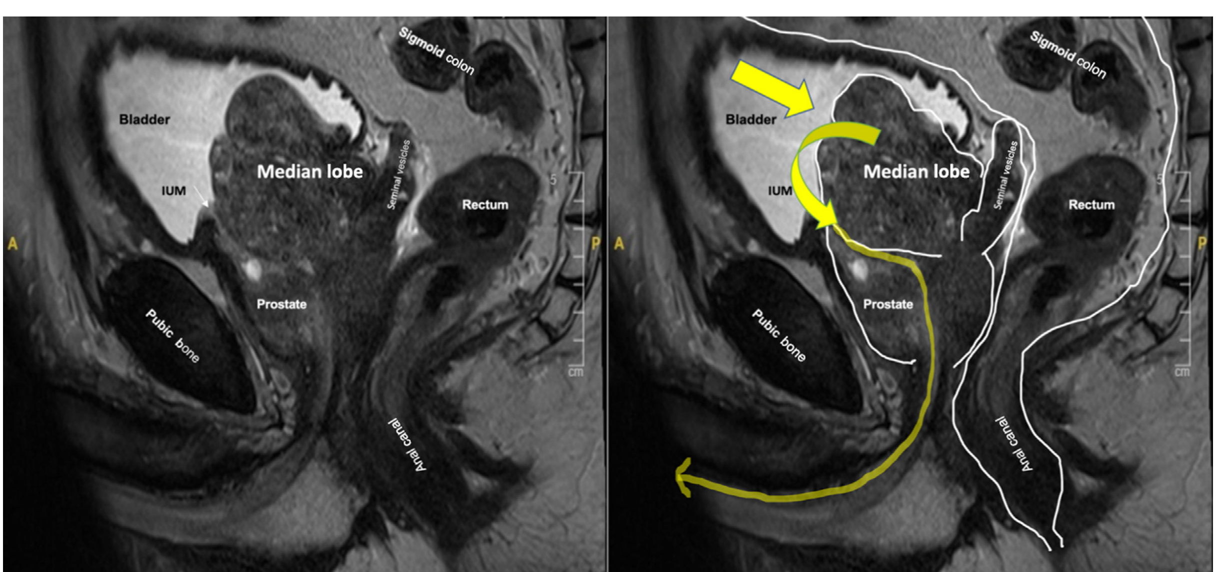

Fig. 1 – Annotated multiparametric magnetic resonance imaging pelvis (sagittal section) demonstrating ball-valve type of obstruction in patients with large median lobes. IUM = internal urethral meatus.

2.2.4. Delivery of median lobe outside the bladder neck

A median lobe was seen and delivered outside using 3-0 Vicryl suture. Delivery of the median lobe helps in visualizing the posterior bladder neck. We used robotic Tenaculum forceps instead of Prograsp forceps in cases of huge median lobes (>2.5 cm in size). For the remaining cases, the Da Vinci instruments used were similar in both groups.

2.2.5. Confirming position of ureteral orifices and posterior bladder neck incision

Once the median lobe was delivered outside, we focused our attention to identifying ureteral orifices. The mucosa at the posterior bladder neck was incised away from ureteric orifices and followed till the "retrotrigonal layer" to expose the vasa and the seminal vesicles.

2.2.6. Vas deferens and seminal vesicle dissection

Exposure of the vas and seminal vesicles is facilitated by holding the posterior edge of the prostate base and pulling it up. The vas deferens and the seminal vesicle dissection was performed according to the procedure published previously [15].

2.2.7. Lateral pedicle control

Using assistance to hold stay sutures on the median lobe and serial traction-countertraction helped in finding a plane between the prostatic capsule and the Denonvilliers' fascia. This plane was followed distally toward the apex and laterally on either side. Then, we come to the lateral attachments where the perforating arteries are entering into the prostatic capsule. These were clipped and cut.

2.2.8. Control of dorsal venous complex

The dorsal venous complex was ligated using 2-0 Vicryl suture in a continuous fashion followed by urethropexy.

2.2.9. Circumferential apical dissection

The prostate is retracted to one side, and anterolateral dissection is performed with the goal of preserving the urethral sphincter. This is repeated on the contralateral side.

2.2.10. Development of hood and urethral transection

As previously described, we then developed a plane between the detrusor apron and the anterior fibromuscular layer of the prostate [15]. This plane was followed till the prostatic apex. Under direct vision, the anterior urethra was cut sharply and the prostate was made free.

2.2.11. Total anatomical reconstruction

The posterior bladder neck reconstruction was performed by developing "mattress" for anastomosis using V-lock suture. Two-layer bladder neck reconstruction was performed. Watertight, tension-free, urethrovesical anastomosis was completed using 3-0 Stratafix suture.

2.3. Outcomes

Prostate size was recorded according to specimen weight within 2 h of removal. The pathological stage, Gleason grade group (GGG), surgical margin status, location of PSMs, perineural/lymphovascular invasion, and pathology upgrading were noted. A PSM was defined as an extension of a tumor to the inked surface of the resected specimen.

Urinary and sexual function outcomes were assessed preoperatively using International Prostate Symptom Score (IPSS) and the International Index of Erectile Function (IIEF), respectively. Complete urinary continence was defined as no pad use over 24 h, and this was checked 6 wk and 3, 6, 9, and 12 mo postoperatively.

2.4. Statistical analysis

Standard statistical software (SPSS v.27.0; IBM Corp., Armonk, NY, USA) was used to analyze and compare the clinical and pathological features of each group, with the Student *t* test used to compare patient age, preoperative PSA level, estimated blood loss, operative duration, and specimen weight. The two-proportion *t* test was used to compare GGG, pathological T stage, and incidence of PSMs for both groups, with differences considered significant at $p < 0.05$.

3. Results

Demographics and baseline clinical characteristics are shown in Table 1. Patients in group B has statistically significantly higher median PSA (7.7 vs 5.8 ng/dl), median PSA density (0.17 vs 0.09), median IPSS (19.5 vs 7.2), and median prostate volume (87.5 vs 35 cc) compared with group A. The median IIEF (58 vs 50) was significantly higher in patients with no PML. There was no statistically significant differ-

Table 1 – Demographics and baseline patient characteristics

Variable	Group A patients with no PML (*N* = 2411)	Group B patients with PML (*N* = 260)	*p* value
Median age (yr)	62.1	67	<0.001[a]
Race			<0.001[a]
AA	270 (11.2)	51 (19.6)	
Caucasian	1924 (79.8)	191 (73.5)	
Others	217 (9)	18 (6.9)	
BMI	26.9	27.1	0.362
Use of 5-ARI			<0.001[a]
No	2307 (95.7)	219 (84.2)	
Yes	104 (4.3)	41 (15.8)	
Prior inguinal hernia repair			0.061
No	2207 (91.5)	229 (88.1)	
Yes	204 (8.5)	31 (11.9)	
Family history of prostate cancer			0.995
No	1957 (81.2)	211 (81.2)	
Yes	454 (18.8)	49 (18.8)	
Median PSA at diagnosis	5.8	7.7	0.009
Median PSA density	0.17	0.09	<0.001[a]
Median IIEF	58	50	<0.001[a]
Median IPSS 1	7	19	<0.001[a]
Median IPSS 2	2	5	<0.001[a]
DRE			0.177
Nonsuspicious	1549 (64.2)	178 (68.5)	
Suspicious	862 (35.8)	82 (31.5)	
Median prostate volume (cc)	35	87.5	<0.001[a]
Biopsy GGG			0.102
1	489 (20.3)	63 (24.2)	
2	952 (39.5)	91 (35.0)	
3	493 (20.4)	44 (16.9)	
4	281 (11.7)	41 (15.8)	
5	196 (8.1)	21 (8.1)	
EAU risk stratification			0.0338[a]
Low	444 (18.4)	54 (20.8)	
Intermediate	1223 (50.7)	110 (42.3)	
High	744 (30.9)	96 (36.9)	

AA = African American race; ARI = alpha-reductase inhibitors; BMI = body mass index; DRE = digital rectal examination; EAU = European Association of Urology; GGG = Gleason grade group; IIEF = International Index of Erectile Function; IPSS = International Prostate Symptom Score; PML = protruded median lobe; PSA = prostate-specific antigen.
[a] Statistically significant.

ence between both groups regarding biopsy GGG. European Association of Urology risk stratification was low (18.4% vs 20.4% for group A vs group B), intermediate (50.7% vs 42.3%), and high (30.9% vs 36.9%) risks.

Table 2 demonstrates perioperative and pathological outcomes for both groups. When compared with group A, the PML group showed a statistically significantly longer median console time (114 vs 134 min) and surgery time (145 vs 170 min), and higher blood loss (150 vs 175 ml). There was no difference in nerve-sparing techniques in both groups.

Both pathological stages (T2, T3; 87%, 13% vs 88%, 12%), presence of lymphovascular invasion (4% vs 3%), and PSMs (7% vs 8.5%) did not score any statistically significant difference between groups A and B. However, the prevalence of perineural invasion was significantly higher in patients with no PML (87.7% vs 79.6%). Both groups depicted comparable urinary continence rates on different consequent postoperative visits (Table 3).

Table 2 – Perioperative and pathological outcomes

Variable	Group A patients with no PML (*N* = 2411)	Group B patients with PML (*N* = 260)	*p* value
Median console time (min)	114	134	<0.001[a]
Median surgery time (min)	145	170	<0.001[a]
Median blood loss (cc)	150	175	<0.001[a]
Nerve-sparing technique			0.540
Bilateral NS	1751 (72.6)	189 (72.7)	
Monolateral NS	287 (11.9)	26 (10)	
Bilateral non-NS	373 (15.5)	45 (17.3)	
Pathology T stage			0.696
T2	2090 (86.7)	229 (88.1)	
T3a	272 (11.3)	25 (9.6)	
T3b	49 (2.0)	6 (2.3)	
Positive surgical margins			0.331
Absent	2246 (93.2)	238 (91.5)	
Present	165 (6.8)	22 (8.5)	
Positive surgical margins			0.596
Absent	2246 (93.2)	238 (91.5)	
Base PSM	72 (3.0)	8 (3.1)	
Mid PSM	49 (2.0)	4 (1.5)	
Apex PSM	44 (1.8)	10 (3.8)	
Perineural invasion			<0.001[a]
No	297 (12.3)	53 (20.4)	
Yes	2114 (87.7)	207 (79.6)	
Lymphovascular invasion			0.389
No	2310 (95.8)	252 (96.9)	
Yes	101 (4.2)	8 (3.1)	
Final pathology GGG			0.063
1	234 (9.7)	43 (16.5)	
2	1406 (58.3)	126 (48.5)	
3	555 (23.0)	62 (23.8)	
4	56 (2.3)	6 (2.3)	
5	160 (6.6)	23 (8.8)	
Final pathology upgrading			0.588
Yes	1926 (79.9)	204 (78.5)	
No	485 (20.1)	56 (21.5)	
Biochemical recurrence (defined as postprostatectomy PSA ≥0.2 on two successive occasions)			0.903
Yes	200 (8.3)	21 (8)	
No	2211 (91.7)	239 (92)	

GGG = Gleason grade group; NS = nerve sparing; PML = protruded median lobe; PSA = prostate-specific antigen; PSM = positive surgical margin.
[a] Statistically significant.

Table 3 – Urinary outcomes over postoperative follow-up period

Variable	Group A patients with no PML (*N* = 2411)	Group B patients with PML (*N* = 260)	*p* value
Urinary continence (%) 0.696			
6 wk	83	79	
3 mo	88	84	
6 mo	91	90	
9 mo	93	93	
12 mo	95	95	

PML = protruded median lobe.

4. Discussion

The current report represents single-center, single-surgeon experience with RARP in patients with PMLs. Using the word "nightmare" should not be regarded as an exaggeration of a real surgical challenge. As per our surgeon, it just fairly describes the state of uneasiness and worry that urologists experience in this scenario, especially during their early learning curve.

Table 4 summarizes the surgical steps and keys to facilitate them in a large median lobe during RARP. Preoperative MRI is an essential tool to properly identify the posterior bladder neck. Hence, we excluded all 46 patients without available MRI data. Additionally, we opted to focus on the impact of a naïve PML on RARP outcomes. Therefore, we excluded patients with previous transurethral resection of

Table 4 – Summary of surgical steps and keys to facilitate the management of the large median lobe during robot-assisted radical prostatectomy

Technical factors	Keys to improve
Identification of posterior bladder neck	1. Preoperative imaging MRI/exact scan 2. Foley catheter on traction 3. Delivery of median lobe out of the bladder
Posterior bladder neck dissection	1. Delivery of and holding the median lobe high (sutures) 2. Confirming the position of ureteric orifices 3. Intraop Lasix/Indigo carmine/methylene blue
Retrotrigonal layer identification	1. Holding the median lobe high (sutures/Pro-grasp forceps/tenaculum) 2. Once a plane is developed, holding the posterior edge of the prostate 3. Assistant to hold the posterior bladder wall
Posterior dissection (nerve sparing)	1. Traction and countertraction 2. Experience of the surgeon and assistance
Bladder neck reconstruction	1. Posterior reconstruction allowing ureteral opening to move away from edge 2. Intraoperative ureteral stents if orifices too close 3. Bladder defect closure in 2 layers 4. For a larger defect, catheter kept for 3–4 extra days and cystogram followed by catheter removal 5. Gentle catheter traction with extra 10 cc in the balloon

the prostate, or hormonal or radiation treatments that were reported to add more difficulty to the procedure [17].

We believe that identification of and adherence to a proper plan of dissection is the key to ensure smooth and safe progression of the procedure. We described anatomic landmarks and a reproducible surgical technique to overcome this demanding surgical scenario. Although this report was meant to also discuss the management of complications, we did not encounter any major complications in the PML group. Additionally, we emphasize that the concept of the best way to deal with complications is how to avoid it, and hence we highlighted our surgical tips in more details. Meticulous bladder neck dissection and proper identification of ureteral orifices led to "zero incidence" of ureteral injury in our cohort. We did not have to perform prophylactic stenting in any of our patients as advocated by other reports [4].

Few points need to be highlighted. Men with a PML constituted only 10.78% of the whole study population. This incidence is similar to those reported in different studies [2–4]. We may attribute a relatively small percentage to the strict selection criterion for this group. We argue that being a retrospective study for 9 yr has resulted in missing more PML patients with relatively insufficient reporting in their operative documentation.

The PML group demonstrated significantly higher median PSA, PSA density, baseline IPSS, and lower IIEF. These findings are intuitively attributed to the physiological and mechanical sequelae of PMLs and are consistent with other reports [18–20]. Similarly, our results echo other data regarding longer operative and console times [2,3]. Meeks et al. [9] noted longer operative times of 349 versus 280 min. On the contrary, Zorn et al. [8] reported no difference in RARP operative times for PML population. Despite scoring a statistical significance in our data, the differences in median console and surgery times were only 20 and 25 min, respectively. It is worth mentioning that additional time was required for challenging posterior bladder neck and seminal vesicle dissection. Additionally, the other part of this additional time was spent in bladder neck reconstruction performed in all PML cases.

Although our data confirmed significantly more blood loss in the PML group, we did not feel any clinical impact or difference in transfusion rates. Similarly, Meeks et al. [9] demonstrated increased estimated blood loss (464 vs 380 ml, p = 0.05) with median lobes.

The impact of a PML on surgical margin status has been a point of debate in the literature. Our current data show that PSM rates were similar between both groups. Moreover, we still did not encounter any difference when PSMs were stratified according to the surgical site. Although it may be logically thought to be more challenging with PMLs, base PSMs were comparable in both groups (3% vs 3.1%). We theorize several explanations for this finding. A PML may force the surgeon to retract the posterior aspect of the prostate more anteriorly during dissection, thereby allowing more exposure to the area. Second, respecting dissection plan posteriorly can efficiently minimize the incidence of cutting into the prostate. Lastly, surgeon experience is known to affect PSM rates [21].

Our results regarding PSMs are consistent with other reports in the literature [22]. Jung et al. [10] confirmed that a PML was not an independent predictor of PSMs in a multivariable analysis. We did not include a univariate or multivariate analysis, as our main focus was to report a reproducible technique for such a challenging category. Additionally, and in contrast to our single-surgeon outcome, their study represented more heterogeneous outcomes of 12 surgeons with varied experience and training.

On the contrary, Jeong et al. [3] demonstrated that a PML was significantly correlated to basal PSM; however, there was no significant relationship between overall PSMs and a PML as a continuous or dichotomous variable (≥10 vs <10 mm). Of note, they used a grading system for median lobe protrusion and correlated this grade with outcomes. We elected to focus on surgical point believing that such further quantification is beyond the scope of this study.

Regarding urinary continence, we depicted similar outcomes between both groups during the follow-up period. This comes in agreement with recently published data [23]. However, other reports confirmed that the presence of a PML adversely impacts continence rates [12,24,25].

Hypothetically, a PML would lead to larger bladder neck defects. Consequently, we highly recommend bladder neck reconstruction with each PML case to achieve postoperative continence. We believe that the common element in continence recovery seems to be the restoration of bladder neck anatomy similar to its preoperative condition.

We report comparable continence rates at all points of the follow-up period. In contrast, Jung et al. [10] suggest that the presence and grade of the PML, as measured via preoperative ultrasound, are significantly related to early recovery of urinary continence after RARP. Again, we did not use any tool to quantify the degree of median lobe protrusion. We still believe that the golden key behind our good continence rate is correlated to our technique in bladder neck reconstruction.

Qian et al. [13] reported oncological and functional outcomes similar to our results. However, they used the Retzius-sparing approach and intergraded a grading system for PMLs. On the contrary, all our cases were done by an anterior transperitoneal approach as per surgeon preference. We commenced with taking down the bladder and then attacking the bladder neck anteriorly.

Certain limitations exist in the current study. First, it is of a retrospective nature. Second, the presence of a PML was determined by the surgeon's arbitrary decision without any predefined criteria or quantitative measurement of the degree of protrusion. Consequently, our inclusion criteria may have been subjective and biased. We believe that we could have included more PML patients if we had utilized more defined MRI criteria. Third, due to the long duration of the study, it included cases during different portions of the surgeon's learning curve and this certainly impacted the ultimate outcomes. In addition, we did not have sexual function outcomes in the cohort. Lastly, we believe that reporting the experience of one of the eminent surgeons in the field should be regarded as a double-edged weapon. On the one side, the study is reporting a solid reproducible technique to avoid complications in such challenging cases.

However, on the other side, our reported favorable outcomes should be considered with extreme caution and cannot be regarded as the standard reference. We still strongly confirm that RARP is a truly challenging technique with a steep learning curve.

5. Conclusions

RARP in patients with a PML is still considered a challenging procedure with a steep learning curve. It is associated with increased operative time and estimated blood loss, but with similar oncological and functional outcomes. Understanding the key steps to facilitate bladder neck dissection is vital to avoid serious intraoperative events and to maximize outcomes.

Conflicts of interest: Dr. A.K. Tewari has served as a site-PI on pharma/industry-sponsored clinical trials from Kite Pharma, Lumicell Inc, Dendreon, and Oncovir Inc. He has received research funding (grants) to his institution from DOD, NIH, Axogen, Intuitive Surgical, AMBFF, and other philanthropy. Dr. A.K. Tewari has served as an unpaid consultant to Roivant Biosciences and an advisor to Promaxo. He owns equity in Promaxo. The remaining authors do not have any conflicts of interests.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.euros.2022.08.017.

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