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TREATMENT OF PROSTATE CANCER USING ROBOT-ASSISTED LAPAROSCOPIC RADICAL PROSTATECTOMY WITH RECONSTRUCTION OF THE PROXIMAL PROSTATIC URETHRA

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ABSTRACT

Introduction: Prostate cancer (PCa) has been one of the leading oncologic pathologies for decades. In the low-risk group the nerve-sparing technique of surgery is used, which is supplemented by preservation and reconstruction of the prostatic urethra. The effectiveness of this technique in preserving the quality of urination, a significant reduction in the rehabilitation time of patients without reducing the quality of the oncologic result of the operation is described.

The aim of the study: To evaluate the long-term results of robot-assisted laparoscopic radical prostatectomy with prostatic urethra reconstruction.

Materials and Methods: 60 patients were included in the study. Patients' selection criteria: low risk of disease prevalence, focal form, tumor location more than 4 mm from the prostatic urethra. During the operation a precision dissection of the prostatic urethra from the prostate is performed. Up to 2cm of the proximal section is preserved, a similar manipulation is performed with the distal urethra. After removal of the prostate, the integrity of the urethra is restored by applying urethro-urethral anastomosis. Before the operation the patients underwent standard examination, including general clinical tests, blood test for prostate-specific antigen (PSA), ultrasound, magnetic resonance imaging (MRI) with 3D modeling. There are also results of pathohistological report, International Prostate Symptom Score (IPSS), International Index of Erectile Function (IIEF), Quality of Life due to urinary disorders, Partin nomogram.

Results: All studied parameters showed good results after 1 month, which were maintained after 6 and 12 months. In 1 patient (1.67%) there was a biochemical recurrence after 6 months (PSA 0.35 ng/ml), which was visualized by MRI as an area of contrast accumulation in the area of neurovascular bundles, the preserved urethra was intact.

Conclusion: Based on the results of the study, there is preservation of the quality of life and no increase in oncologic risk one year after surgery. It is possible to expand the selection criteria and perform prostatic urethra preservation without performing nerve-sparing.

Keywords: radical prostatectomy, robot-assisted surgery, prostate cancer, prostatic urethra reconstruction.

INTRODUCTION

Prostate cancer (PCa) is one of the most common cancers worldwide. [1]. In Russia, according to data at the end of 2022, prostate cancer ranks second in incidence rate for men and amounts to 15.1% [2]. This is largely due to improved diagnosis, with more and more adult men undergoing screening tests in the absence of symptoms. This makes it possible to detect the oncological process at earlier stages. According to clinical guidelines, one of the possible treatment options is active surveillance [3]. However, many patients do not want to live with a tumor, knowing that there is radical treatment option. Radical prostatectomy in one form or another is recognized as the gold standard for surgical treatment of prostate cancer in the world [4].

Since we are dealing with early diagnosis, we are increasingly encountering the disease in a low-risk group with a favorable prognosis. With this option, a nerve-sparing surgical technique is used, which make it possible to preserve erectile function and improve continence after surgery. Possible complications, such as strictures of the vesicoureteral anastomosis or urinary incontinence, can develop in 8-10% of cases, according to various sources [5].

With the need to develop more organ-preserving surgical techniques, in recent years scientific studies have increasingly appeared showing the need to preserve the maximum length of the prostatic urethra [6, 7]. The operation is called radical prostatectomy with reconstruction of the prostatic urethra. We describe the effectiveness of this technique in improving urination rates, significantly reduced rehabilitation time for patients without reducing the quality of the oncological result of the operation while preserving the distal part of the prostatic urethra.

In addition, we point out the importance of preserving the proximal urethra and completely preserving the bladder neck, since this area contains muscle fibers that make up the urethral sphincter. Another point is related to the peculiarity of the anastomosis. When reconstructing the urethra, a urethro-urethral anastomosis is actually formed, and tissues of similar structure are combined. Equally important is convenience for the surgeon, since the coaptation of the urethra parts with each other is better than with the urethrovesical option.

Purpose of the study: to study and evaluate the long-term results of robot-assisted laparoscopic radical prostatectomy with reconstruction of the prostatic urethra.

MATERIALS AND METHODS

The study started from 2022 at the St. Luke's Multidisciplinary Clinical Hospital, Simferopol. A laparoscopic robot-assisted prostatectomy with urethral reconstruction was worked through and successfully performed. For surgical intervention, the ActorMed SoloAssist 2 robotic assistant and Olympus laparoscopic stand were used. The study included 60 patients. All patients underwent standard prehospital examination according to clinical guidelines. Additional selection criteria included the assessment of a 3D model created on the basis of magnetic resonance imaging (MRI). The study included patients with a single focal tumor located farther than 4 mm from the prostatic urethra.

Additionally, before surgery and in subsequent control studies, patients were surveyed using the International Prostate Symptom Score (IPSS), International Index of Erectile Function (IIEF-5), and urinary symptoms related Quality of Life index (QoL). The results of the questionnaire were not criteria for patient selection; they were used as control values for assessing postoperative results.

During the operation, a precision dissection of the prostatic urethra from the prostate is performed. Up to 2 cm of the proximal part is preserved; a similar manipulation is performed with the distal urethra. After removal of the prostate, the integrity of the urethra is restored by applying a urethro-urethral anastomosis.

The study was approved by the Local Independent Ethics Committee of V.I. Vernadsky Crimean Federal University, Simferopol. The study was carried out in accordance with the provisions of the Declaration of Helsinki (revised in Fortaleza, Brazil, October 2013).

The data obtained after patient survey were entered into a Microsoft Office Excel® summary table. Statistical processing was carried out in The Jamovi Project (2024) program. Variables reflecting the analyzed sample were tested for normality of distribution (Kolmogorov-Smirnov test). Depending on the test results, if the distribution turned out to be normal, the arithmetic mean and standard deviation ($M \pm SD$) were used to describe the parameter. Parametric paired Student's t test was used to compare differences between groups.

RESULTS AND DISCUSSION

The mean age was 64.1 years (95% CI 61.8 - 66.4). In all patients, acinar adenocarcinoma was verified at

the diagnostic stage based on the results of multifocal cognitive fusion biopsy of the prostate under ultrasound guidance. Gleason score no more than 7 (4+3), ISUP no more than II, according to the designated criteria. The volume of the prostate gland according to the results of ultrasound and MRI was on average 72.4 cm³ (95% CI 62.8 - 81.9, standard deviation 31.0). Disease stages T1c - T2bN0M0. The baseline mean PSA level in the sample was 8.59 ng/ml (95% CI 8.26 - 8.91, standard deviation 1.04, p < 0.024). The number of postoperative complications was assessed according to the Clavien-Dindo classification. Most complications (16.67%) were grade 1 and slightly lengthened the hospital stay. 3 patients (5%) had grade 2 complications, including postoperative fever requiring adjustment of antibiotic therapy. Table 1.

Table 1. Preoperative data

Parameter	Value	
	Median	InterQuartile range
Age, years	64	59 – 69
Body mass index, kg/m ²	25.56	24.2 – 26.84
Prostate volume, cm ³	73	45.5 – 91
Prostate-specific antigen, ng/ml	8.7	7.9 – 9.45
Average flow rate, ml/s	9.8	8.3 – 11.5
Maximum flow rate, ml/s	12.9	11.6 – 14.9
International Prostate Symptom Score, points	14	9 – 19
International index of erectile function, points	21	18 – 22

The catheter was removed on average on the day 5. The minimum period for removal was 3 days after surgery. The next day the patient was discharged for further outpatient treatment. After removal of the catheter, some patients noted mild dysuria; 12 patients (20%) used a safety pad. Urine leaks were noted during physical activity and bending of the body. This phenomenon was observed during increased activity of the patient with a full bladder. After the correct recommendations, within a week, patients were able to hold urine.

The histology results confirmed acinar adenocarcinoma. 24 patients had an increase in disease stage or Gleason score. No patients were upstaged to T3. In all cases, margin-negative R0 resections were obtained, but in 4 patients (6.67%) tumor cells were obtained within 2 mm from the resection along the lateral margin in the area of the neurovascular bundles. The distance from the tumor to the urethra was more than 4 mm in all cases.

After 1 month patients came for the first follow-up consultation which included a basic examination and questionnaire. The studied parameters were within acceptable reference values. Table 2.

Table 2. Control values before surgery and after 1 month

Parameter	Before surgery		After 1 month		P
	Median	InterQuartile range	Median	InterQuartile range	
Prostate-specific antigen, ng/ml	8.7	7.9 – 9.45	0.09	0.0515 – 0.161	< 0,01
Average flow rate, ml/s	9.8	8.3 – 11.5	11.5	9.5 – 12.2	< 0,01

Maximum flow rate, ml/s	12.9	11.6 – 14.9	15.4	13.9 – 16.9	< 0,01
International Prostate Symptom Score, points	14	9 – 19	3	2 – 4	< 0,01
Quality of life, points	5 ± 0,5	-	1 ± 0,5	-	-

Since patients were advised to limit sexual activity and any stimulating factors during the first month, this component was not assessed. In one patient (1.67%) a month later, urine leakage persisted, up to 1 pad per day, which required further drug correction.

The next follow-up examination was carried out after 6 months. The patients maintained a sufficient level of quality of life; subjectively, everyone noted good quality of urination. When assessed on the IPSS scale, the average score was 2 points. Control MRI with intravenous enhancement showed the preserved prostatic part of the urethra, with periprostatic tissues around it, consisting partly of the periprostatic fascia and intrapelvic fascia. Using the modified surgical technique, the integrity of these structures was restored, thereby performing anterior plastic surgery of the periprostatic structures, aimed at improved fixation of the urethra and bladder neck. Erectile function began to recover in 30% of patients to a level of 14–16 points on the IIEF-5 scale.

The results show that PSA and quality of life scores are not significantly different when compared at 1 and 12 months. In almost all patients, PSA did not increase above 0.2 ng/ml during control. One patient (1.67%) had an increase in blood PSA to 0.35 ng/ml; a control MRI was prescribed, the results of which showed an increase in the accumulation of contrast agent in the area of the neurovascular bundles on the left. Table 3.

Table 3. Control values at 1 month and 12 months after surgery

Parameter	After 1 month		After 12 months		p
	Median	InterQuartile range	Median	InterQuartile range	
Prostate-specific antigen, ng/ml	0.09	0.0515 – 0.161	0.07	0.03 – 0.13	0.156
Average flow rate, ml/s	11.5	9.5 – 12.2	11.6	10 – 12.4	0.034
Maximum flow rate, ml/s	15.4	13.9 – 16.9	15.9	14.5 – 16.9	<0.001
International Prostate Symptom Score, points	3	2 – 4	2	1 – 3	<0.01
International index of erectile function, points	-	-	13	8 – 15	-
Quality of life, points	1 ± 0,5	-	1 ± 0,5	-	0.077

There is a significant difference (p <0.05) when comparing urination quality indicators; there is a tendency for indicators to improve after a year.

The results of the study show the effectiveness of the discussed method, including the preservation of quality of life and no increase in cancer risk one year after the intervention. For low-risk patients, this operation can improve the quality of urination and significantly speed up rehabilitation time. The oncological results obtained do not exceed those after standard radical prostatectomy in other clinics. Among other

things, we note that there was no evidence on continuation of the process in the area of the preserved urethra. Thus, we believe that the oncological component of the method is satisfactory and the risks do not increase. Moreover, expansion of the acceptable criteria for the operation may be considered. Preservation and reconstruction of the prostatic urethra can be performed without preserving the neurovascular bundles, even in a completely extrafascial version. However, this statement requires further study.

A slight improvement in the results of assessing the quality of urination one year after surgery, compared with the indicators after 1 month, may indicate complete recovery due to reparative processes in the area of the preserved prostatic urethra. This phenomenon is also explained by the use of ultrasonic scalpels, which, although they have minimal lateral spread of energy in the tissue, still have an undesirable effect on the preserved structures, which are restored over time.

Modern studies have established that the distal urethral sphincter plays a key role in urinary continence after prostatectomy. However, according to the literature, the smooth muscle fibers of the bladder sphincter extend to the prostatic urethra almost to its middle. These fibers are inevitably damaged by standard surgical techniques, and extensive dissection of the bladder neck can lead to urinary incontinence or significantly prolong the recovery period.

Our previously proposed technique significantly improves urinary recovery in patients in the first days after catheter removal, ensuring a rapid return to normal life after surgery [6]. Currently, the literature describes the results of studies confirming the absence of spread of the oncological process to the urethra even at high stages of the disease [7, 8]. Many works describe the need to preserve periprostatic structures [9]. This tendency is developing in the preservation of the urethra; scientific works describe single clinical observations and small samples [10-12]. Our study includes the largest sample of patients and long-term results. This work was discussed at all-Russian conferences and was met with interest, since the further development of medicine is moving towards less invasive interventions with maximum preservation of the patient's quality of life even with complex oncological interventions.

CONCLUSION

Summarizing all of the above, it can be noted that this surgical technique demonstrates good long-term results of the oncological component in terms of the relapse-free course and high indicators of the patients' quality of life and, in particular, urination. Significant acceleration of recovery time reduces the need for long-term inpatient and subsequent outpatient treatment. At the moment, patients are being monitored according to standard protocols.

REFERENCES

1. James N. D., Tannock I., N'Dow J., Feng F., Gillessen S., Ali S. A., Trujillo B., Al-Lazikani B., Attard G., Bray F., Compérat E., Eeles R., Fatiregun O., Grist E., Halabi S., Haran Á., Herchenhorn D., Hofman M. S., Jalloh M., Loeb S., MacNair A., Mahal B., Mendes L., Moghul M., Moore C., Morgans A Morris., M., Murphy D., Murthy V., Nguyen P. L., Padhani A., Parker Ch., Rush H., Sculpher M., Soule H., Sydes M. R., Tilki D., Tunariu N., Villanti P., Xie L. P. The Lancet Commission on prostate cancer: planning for the surge in cases. *Lancet*. 2024; 403: 1683–722. DOI: [10.1016/S0140-6736\(24\)00651-2](https://doi.org/10.1016/S0140-6736(24)00651-2)
2. Korchagina T.A. Cancer incidence rates as a threat to the demographic security of the Russian Federation. *Russian Economic Bulletin*. 2024;7 (3): 79 – 85. <https://doi.org/10.58224/2658-5286-2024-7-3-79-85>.
3. Fizazi K., Gillessen S. Updated treatment recommendations for prostate cancer from the ESMO Clinical Practice Guideline considering treatment intensification and use of novel systemic agents. *Annals of Oncology*. 2023;34(6):557-563. DOI: [10.1016/j.annonc.2023.02.015](https://doi.org/10.1016/j.annonc.2023.02.015)
4. Cornford Ph., van den Bergh R.C.N., Briers E., Van den Broeck Th., Brunckhorst O., Darragh J., Eberli D., De Meerleer G., De Santis M., Farolfi A., Gandaglia G., Gillessen S., Grivas N., Henry A.M., Lardas M., van Leenders Geert J.L.H., Liew M., Linares Espinos E., Oldenburg J., van Oort I. M., Oprea-Lager D. E., Ploussard G., Roberts M.J., Rouvière O., Schoots I.G., Schouten N., Smith E.J., Stranne J., Wiegel T., Willemse P. P. M., Tilki D. EAU-EANM-ESTRO-ESUR-ISUP-SIOG Guidelines on Prostate Cancer—2024 Update. Part I: Screening, Diagnosis, and Local Treatment with Curative Intent. *European Urology*. 2024. DOI: [10.1016/j.eururo.2024.03.027](https://doi.org/10.1016/j.eururo.2024.03.027)
5. Schaeffer E.M., Srinivas S., Adra N., An Y., Bitting R., Chapin B., Cheng H.H., D'Amico A.V., Desai N., Dorff T., Eastham J.A., Farrington T.A., Gao X., Gupta S., Guzzo T., Ippolito J.E., Karnes R.J., Kuettel M.R., Lang J.M., Lotan T., McKay R.R., Morgan T., Pow-Sang J.M., Reiter R., Roach M., Robin T., Rosenfeld S., Shabsigh A., Spratt D., Szmulewitz R., Teply B.A., Tward J., Valicenti R., Wong J.K., Snedeker J., Freedman-Cass D.A. NCCN Guidelines® Insights: Prostate Cancer, Version 3.2024. *J Natl Compr Canc Netw*. 2024;22(3):140-150. <https://doi.org/10.6004/jnccn.2024.0019>.
6. Angulo JC. Complications of Prostate Cancer Treatment: Open Issues. *Journal of Clinical Medicine*.

2024; 13(11):3090. DOI: [10.3390/jcm13113090](https://doi.org/10.3390/jcm13113090)

7. Eremenko S.N., Mikhaylichenko V.Yu., Eremenko A.N., Dolgoplov V.P., Kozak A.A., Chernega V.S., Aliyev M.A. Laparoscopic radical prostatectomy with sparing of the proximal prostatic urethra. *Urology Herald*. 2023;11(2):37-46. <https://doi.org/10.21886/2308-6424-2023-11-2-37-46>
8. Asimakopoulos A.D., Annino F., Colalillo G., Gaston R., Piechaud T., Mauriello A., Anceschi U., Borri F. "Urethral-Sparing" Robotic Radical Prostatectomy: Critical Appraisal of the Safety of the Technique Based on the Histologic Characteristics of the Prostatic Urethra. *Curr Oncol*. 2023;30(1):1065-1076. DOI: [10.3390/curroncol30010082](https://doi.org/10.3390/curroncol30010082). PMID: 36661731; PMCID: PMC9857678.
9. Leibovich B.C., Blute M.L., Bostwick D.G., Wilson T.M., Pisansky T.M., Davis B.J., Ramnani D.M., Cheng L., Sebo T.J., Zincke H. Proximity of prostate cancer to the urethra: implications for minimally invasive ablative therapies. *Urology*. 2000 Nov 1;56(5):726-9. DOI: [10.1016/s0090-4295\(00\)00792-5](https://doi.org/10.1016/s0090-4295(00)00792-5)
10. Urkmez A., Ranasinghe W., Davis, J. Surgical techniques to improve continence recovery after robot-assisted radical prostatectomy. *Translational Andrology And Urology*. 2020;9(6):3036-3048. DOI: [10.21037/tau.2020.03.36](https://doi.org/10.21037/tau.2020.03.36)
11. Brunocilla E., Schiavina R., Pultrone C.V., Borghesi M., Rossi M., Cevenini M., Martorana G. Preservation of the smooth muscular internal (vesical) sphincter and of the proximal urethra for the early recovery of urinary continence after retropubic radical prostatectomy: a prospective case-control study. *Int J Urol*. 2014;21(2):157-62. DOI: [10.1111/iju.12206](https://doi.org/10.1111/iju.12206). PMID: 23802754.
12. Simforoosh N., Dadpour M., Mousapour P., Honarkar Ramezani M. Improving early urinary continence recovery after radical prostatectomy by applying a sutureless technique for maximal preservation of the intrapelvic urethra: A 17-year single-surgeon experience. *Urologia*. 2020;87(4):178-184. DOI: [10.1177/0391560320925570](https://doi.org/10.1177/0391560320925570). PMID: 32493134.

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