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SEXUAL CONSTITUTION (SEXUALITY) OF MEN WITH PROSTATE CANCER

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Introduction. Evaluation of sexual function in men with prostate cancer (PCa) is of great importance, since treatment methods can influence on sexual function. Questionnaires allow to evaluate sexual function in men during the last month before the treatment. At the same time, the sexual life of a man who has developed PCa is still not studied. The experience of assessing the sexual constitution of men with newly diagnosed PCa is presented in the article.

Aim. To determine male sexuality from its first manifestations to the moment of PCa diagnosis, i.e. throughout the entire period of sexual activity, as well as to evaluate the relationship between sexuality and serum testosterone levels at the time of PCa diagnosis.

Materials and methods. A total of 87 patients aged 47–75 years diagnosed with PCa pf T1C-3bN0-1M0-1a, who independently answered the questions of the questionnaire "Integral assessment of male sexuality" (2009), were included in the study. All men underwent an examination for serum total testosterone.

Results. From the whole cohort, 90.8% of men were defined as hyposexual, and 9.2% had normal sexuality. Weak sexual constitution was found throughout the entire period of sexual life, but by the time of PCa diagnosis, it was even lower. 70.1% of patients had a total testosterone deficiency at the time of PCa detection. No reliable relationship was found between the reduced and normal sexual constitution and serum testosterone levels.

Conclusion. Most men with PCa have low sexual activity throughout their lives, a high incidence of testosterone deficiency at the time of cancer diagnosis. In addition, there is no relationship between serum testosterone levels and male sexuality.

K e y w o r d s: male sexual constitution, male sexuality, prostate cancer, serum testosterone

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Introduction. The quality of life of patients with prostate cancer (PCa) directly depends on the stage of the disease, the treatment method, its efficiency, and safety. At the same time, not only disease-free and overall survival are important, but also the influence of many contributing factors on the patient's sexuality [1-3].

It is well known that the initial state of men's sexual function before starting PCa treatment differs in a wide range of its components, from complete preservation to complete absence of libido, erection, ejaculation, and orgasm. Therefore, for patients with preserved sexual function for a certain age, indications have been developed for choosing one or another treatment method of PCa, nerve-sparing techniques and penile rehabilitation after the main treatment [2, 4-7]. Extensive studies have been carried out to evaluate the efficiency and safety of sexual dysfunction treatment after radical prostatectomy, external beam radiation therapy, and brachytherapy [8-12].

It should be noted that the assessment of men's sexual function includes an extremely short period of time (one month) before the start of radical or other treatment for PCa. At the same time, an exclusively pragmatic task is solved to determine the preservation/weakening of one or another component of sexual function and the degree of its deterioration. For this purpose, validated questionnaires are used in domestic and international practice, for example, IIEF-15, IIEF-5, MSHQ-Ej, AMS, etc. [13-15]. However, C.A. Bravi et al. (2021) proposed to evaluate erectile function not only four weeks before radical prostatectomy but also six months before it, as differences in results were found: in one out of six patients with good function six months ago, it deteriorated by the fourth week before surgery [16].

However, taking into account that PCa is a malignant tumor of the male reproductive system organ, one of the functions of which is sexuality in all its manifestations, it seems extremely important to understand whether there are any features of men's sexuality throughout their lives that distinguish them from men in the general population, men of the same age with benign prostatic hyperplasia, i.e., is the peculiarity of men's sexuality a certain predisposition factor or risk for the development of PCa?

In 2009, M.I. Kogan and A.Yu. Kireev published a questionnaire for the integral assessment of male sexuality, consisting of 34 questions with six answers and allowing to form three groups of sexual constitution: hypo-, normo-, and hypersexuality [17]. The use of this questionnaire in patients with benign prostatic hyperplasia allowed establishing almost equal proportions

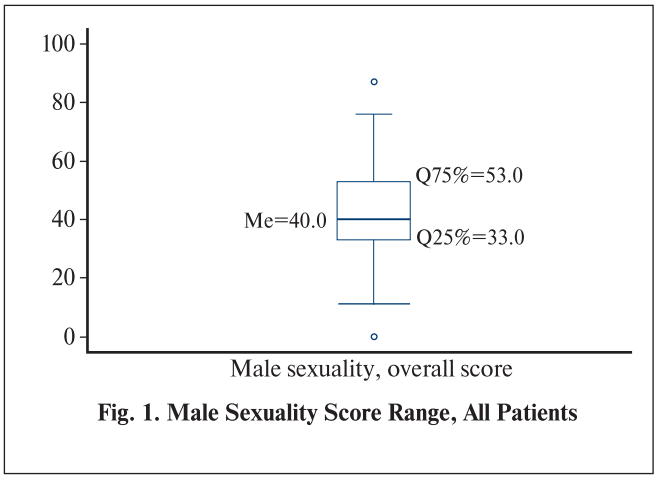


Fig. 1. Male Sexuality Score Range, All Patients

of the three groups of sexual constitution in this disease. Similar studies in patients with PCa have not been carried out previously.

Aim. To determine men's sexuality from its first manifestations to the moment of PCa diagnosis, i.e., throughout the entire period of sexual activity, as well as to determine the relationship of sexuality with testosterone levels at the time of PCa diagnosis.

Materials and methods. A total of 87 patients with a mean age of 64 (61.00; 68.00) years in the range of 47-75 years with a newly established diagnosis of PCa of T1C-3bN0-1M0-1a were included in the study. A measurement of total testosterone level in serum was performed on an automatic IMMULITE analyzer with the IMMULITE Total Testosterone test. Upon morphological confirmation of PCa, patients independently completed the Rostov questionnaire for the integral assessment of male sexuality [17].

The following statistical methods were used to study male sexuality and its relationship with testosterone levels. Using the Kolmogorov-Smirnov tests (with Lilliefors test) and Shapiro-Wilk test, it was found that the data do not follow a normal distribution, so median (Me) and quartiles (Q25%; Q75%) were used for description. The non-parametric Mann-Whitney test was performed to compare groups by testosterone level according to sexuality. The chi-square test was used to compare groups by testosterone level and age. Correlation analysis between testosterone level and male sexuality included calculation of Spearman correlation coefficients (with verification of significance using Student's t-test) and empirical correlation ratio (with significance verification using Fisher's test). Graphical data are presented by box plots and scatter diagrams. Calculations were performed using the software package SPSS ver.26 and MS Excel 2019.

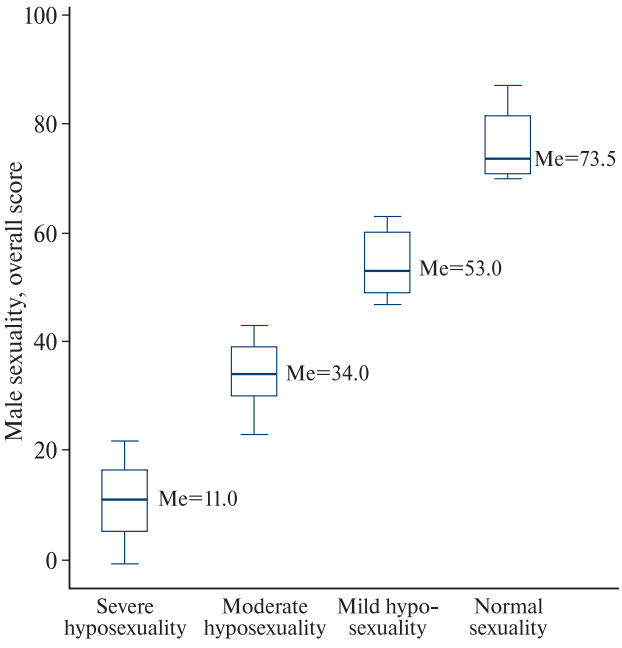


Fig. 2. Male sexuality score range

Results. The median total sexuality score was 40.00 (33.00; 53.00) in the range from 0 to 87 points. The median level of total testosterone was 9.78 (5.7; 12.25) in the range from 1.4 to 26.15 nmol/L. *Figure 1* shows a box plot of the total male sexuality score.

For most patients (79 out of 87, 90.8%), hyposexuality was characteristic, and only eight men (9.2%) were defined as normosexual. Among 87 patients, there were no men with hypersexuality.

Indicators of hyposexuality (0-67 points) were divided into three equivalent subgroups: subgroup of severe hyposexuality (0-22 points), moderate hyposexuality (23-46 points), and mild hyposexuality (46-67 points). The indicators of the three subgroups of hyposexuality, as well as normal sexuality, are presented in Table 1 and *Figure 2*.

So, most of the patients had moderate and mild hyposexuality (n=49, 62% and n=27,34.2%, respectively). Noteworthy is the indicator of normal sexuality, the median of which was close to the upper limit of hyposexuality.

Figure 3 presents a scatter diagram of male sexuality indicators (total scores) and testosterone levels in 87 patients, with no significant relationship between testosterone level and male sexuality (p>0.05).

Due to the small number of patients with severe hyposexuality, analysis of the relationship between sexuality and testosterone levels was performed only

Table 1

Male Sexuality Indicators

Groups	Me (Q25%; Q75%)
Severe hyposexuality (n=3)	11.00 (0.00; -)
Moderate hyposexuality (n=49)	34.00 (30.00; 39.50)
Mild hyposexuality (n=27)	53.00 (49.00; 61.00)
Normal sexuality (n=8)	73.50 (71.00; 84.25)

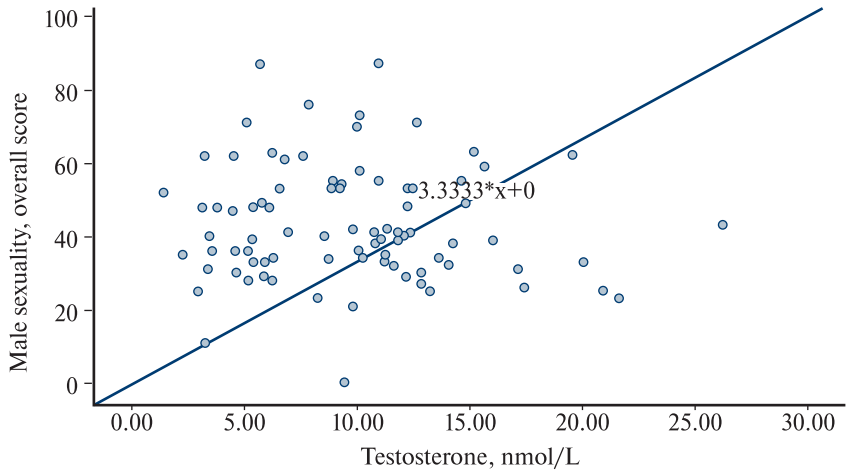


Fig. 3. Scatterplot of male sexuality score and testosterone level

for three groups of patients (*Table 2*). As can be seen, no significant relationship was found between different levels of male sexuality indicators and testosterone levels ($p>0.05$).

The absence of a significant relationship is illustrated by *Figures 4-6*.

Figure 7 presents a scatter diagram of testosterone levels by sexuality groups. No significant relationship was also seen (the empirical correlation ratio is 0.914, however, $p=0.185$).

Indicators of sexuality during the three periods of sexual relations (initial period, intermediate, and preceding the diagnosis of PCa) are shown in *Table 3*. In each of the three time periods, the possible maximum score reaches 35.

It was found that the medians of indicators and quartiles of the first two time periods are at almost the same extremely low level, and in the period preceding the diagnosis of PCa, the median decreases even more, almost 2-2.5 times.

Thus, this group of men is characterized by hyposexuality throughout their sexual life with its sharp drop in the third time period. Assessment of testosterone levels revealed its normal level in only 24 (27.6%) of 87 cases. And in patients, who were younger than 60 years (73.3%), and in those older than 60 years (71.4%), testosterone deficiency was predominantly noted. No significant relationship was found between these age groups and testosterone levels ($p>0.05$).

Tables 4 and *5* indicate indicators of male sexuality and testosterone levels. No significant relationship between these characteristics was also found.

Discussion. Male sexual function is a complex phenomenon depending on many somatic, biological, psychological, social, and cultural factors [18-20]. The study of differences in sexual activity, sexual desire, erection, duration of sexual intercourse, orgasm, and satisfaction with sexual life among men is important for understanding how various factors, including genetic and biological, can affect sexual behavior, perception of sexuality, general health status, and possible development of certain diseases [18].

Biological and genetic factors play a significant role in the formation of differences between men in sexual

Table 2

Correlation analysis of the relationship between male sexuality indicators and testosterone levels

Groups	Correlation coefficients of male sexuality and testosterone levels*
All patients	-0.052 ($p=0.639$)
Moderate hyposexuality	-0.056 ($p=0.703$)
Mild hyposexuality	0.339 ($p=0.083$)
Normal sexuality	-0.036 ($p=0.938$)

*Spearman correlation coefficients, p, significance level for the t-test.

Table 3

Male sexuality indicators in relation to periods of patients' sexual life (all patients)

Indicators	Me (Q25%; Q75%)
Male sexuality at the beginning of sexual life, points	8.00 (6.00; 12.00)
Male sexuality in the middle of sexual life, points	9.00 (6.00; 11.00)
Male sexuality at the time of cancer diagnosis, points	4.00 (2.00; 8.00)

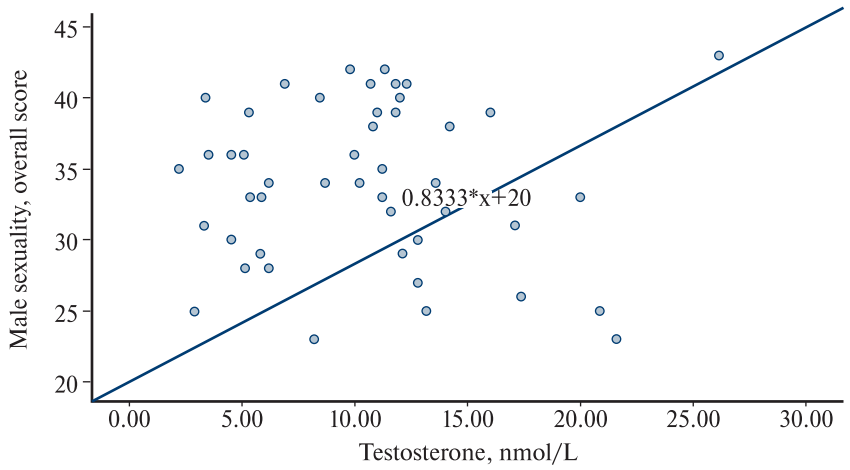


Fig. 4. Scatterplot of male sexuality score and testosterone level (patients with moderate hyposexuality)

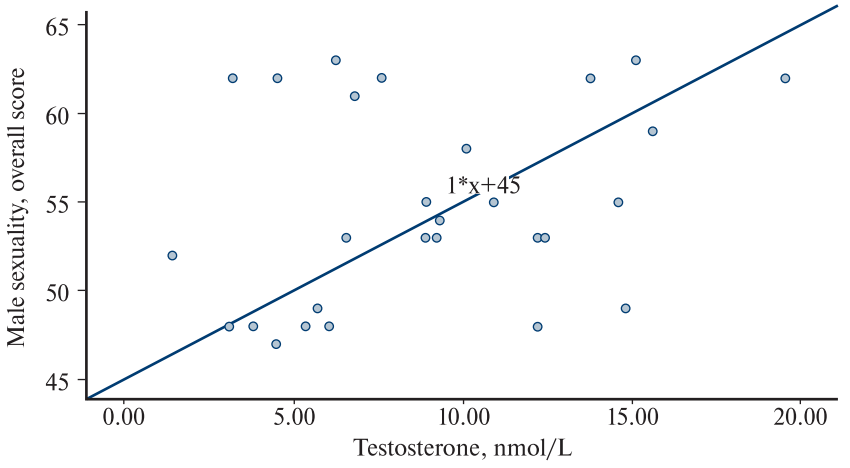


Fig. 5. Male Sexuality Score and Testosterone Level Scatterplot (patients with mild hyposexuality)

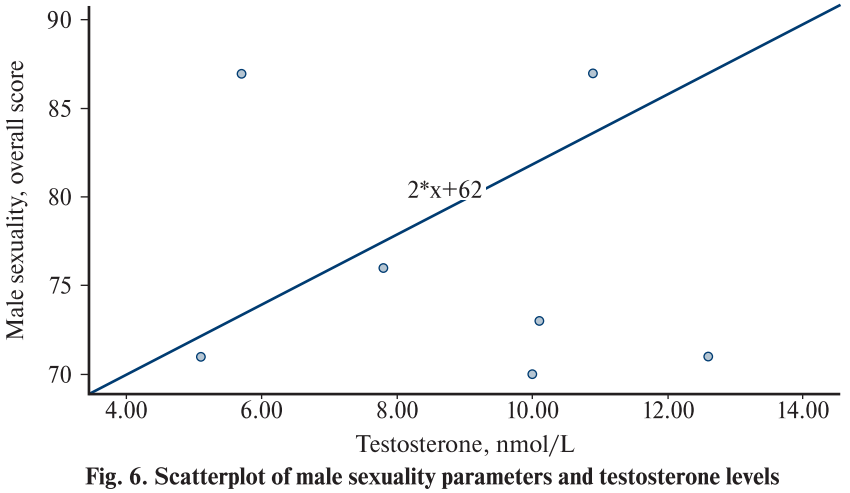


Fig. 6. Scatterplot of male sexuality parameters and testosterone levels (patients with normal sexuality)

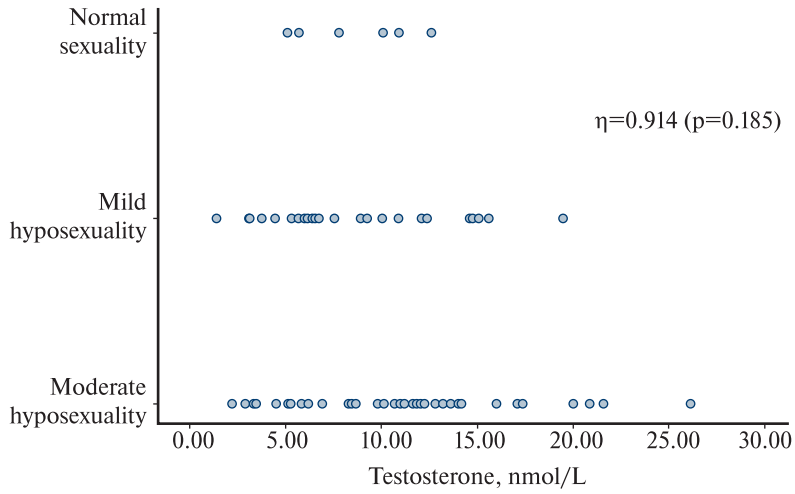


Fig. 7. Scatterplot of male sexuality parameters and testosterone levels (all patients)

behavior. The main biological aspects include levels of sex hormones, neurophysiological features, and the state of the reproductive system. Such organs, associated with the biological and genetic potential of a man, certainly include the prostate gland, which is a target in the metabolism of testosterone and other hormones with androgenic influence [21].

Since the 1940s, the association between testosterone and PCa has been well known. However, until the current time, many aspects of tumorigenesis in the prostate and hormonal metabolism remain undisclosed. At the same time, studies showed that genes responsible for regulating the level of testosterone and other hormones can affect men's sexual behavior [22].

Genes associated with the function of receptors of testosterone and other androgens also play an important role [23]. Genetic mutations in these receptors can affect libido, sexual behavior, and fertility in men. Genetic differences in receptors of neurotransmitter (dopamine, serotonin, oxytocin) can also explain differences in sexual activity and satisfaction in men [24].

In this regard, it seemed appropriate to investigate the features of sexual activity and sexual function of men throughout their lives from the moment of diagnosis of PCa and to study the relationship of sexuality with testosterone level. The results of our study indicate that 90.8% of men with newly diagnosed PCa throughout their lives are characterized by reduced sexual activity relative to average normative values, and men with normal sexuality are close to the upper values of hyposexuality. In addition, the indicators of low sexual constitution of men with PCa were stable throughout the entire period of sexual life, but by the time of PCa diagnosis, these indicators were even more reduced, and their median differed from the upper limit by almost nine times.

The most important point in our results is the absence of any significant relationship between the parameters of reduced and normal sexual constitution with serum

Table 4

Male Sexuality Indicators in Relation to Testosterone Levels

Parameter	Testosterone deficiency (*n*=61)	Normal testosterone levels (*n*=24)	*p* *
Male sexuality, total score	41.0 (34.0; 53.5)	38.5 (29.25; 53.0)	0.341
Sexuality at the beginning of sexual life, points	8.0 (6.0; 11.5)	8.0 (5.0; 12.5)	0.926
Sexuality in the middle of sexual life, points	9.0 (6.0; 11.0)	8.0 (6.0; 10.0)	0.537
Sexuality at the time of PCa diagnosis, points	5.0 (2.0; 8.0)	3.5 (1.25; 7.0)	0.492

* significance level for the Mann-Whitney criterion.

Table 5

Уровни тестостерона в связи с мужской сексуальностью

Группы пациентов	Уровень тестостерона Me (Q25%; Q75%)	*p**
Умеренная гипосексуальность (*n*=48) (1)	10,75 (5,82; 12,8)	(1.2)=0.294
Легкая гипосексуальность (*n*=27) (2)	8,88 (5,34; 12,2)	(1.3)=0.472
Нормосексуальность (*n*=7) (3)	10,0 (5,7; 10,9)	(2.3)=0.749

* – уровень значимости для критерия Манна-Уитни.

testosterone levels in patients. And this is despite the fact that by the time of PCa diagnosis, 70.1% of patients had testosterone deficiency, both those who were <60 years and those who were older than 60 years.

This is a very remarkable feature of this group of patients, which distinguishes it significantly from the group of men with benign prostatic hyperplasia, in which we previously confirmed a significant relationship between testosterone levels and sexual constitution [25].

The results of our study need a more extensive collection and analysis of clinical data, and their limited value is due to the fact that such studies have not been carried out previously, and there is no possibility for comparing the results.

Conclusion. The sexual constitution of the majority of men with PCa is characterized by hyposexuality, which significantly intensifies by the time of diagnosis of prostate tumor. At the same time, most men have a testosterone deficiency. Throughout the sexual life of men, no reliable relationship was found between their sexual activity and the serum level of testosterone measured at the time of PCa diagnosis.

REFERENCES

1. *Somov A.N., Suslin S.A.* Prostate cancer. Epidemiology, risk factors and early detection. Preventive medicine. 2020;23(3):149–155. https://doi.org/10.17116/profmed202023031149. Russian (Сомов А.Н., Суслин С.А. Рак предстательной железы. Эпидемиология, факторы риска и раннее выявление. Профилактическая медицина. 2020;23(3):149–155. https://doi.org/10.17116/profmed202023031149).
2. Guidelines on Prostate Cancer. P. Cornford, D. Tilki, R.C.N. van den Bergh, E. Briers, Patient Advocate (European Prostate Cancer Coalition/Europa UOMO), D. Eberli, G. De Meerleer, M. De Santis, S. Gillessen, A.M. Henry, G.J.L.H. van Leenders, J. Oldenburg, I.M. van Oort, D.E. Oprea-Lager, G. Ploussard, M. Roberts, O. Rouvière, I.G. Schoots, J. Stranne, T. Wiegel Guidelines Associates: T. Van den Broeck, O. Brunckhorst, A. Farolfi, G. Gandaglia, N. Grivas, M. Lardas, M. Liew, E. Linares Espinós, P-P.M. Willemse Guidelines Office: J. Darraugh, E. Smith, N. Schouten. European Association of Urology 2024.
3. Russian clinical guidelines for prostate cancer. 2023. Russian (Российские клинические рекомендации по раку предстательной железы. 2023).
4. *Greimel E, Nagele E, Lanceley A, Oberguggenberger A S, Nordin A, Kuljanic K, Arraras J I, Wei-Chu C, Jensen P T, Tomaszewski K A, Creutzberg C L, Galalae R, Toelen H, Zimmermann K, Bjelic-Radisic V, Costantini A, Almont T, Serpentini S, Paskeviciute L, Vistad I, Schmalz C.* EORTC Quality of Life Group. Psychometric validation of the European Organisation for Research and Treatment of Cancer-Quality of Life Questionnaire Sexual Health (EORTC QLQ-SH22). Eur J Cancer. 2021;154:235–245.2021. DOI: 10.1016/j.ejca.2021.06.003
5. *Rubilotta E, Gubbiotti M, Balzarro M, Castellani D, Pirola GM, Gemma L, Teoh JY, Polykarpova A, Autrán-Gómez AM, Tortolero Blanco L, Migliorini F, Tafuri A, Antonelli A.* Current trends in erectile rehabilitation after radical prostatectomy: Results from a worldwide survey. Andrologia. 2022 Oct;54(9):e14506. doi: 10.1111/and.14506. Epub 2022 Jul 3. PMID: 35780809.
6. *Gromicho A, Costa P, Araújo D, Pereira D, Ferraz L.* Sexual rehabilitation with intracavernous alprostadil after radical prostatectomy: Outcomes from a nursing program. Arch Ital Urol Androl. 2021 Dec 20;93(4):404-407. doi: 10.4081/aiua.2021.4.404. PMID: 34933528.
7. *Kianian R, Andino JJ, Morrison JJ, Grundy D, Appleton A, Lavold AJ, Eleswarapu SV, Mills JN.* Potential primary prevention of Peyronie's disease post prostatectomy?-retrospective analysis of peri-operative multi-modal penile rehabilitation. Transl Androl Urol. 2023 Nov 30;12(11):1708-1712. doi: 10.21037/tau-23-281. Epub 2023 Nov 23. PMID: 38106686; PMCID: PMC10719776.
8. *Daniela Wittmann , Akanksha Mehta , Eilis McCaughan , Martha Faraday, Ashley Duby, Andrew Matthew, Luca Incrocci , Arthur Burnett, Christian J Nelson, Stacy Elliott, Bridget F Koontz, Sharon L Bober, Deborah McLeod, Paolo Capogrosso, Tet Yap, Celestia Higano, Stacy Loeb, Emily Capellari, Michael Glodé, Heather Goltz, Doug Howell, Michael Kirby, Nelson Bennett, Landon Trost, Phillip Odiyo Ouma, Run Wang, Carolyn Salter, Ted A Skolarus, John McPhail, Susan McPhail, Jan Brandon, Laurel L Northouse, Kellie Paich, Craig E Pollack, Jen Shifferd, Kim Erickson, John P Mulhall.* Guidelines for Sexual Health Care for Prostate Cancer Patients: Recommendations of an International Panel. J Sex Med. 2022;19(11):1655–1669. https://doi.org/10.1016/j.jsxm.2022.08.197.
9. *Nobuhiro Haga, Takeshi Miyazaki, Kazuna Tsubouchi, Yu Okabe, Kan Shibayama, Daiki Emoto, Wataru Matsuoka, Hiroko Maruta, Chikao Aoyagi, Hiroshi Matsuzaki, Shinichiro Irie, Nobuyuki Nakamura, Hirofumi Matsuoka.* Comprehensive approach for preserving cavernous nerves and erectile function after radical prostatectomy in the era of robotic surgery. Int J Urol. 2021;28(4):360–368. doi: 10.1111/iju.14491.
10. *Leonore F Albers, Corinne N Tillier, Erik van Muilekom, Erik van Werkhoven, Henk W Elzevier, Bas W G van Rhijn, Henk G van der Poel, Kees Hendricksen.* Sexual Satisfaction in Men Suffering From Erectile Dysfunction After Robot-Assisted Radical Prostatectomy for Prostate Cancer: An Observational Study. J Sex Med. 2021;18(2):339–346. doi: 10.1016/j.jsxm.2020.11.011.
11. Penile Rehabilitation Strategy after Nerve Sparing Radical Prostatectomy: A Systematic Review and Network Meta-Analysis of Randomized Trials/Reza Sari Motlagh, Mohammad Abufaraj, Lin Yang, Keiichiro Mori, Benjamin Pradere, Ekaterina Laukhtina, Hadi Mostafaei, Victor M Schuettfort, Fahad Quhal, Francesco Montorsi, Mohsen Amjadi, Christian Gratzke, Shahrokh F Shariat. J Urol. 2021;205(4):1018–1030. doi:10.1097/JU.0000000000001584.
12. *Agochukwu-Mmonu N, Murali A, Wittmann D, Denton B, Dunn RL, Montie J, Peabody J, Miller D, Singh K;* Michigan Urological Surgery Improvement Collaborative. Development and Validation of Dynamic Multivariate Prediction Models of Sexual Function Recovery in Patients with Prostate Cancer Undergoing Radical Prostatectomy: Results from the MUSIC Statewide Collaborative. Eur Urol Open Sci. 2022 Apr 18;40:1-8. doi: 10.1016/j.euros.2022.03.009. PMID: 35638089; PMCID: PMC9142747.
13. *Fischer F, Kowalski C, Simon J, Graefen M, Rose M, Beyer B.* Die Übertragbarkeit von IIEF-5 (International Index of Erectile Function 5 Item Short Form) auf EPIC-26 (Expanded Prostate Cancer Index Composite 26) : Sexuelle Funktion nach radikaler Prostatektomie [The interoperability of IIEF-5 with EPIC-26 : Sexual function after radical prostatectomy]. Urologie. 2023 Jun;62(6):602-608. German. doi: 10.1007/s00120-023-02027-2. Epub 2023 Mar 6. PMID: 36877230.
14. *Mi Z, Liu J, Wang L, Luo Y, Yang K.* Screening of Associated Factors for Erectile Dysfunction after Radical Prostatectomy and Construction of a Clinical Risk Assessment Model: A Retrospective Study. Arch Esp Urol. 2024 Jan;77(1):92-97. doi: 10.56434/j.arch.esp.urol.20247701.12. PMID: 38374018.
15. *Neuzillet Y, Dreyfus JF, Raynaud JP, Rouanne M, Schneider M, Roupret M, Drouin S, Galiano M, Cathelineau X, Lebret T, Botto H.* Relationship of preoperative androgen levels and metabolic syndrome with quality of life and erectile function in patients who are to undergo radical prostatectomy. Asian J Androl. 2021 Sep-Oct;23(5):520-526. doi: 10.4103/aja.aja_3_21. PMID: 33762475; PMCID: PMC8451490.
16. *Bravi CA, Tin A, Benfante N, Salonia A, Briganti A, Montorsi F, Mulhall JP, Eastham JA, Vickers AJ.* Comparison of Two Methods for Assessing Erectile Function Before Radical Prostatectomy. Eur Urol Oncol. 2021 Apr;4(2):323-326. doi: 10.1016/j.euo.2019.02.003. Epub 2019 Mar 9. PMID: 31412005; PMCID: PMC9400435.
17. *Kogan M.I. Kireev A.Yu.* Questionnaire for the integral assessment of male sexuality. Urology. 2009;1:46–50. Russian (Коган М.И. Киреев А.Ю. Анкета интегральной оценки мужской сексуальности. Урология. 2009;1:46–50).
18. Vornik B.M., Dmitrenko A.A. Sexy. Who are they? IC «Family»,

Kiev, 2015. Russian (Ворник Б.М., Дмитренко А.А. Сексуалы. Кто они? ИЦ «Семья», Киев, 2015 г.).
19. *Shakhramanyan V.A., Hakopyan S.V.* General sexology. Author's edition, Yerevan, 2011. Russian (Шахраманян В.А., Акопян С.В. Общая сексология. Авторское издание, Ереван, 2011 г.).
20. *Zharov L.V.* Paradoxes of Russian sexuality. Publishing house of the APSN of the SCSC HSE, Rostov-on-Don, 2006. Russian (Жаров Л.В. Парадоксы русской сексуальности. Изд. АПСН СКНЦ ВШ, Ростов-на-Дону, 2006 г.).
21. *Kogan M.I., Vorobyov S.V., Khripun I.A., Belousov I.I., Ibishev H.S.* Testosterone. From sexuality to metabolic control. Phoenix, Rostov-on-Don, 2017. Russian (Коган М.И., Воробьев С.В., Хрипун И.А., Белоусов И.И., Ибишев Х.С. Тестостерон. От сексуальности к метаболическому контролю. Феникс, Ростов-на-Дону, 2017 г.).
22. *Khripun I.A., Ismailov R.S., Belousov I.I., Ibishev Kh.S., Kogan M.I.* Androgen receptor gene CAG-trinucleotide repeat length affects function of endothelium in men with hypogonadism and type 2 diabetes mellitus. Urology Herald. 2024;12(4):14-22. https://doi.org/10.21886/2308-6424-2024-12-4-14-22. Russian (Хрипун И.А., Исмаилов Р.С., Белоусов И.И., Ибишев Х.С., Коган М.И. Длина CAG-тринуклеотидного повтора гена рецептора андрогенов влияет на функцию эндотелия у мужчин с гипогонадизмом и сахарным диабетом 2 типа. Вестник урологии. 2024;12(4):14-22. https://doi.org/10.21886/2308-6424-2024-12-4-14-22).
23. Testosterone and the Androgen Receptor. Thomas Gerald, Ganesh Raj. Urol Clin North Am. 2022 Nov;49(4):603–614. https://doi.org/10.1016/j.ucl.2022.07.004.
24. Is Testosterone a Food for the Brain? Giacomo Ciocca , Erika Limoncin, Eleonora Carosa, Stefania Di Sante, Giovanni L Gravina, Daniele Mollaioli, Daniele Gianfrilli, Andrea Lenzi , Emmanuele A Jannini. Sex Med Rev. 2016 Jan;4(1):15–25. https://doi.org/10.1016/j.sxmr.2015.10.007.
25. *Kogan M.I., Kireyev A.Y., Afoko A.A., Fomkin R.G., Tampuori J.K.* Different levels of testosterone in the blood and polymorphism of the androgen receptor gene in patients with symptomatic BPH depending on their sexual activity. European Urology Supplements of 24-th Annual EAU Congress (Abstracts). Stockholm, Sweden. 2009. Abstract 356.

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