KOTUŁA, Jacek, KAPLER, Marta, MĄSIOR, Magdalena Natalia, ZINKOW, Karolina and ŚWIERCZEK, Izabella. Erectile dysfunction as a common complication of radical prostatectomy. Quality in Sport. 2024;32:55168 eISSN 2450-3118.
https://dx.doi.org/10.12775/QS.2024.32.55168
https://apcz.umk.pl/QS/article/view/55168

The journal has been 20 points in the Ministry of Higher Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Higher Education and Science of 05.01.2024. No. 32553.
Has a Journal's Unique Identifier: 201398. Scientific disciplines assig589 ned: Economics and finance (Field of social sciences); Management and Quality Sciences (Field of social sciences).
Punkty Ministerialne z 2019 - aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 r. Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398.
Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych).

The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 13.09.2024. Revised: 12.11.2024. Accepted: 13.11.2024. Published: 14.11.2024.

Erectile dysfunction as a common complication of radical prostatectomy

Marta Kapler,
Ludwik Rydygier Specialist Hospital in Kraków, Złotej Jesieni 1, 31-826, Kraków
https://orcid.org/0009-0008-4973-1396
martakapler@gmail.com

Jacek Kotuła,
St, Anne's Hospital in Miechów, Szpitalna 3, 32-200, Miechów https://orcid.org/0009-0005-5212-2362
jacekkoszat@gmail.com

Magdalena Natalia Mąsior,
Ludwik Rydygier Specialist Hospital in Kraków, Złotej Jesieni 1 Estate, 31-826, Kraków
https://orcid.org/0009-0006-4806-9949
masiormagdalena@gmail.com

Karolina Zinkow,
Gabriel Narutowicz Specialist City Hospital in Kraków, Prądnicka 35, 31-202, Kraków
https://orcid.org/0009-0006-6891-7984
karolina1316@autograf.pl

Corresponding Author
Izabella Świerczek
Janusz Korczak Voivodeship Specialist Hospital, Slupsk
https://orcid.org/0000-0001-5958-626X
swierczek.izabella.natalia@gmail.com

Abstract

Prostate cancer is a widespread disorder among older men cured in most cases by radical prostatectomy. Erectile dysfunction, among other sexual disabilities, following a prostatectomy, plays an important role in the quality of life of these patients. Due to the high prevalence of this problem, the knowledge about health aspects leading to postoperative erectile dysfunction should be extended, enabling better prevention of this disorder.

This study aims to assess the risks and benefits of preoperative sexual stimulation in patients undergoing different types of prostatectomy on erectile dysfunction by analysing available data from articles found on several internet archives such as PubMed, Google Scholar or Embase.

This research shows that erectile function in patients undergoing radical prostatectomy depends both on protective factors of ED, risk factors of ED preoperatively, active sexual rehabilitation before and after surgery, and finally on the type of procedure itself. Patients benefit from good sexual conditions before the surgery, few risk factors such as obesity or cardiovascular diseases, having undergone one of nerve-sparing techniques and active sexual rehabilitation in the postoperative period.

Keywords: preoperative masturbation, erectile dysfunction, ED, prostatectomy, sexual dysfunction, quality of life

Introduction

Prostate cancer is the most common disease among males worldwide [1]. In the general population, it is the second most common cancer and the second leading cause of cancer death among men in Poland, with approximately 35 000 (in 2019) cases and 4 440 deaths (in 2014) [2]. Annual deaths from this condition are on a rise, when comparing the coefficient of deaths per 100 000 men: 16.97 men in 2000 to 26.22 in 2015 [3]. Prognosis indicates that the total number of deaths will also rise from about 4 440 in 2014 to an estimated 6 550 by 2030 [4]. Across the European continent, a significant progress has been made, with approximately 352 000 avoided deaths between 1989 and 2021, reflecting the advancements in diagnosis and treatment [5].

The influence of masturbation on health had a fluctuating relationship through the ages. Masturbation was viewed for most of history in a bad light and was often linked to a variety of conditions [6]. During the 18th and 19th centuries, masturbation was thought to lead to either physical or mental deterioration of health [7]. This worldview was popularised, among others, by a Swiss doctor named Samuel Auguste Tissot, who declared the notion that excessive masturbation could lead to worsening of sight or even in extreme cases to insanity [8].

His ideas were repeated throughout the following centuries, which greatly affected the importance of masturbation and other sexual activities on the wellbeing of humans [9].

The attitude towards masturbation started to change from the beginning of the 20th century, when sexual activity and specifically masturbation, was more often viewed as a normal activity and not as harmful to health [10]. Current age researchers focus on masturbation in the context of sexual and psychological well being, as well as post-prostatectomy recovery options - for example, studies have shown that regular sexual activity, including masturbation, can lead to positive outcomes in treating or maintaining erection and overall penile health by improving blood flow [11], [12], [13].

Radical prostatectomy, a widely practised type of surgery in curing prostate cancer ends in up to 14%-90% cases [14] of noticeable postoperative issues such as erectile dysfunction (ED) or urinary incontinence [15]. One way of combating these complications are various forms of penile rehabilitation, which consist of various types of activities, ranging from stimulation performed by the patient himself to intraurethral drug administration [16], [17].

Aim of the study

This study assesses the impact of various risk factors leading to ED, differences between available types of radical prostatectomy and the influence of various forms of preoperative sexual activity (PSA), including masturbation, on postoperative wellbeing in patients undergoing radical prostatectomy based on available data found in open access medical archives. The gist of the article is to summarise current medical knowledge and trends in combating post-prostatectomy complications.

Methods

This study aims to conduct a comprehensive overview of existing research papers in terms of the impact of different types of PSA, among others, masturbation and strategies for mitigating the risk of ED in patients undergoing radical prostatectomy. This study undertook an overview of the following databases: PubMed, Google Scholar, ResearchGate, SpringerLink and ScienceDirect. Following keywords were used in search for adequate resources: “radical prostatectomy”, “erectile dysfunction”, “postoperative”, “preoperative”, “complications”, “sexual functions”, “urinary incontinence”, “masturbation”, “penile rehabilitation”, “quality of life”. The various sources obtained during the search consist of the following types of medical studies: prospective cohort studies, randomised controlled trials, observational studies, systematic reviews, meta-analysis and retrospective cohort studies.

Erectile dysfunction frequency in general population and as a compilation after radical prostatectomy

In Poland, ED prevalence ranges from 30.1% to around 61.1%, highlighting the importance of combating the condition [18]. As men age, the frequency of ED rises - below 2% in men younger than 40 years old [19], around 10% of men suffer from ED in their 40s, and almost 80% men suffer from this condition in the age of 80 [20].

The frequency of ED in patients suffering from diabetes mellitus is approximately 52,5% both in Europe's and Polish population [21]. Cardiovascular diseases pose a significant risk when considering sexual health - up to 62% of men who suffered a myocardial infarction suffer from ED [22].

The most significant risk factors in ED are: age [23], diabetes mellitus [24], cardiovascular disease and hypertension [22], smoking tobacco [25], obesity [26], psychological ailments [27], Lower Urinary Tract Symptoms (LUTS) and Benign Prostatic Hyperplasia (BPH) [28], endocrine disorders, especially low testosterone levels [29], environmental factors - exposure to toxins, pesticides, heavy metals [30]. Patients undergoing radical prostatectomy suffer from ED in almost 68% of cases [31]. In the first year after the procedure, the patients can expect worsening severity of ED, almost by 8.0 points on a 20-point scale [32]. The recovery of erectile functions is slow in the first postoperative year, with significant improvements only observed after 12 months post-surgery [33].

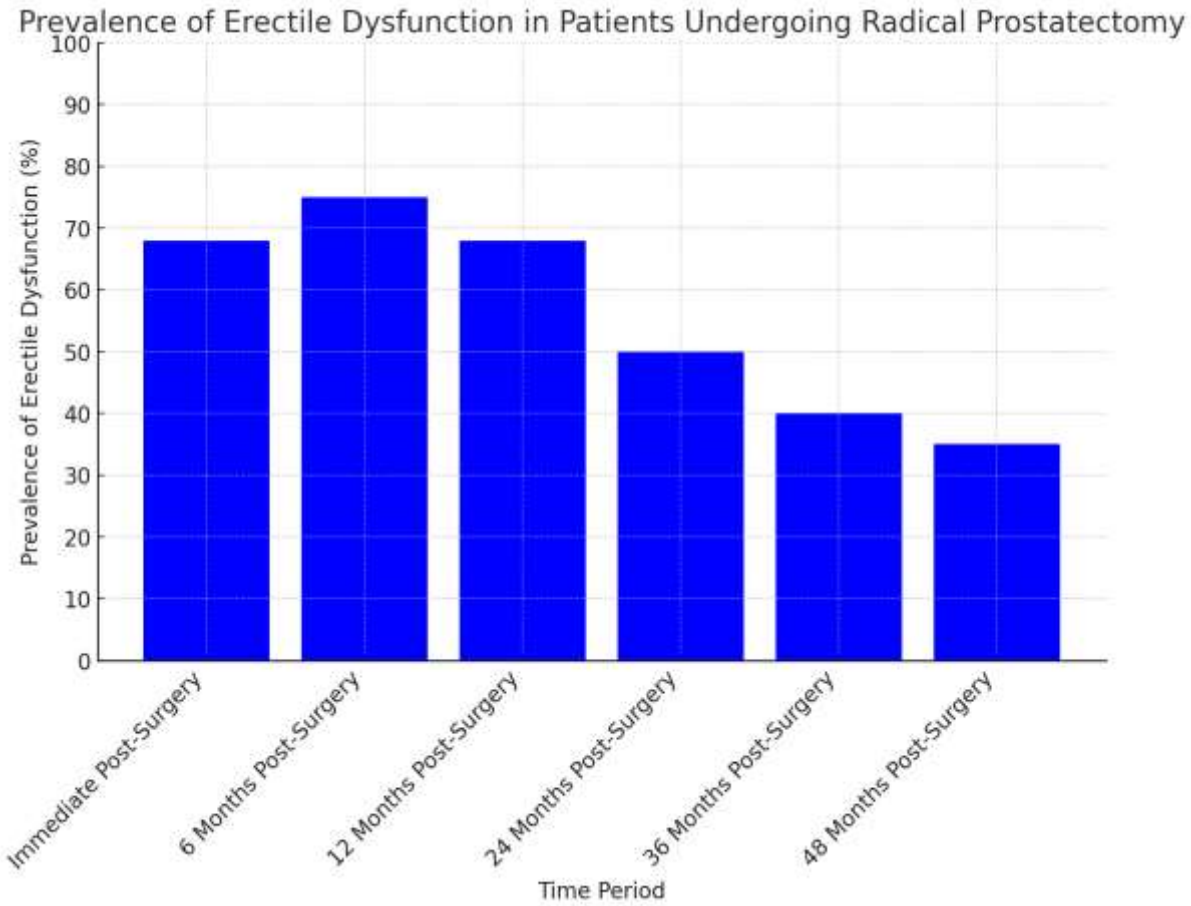

Figure 1. Prevalence Of Erectile Dysfunction In Patients Undergoing Radical Prostatectomy [33].

Different forms of autosexual activities in the general patient population and their potential positive effects on health

The number of techniques used in autosexual activities is only limited by human imagination. In this article, we will focus on the most popular types of masturbation. Gathered literature differentiates distinct forms of autosexual activities with the most common listed as follows. Manual masturbation is by far the most popular type of autosexual efforts employed by the general population. This technique utilises one's hands to achieve sexual arousal. Empirical research indicates that manual masturbation coalesces with improved penile blood flow, thus elevating general penial proficiency [10], [11], [15], [34].

The subsequent elevated blood flow improves penile oxygenic saturation which may improve long-term preservation of erectile function of the penis [35]. Masturbation devices, such as vibrating eggs, have also been studied for health enhancing capabilities. Studies indicate that such devices can significantly improve patients' satisfaction and sexual capabilities [36]. For example, the use of vibrating apparatus is believed to boost overall sexual experience coming from autosexual action in men suffering from ED [12]. Alternative devices, for instance, vacuum erection devices (VED) or penile traction therapy (PTT) accessories have also been examined and found to be beneficial in treating ED and Peyronie's disease [37]. Additionally, in conjunction with manual masturbation, this equipment is noted for their ability to provide constant stimulation, which is often more effective than manual activities alone [10]. Researchers also studied these devices for therapeutic benefits, suggesting that they can aid in treating sexual dysfunction by providing targeted stimulation [38]. However, patients with better general health condition tend to masturbate more regularly [39]. Studies show that as individuals age, they are more likely to show a decline in autosexual activities [39], [40]. Younger men, who are more likely to have preserved preoperative erectile functions, prioritise the safeguarding of this aspect of health postoperatively. This concern is widely taken into account among the younger population of men diagnosed with prostate cancer due to improving diagnostic capabilities that lead to stating the diagnosis far earlier than in previous decades [41], [42]. Unsurprisingly, people without a sexual partner report higher masturbation frequency than those with a sexual partner [43], [44].

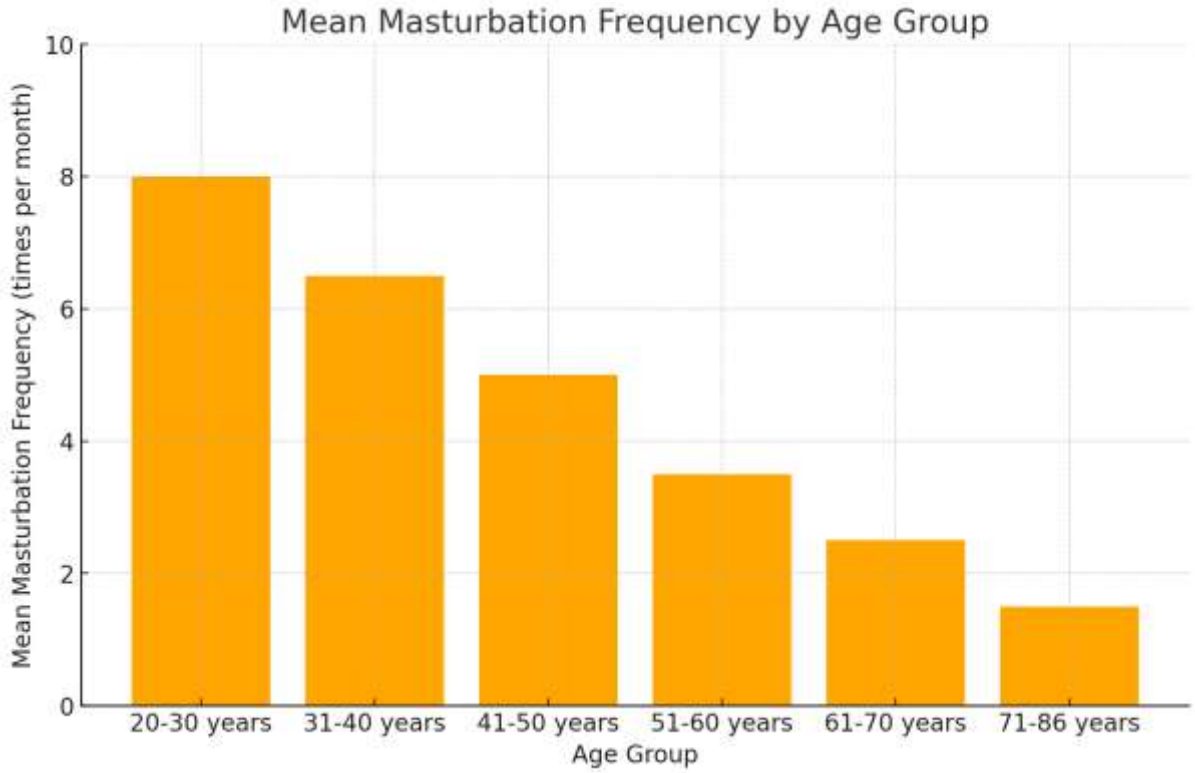

Figure 1. Mean Masturbation Frequency by Age Group [40].

Various surgical techniques used in radical prostatectomy and their effects on erectile dysfunction (ED)

Radical prostatectomy is a common form of treatment in curing patients with prostate cancer. The procedure involves dissecting prostate gland and if needed surrounding tissues, like lymphatic glands. The frequency of postoperative complications, including erectile dysfunction and urinary incontinence depends greatly on the type of surgery itself.

One of the most important advances in radical prostatectomy is the development of laparoscopic (LRP) nerve-sparing techniques. This type of procedure seeks to preserve the cavernous nerves, which are vital for preserving erectile function. The nerve-sparing approach can be divided into intrafascial nerve-sparing prostatectomy and interfascial nerve-sparing prostatectomy. Intrafascial nerve-sparing - this technique confides in precise chirurgical dissections within the prostatic fascia, allowing for utmost preservation of neurovascular bundle tissue. Intrafascial nerve-sparing technique excels in treating patients with low-risk cancer and preserved preoperative erectile function [45], [46]. Interfascial nerve-sparing technique involves dissection between the prostatic fascia and remaining neurovascular bundles. While not as precise as intrafascial dissection this surgery still offers a substantial preservation of the nerves and is employed in cases where cancer control is a top priority [47], [48].

Robot-assisted radical prostatectomy (RARP) gains in popularity due to its higher margin of precision and improves visual capabilities. The use of robotic systems enables surgeons to perform intricate dissections with much greater control, thus improving rates of nerve preservation and reducing postoperative complications.

Medical research shows that RARP can lead to superior early postoperative urinary incontinence and erectile function on preoperative or even improved levels of functioning compared to open or laparoscopic approaches to treating prostate cancer [49], [50], [51], [52].

Open radical prostatectomy (OPR) commits to a larger incision and a direct access to the prostate gland. While being efficient with treating cancer, this type of operation causes longer recovery time and higher risk of complications in patients [53]. In contrast the laparoscopic approach utilises smaller incisions and far better view and precision caused by the use of a laparoscopic camera. Lower level of precision in traditional methods results in longer postoperative recovery, more postoperative pain and recurring complications [54]. Although both traditional and laparoscopic methods can be employed in nerve-sparing procedures, with less complications in the latter robotic techniques tower above both of the previously mentioned techniques [55], [56].

The choice of a preferred surgical technique in radical prostatectomy greatly affects patients' postoperative quality of life. ORP comes with the highest risk of postoperative ED due to potential damage to neurovascular bundles during surgery. Nerve-sparing surgery in combination with robot assisted techniques provide promising results in terms of preserving erectile function and urinary continence compared to other ways of performing radical prostatectomy [57], although with the overall lowest risk of postoperative ED varies thanks to the more precise robotic control of neurovascular damage, the final outcome can be surgeon - dependant [58], [59]. Ongoing research and advances, including personalised therapies, in the field of minimising adverse effect on postoperative complications, keep on refining the approach to optimal cancer control while minimising adverse effects on sexual and urinary functions [45], [48], [60], [61].

Risk factors affecting the frequency of ED after radical prostatectomy

Research indicates that preoperative erectile function is a major predictor of postoperative outcomes, including erectile function and continence. Wille et al. found out that patients with better erectile function were more likely to succeed in the preservation of postoperative continence and sexual abilities after surgical removal of prostate [62]. Additionally, vascular risk factors were found to negatively impact erectile function recovery after radical prostatectomy notwithstanding patients' age, preoperative erectile function and surgical technique employed in the process. Reports indicate that preoperative management of vascular health is crucial for better sexual function preservation [63]. Psychological factors also play a role in keeping postoperative sexual abilities on par with those previous to the surgery. Messaoudi et al. proved that higher preoperative motivation to preserve sexual functions and psychological preparedness for radical prostatectomy was directly associated with improved postoperative outcomes both erectile function and overall sexual satisfaction [64].

Analysis of the impact of preoperative masturbation on postoperative erectile and autosexual function after radical prostatectomy

The affiliation between preoperative autosexual activity and postoperative erectile function in patients undergoing prostatectomy is a critical area of interest due to its huge potential implications for improving patients' quality of life. As a result, recovery strategies for this group of patients may be improved. Positive effects of regular masturbation were observed in each and every age group [41], [42]. Although patients suffering from fewer comorbidities and better overall health condition were more keen to engage in regular masturbation [39] and could expect better postoperative outcomes following radical prostatectomy in terms of ED and urinary continence [41], [65], [66]. Postoperative erectile functions were found to be susceptible to enhancement by the use of pharmacologic therapies such as PDE-5 inhibitors. Many cases report the use of phosphodiesterase type 5 inhibitors (PDE5-I) while treating post-prostatectomy ED, used frequently as first-line treatment following radical prostatectomy [67]. Researchers highlight the benefits of postoperative PDE5-I therapy in patients undergoing bilateral nerve sparing prostatectomy [63]. Furthermore, early indications show that the introduction of the Medicated Urethral System for erection (MUSE) postoperatively, has been associated with faster recovery of erectile function and successful sexual activities [68], [69]. MUSE works via inserting a small capsule containing Alprostadil into the urethra which improves penile blood flow and, in consequence, erection. Penile rehabilitation is essential in preserving erectile functions after radical prostatectomy due to the significant incidents of postoperative erectile dysfunction. A research by Meissner et al. found out that patients who perform autosexual activities before the operation were found to have a higher rate of moderate to good erectile function compared to those who did not commit to autosexual rehabilitation after 24 months since the operation (47.5% vs. 37.5%; P=0.193) [70]. Positive effects of regular masturbation were observed in each and every age group [41], [42]. These patients also experienced more frequent morning erections than those that abstained from masturbation (54.6% vs. 34.9%; P=0.011). Furthermore, urinary continence was also higher in patients who performed autosexual activities than in those patients who did not perform autosexual activities (83.1% vs. 70.2%; P=0.042) [70].

The choice of appropriate type of operation is crucial in maintaining high quality of life after the surgery including keeping erectile function and urinary continence. Nerve-sparing techniques are preferred when aiming to preserve those abilities compared to traditional technique [71]. A study found out that 97% of patients who underwent bilateral nerve-sparing operations were spared from erectile dysfunction compared to 80% who underwent unilateral nerve-sparing operations [72].

Conclusions

The study highlights the significance of preoperative risk factors and actions that could decrease the risk of post-prostatectomy erectile dysfunction. The analysis highlights the fact that the preservation of erectile functions starts well before the operation - minimising the risk factors, proper psychological support, the choice of an appropriate surgical method and finally adequate methods of postoperative rehabilitation must be mutually dependent.

Preoperative autosexual activities, including masturbation, play a vital role in enhancing postoperative sexual health, urinary continence, and quality of life of patients undergoing radical prostatectomy. This insight is crucial for developing preoperative strategies that combat potential complications associated with this type of procedure. Specifically, these findings indicated that higher preoperative sexual and autosexual activities correlated with a reduced risk of postoperative erectile dysfunction and urinary incontinence. This analysis proves that tailored preoperative interventions, including counselling on the importance of sexual health can lead to enhanced postoperative health. Choosing the least nerve-damaging operation method is crucial in long-term patient well-being with laparoscopic procedures leading the way currently and robot assisted methods in the future. Further research is necessary to validate these findings and explore the underlying conditions both mitigating and inducing postoperative erectile dysfunction to fully understand the cause and therefore find adequate alignment. As shown, the wellbeing of a patient not only lies in the gifted hands of the surgeons, but also, literally, in patients' hands.

Disclosures:

Author's contribution:

Conceptualization: Jacek Kotuła, Karolina Zinkow, Magdalena N. Mąsior
Methodology: Jacek Kotuła, Marta Kapler, Izabella Świerczek
Formal analysis: Karolina Zinkow, Magdalena N. Mąsior
Investigation: Jacek Kotuła, Izabella Świerczek, Karolina Zinkow
Resources: Magdalena N. Mąsior, Marta Kapler, Marta Kapler
Data Curation: Izabella Świerczek, Karolina Zinkow
Writing - rough preparation: Jacek Kotuła, Karolina Zinkow
Writing - review and editing: Magdalena N. Mąsior, Karolina Zinkow
Visualisation: Izabella Świerczek, Magdalena N. Mąsior
Supervision: Jacek Kotuła, Izabella Świerczek, Magdalena N. Mąsior, Marta Kapler, Karolina Zinkow

All authors have read and agreed with the published version of the manuscript.

Funding statement:
The study did not receive special funding.

Institutional review board statement:
Not applicable.

Informed consent statement:
Not applicable.

Data availability statement:
Not applicable.

Conflict of interest:
The authors declare no conflict of interest.

References

1. Napodano, G.; Ferro, M.; Sanseverino, R. High-Risk Prostate Cancer: A Very Challenging Disease in the Field of Uro-Oncology. Diagnostics 2021, 11, 400. https://doi.org/10.3390/diagnostics11030400
2. Didkowska, J., Wojciechowska, U., Michalek, I.M. et al. Cancer incidence and mortality in Poland in 2019. Sci Rep 12, 10875 (2022). https://doi.org/10.1038/s41598-022-14779-6
3. Pikala M, Burzyńska M, Maniecka-Bryła I. Epidemiology of Mortality Due to Prostate Cancer in Poland, 2000–2015. International Journal of Environmental Research and Public Health. 2019; 16(16):2881. https://doi.org/10.3390/ijerph16162881
4. Czaderny K. High prostate cancer mortality in Poland. A spatial, temporal and structural analysis. Przegl Epidemiol. 2018;72(2):235-246. PMID: 30111069.
5. La Vecchia, Carloa; Negri, Evaa,b; Carioli, Gretaa,c. Progress in cancer epidemiology: avoided deaths in Europe over the last three decades. European Journal of Cancer Prevention 31(4) 388-392, July 2022. | DOI: 10.1097/CEJ.0000000000000714
6. Frederick M. Hodges, The Antimasturbation Crusade in Antebellum American Medicine, The Journal of Sexual Medicine, Volume 2, Issue 5, 1 September 2005, Pages 722–731, https://doi.org/10.1111/j.1743-6109.2005.00133.x
7. Alsaoub, Nour (2015) Female Autoerotism in Twentieth Century Sexology and Sex Research. PhD thesis, University of York, uk.bl.ethos.666621
8. Zachar P, Kendler KS. Masturbatory insanity: the history of an idea, revisited. Psychological Medicine. 2023;53(9):3777-3782. doi:10.1017/S0033291723001435
9. Laury, G. V. (1979). Myths About Masturbation Throughout The Ages. Journal of Sex Education and Therapy, 5(1), 3–4. https://doi.org/10.1080/01614576.1979.11074606
10. Kocharyan G. (2023). Masturbation and its consequences in the light of scientific ideas and empirical data. Psychological Counseling and Psychotherapy, (19), 38-44. https://doi.org/10.26565/2410-1249-2023-19-06
11. Huang, S.; Niu, C.; Santtila, P. Masturbation Frequency and Sexual Function in Individuals with and without Sexual Partners. Sexes 2022, 3, 229-243. https://doi.org/10.3390/sexes3020018
12. Zamboni, B. D., & Crawford, I. (2003). Using Masturbation in Sex Therapy: Relationships Between Masturbation, Sexual Desire, and Sexual Fantasy. Journal of Psychology & Human Sexuality, 14(2–3), 123–141. https://doi.org/10.1300/J056v14n02_08
13. Csako, R. I., Rowland, D. L., Hevesi, K., Vitalis, E., & Balalla, S. (2022). Female Sexuality in Aotearoa/New Zealand: Factors and Sexual Response Associated with Masturbation. International Journal of Sexual Health, 34(4), 521–539. https://doi.org/10.1080/19317611.2022.2099499

14. Asker H, Yilmaz-Oral D, Oztekin CV, Gur S. An update on the current status and future prospects of erectile dysfunction following radical prostatectomy. Prostate. 2022 Sep;82(12):1135-1161. doi: 10.1002/pros.24366. Epub 2022 May 17. PMID: 35579053.
15. Burnett AL. Erectile Dysfunction Following Radical Prostatectomy. JAMA. 2005;293(21):2648–2653. doi:10.1001/jama.293.21.2648
16. Kacker, R. and O'Leary, M.P. (2013), Penile rehabilitation after radical prostatectomy. Trends in Urology & Men's Health, 4: 12-16. https://doi.org/10.1002/tre.351
17. Mehta A, Sigman M. Penile rehabilitation after radical prostatectomy. Med Health R I. 2009 Oct;92(10):331-3. PMID: 19911712.
18. Przydacz, M., Chlosta, M., Rajwa, P. et al. Population-level prevalence, effect on quality of life, and treatment behavior for erectile dysfunction and premature ejaculation in Poland. Sci Rep 13, 13168 (2023). https://doi.org/10.1038/s41598-023-39968-9
19. Prins, J., Blanker, M., Bohnen, A. et al. Prevalence of erectile dysfunction: a systematic review of population-based studies. Int J Impot Res 14, 422–432 (2002). https://doi.org/10.1038/sj.ijir.3900905
20. Pellegrino F, Sjoberg DD, Tin AL, Benfante NE, Briganti A, Montorsi F, Eastham JA, Mulhall JP, Vickers AJ. Relationship Between Age, Comorbidity, and the Prevalence of Erectile Dysfunction. Eur Urol Focus. 2023 Jan;9(1):162-167. doi: 10.1016/j.euf.2022.08.006. Epub 2022 Aug 26. PMID: 36031560; PMCID: PMC10353735.
21. Systematic Review or Meta-analysis High prevalence of erectile dysfunction in diabetes: a systematic review and meta-analysis of 145 studies Y. Kouidrat, D. Pizzol, T. Cosco, T. Thompson, M. Carnaghi, A. Bertoldo, M. Solmi, B. Stubbs, N. Veronese
22. Rinkūnienė, Egidija, Silvija Gimžauskaitė, Jolita Badarienė, Vilma Dženkevičiūtė, Milda Kovaitė, and Alma Čypienė. 2021. "The Prevalence of Erectile Dysfunction and Its Association with Cardiovascular Risk Factors in Patients after Myocardial Infarction" Medicina 57, no. 10: 1103. https://doi.org/10.3390/medicina57101103
23. Castro RP, Hernández PC, Casilda RR, García JR, Tapia MJ. Epidemiología de la disfunción eréctil. Factores de riesgo [Epidemiology of erectile dysfunction. Risk factors]. Arch Esp Urol. 2010 Oct;63(8):637-9. Spanish. PMID: 20978295.
24. Oyelade BO, Jemilohun AC, Aderibigbe SA. Prevalence of erectile dysfunction and possible risk factors among men of South-Western Nigeria: a population based study. Pan Afr Med J. 2016 Jun 8;24:124. doi: 10.11604/pamj.2016.24.124.8660. PMID: 27642462; PMCID: PMC5012735.
25. DeLay KJ, Haney N, Hellstrom WJ. Modifying Risk Factors in the Management of Erectile Dysfunction: A Review. World J Mens Health. 2016 Aug;34(2):89-100. https://doi.org/10.5534/wjmh.2016.34.2.89

26. Molina-Vega, María1,2; Asenjo-Plaza, Maite3; Banderas-Donaire, María José3; Hernández-Ollero, María Dolores4; Rodríguez-Moreno, Silvia4; Álvarez-Millán, Juan J5; Cabezas-Sanchez, Pablo5; Cardona-Díaz, Fernando1,2; Alcaide-Torres, Juan1; Garrido-Sánchez, Lourdes1,2; Castellano-Castillo, Daniel1,2; Tinahones, Francisco J1,2,; Fernández-García, José C1,2,. Prevalence of and risk factors for erectile dysfunction in young nondiabetic obese men: results from a regional study. Asian Journal of Andrology 22(4):p 372-378, Jul–Aug 2020. | DOI: 10.4103/aja.aja_106_19
27. Nguyen HMT, Gabrielson AT, Hellstrom WJG. Erectile Dysfunction in Young Men-A Review of the Prevalence and Risk Factors. Sex Med Rev. 2017 Oct;5(4):508-520. doi: 10.1016/j.sxmr.2017.05.004. Epub 2017 Jun 20. PMID: 28642047.
28. Calogero, A. E., Burgio, G., Condorelli, R. A., Cannarella, R., & La Vignera, S. (2018). Epidemiology and risk factors of lower urinary tract symptoms/benign prostatic hyperplasia and erectile dysfunction. The Aging Male, 22(1), 12–19. https://doi.org/10.1080/13685538.2018.1434772
29. Allen MS, Walter EE. Erectile Dysfunction: An Umbrella Review of Meta-Analyses of Risk-Factors, Treatment, and Prevalence Outcomes. J Sex Med. 2019 Apr;16(4):531-541. doi: 10.1016/j.jsxm.2019.01.314. Epub 2019 Mar 2. PMID: 30833150.
30. Roychoudhury, Shubhadeep, Saptaparna Chakraborty, Arun Paul Choudhury, Anandan Das, Niraj Kumar Jha, Petr Slama, Monika Nath, Peter Massanyi, Janne Ruokolainen, and Kavindra Kumar Kesari. 2021. "Environmental Factors-Induced Oxidative Stress: Hormonal and Molecular Pathway Disruptions in Hypogonadism and Erectile Dysfunction" Antioxidants 10, no. 6: 837. https://doi.org/10.3390/antiox10060837
31. Saad Thamer Alshahrani, Omar Safar, Nazal A Almsaoud, Adel Elatreisy, Ahmed Ibrahim, Sulaiman M Alkhaldi, Abdulhamid M Alkhaldi, Raed Alwadai, Muath Almurayyi, Saeed A Asiri, Abdulaziz M Alqahtani, Abdullah Saleh Alshafi, Saleh Alghamdi, Ahmed Al-hadi, Basel Hakami, Meshari A. Alzahrani. Evaluation of the efficacy of stem cell therapy in erectile dysfunction after radical prostatectomy: a comprehensive systematic review. Journal of Men's Health. 2024. 20(3);25-31.
32. Neuzillet, Yann1,; Rouanne, Mathieu1; Dreyfus, Jean-François2; Raynaud, Jean-Pierre3; Schneider, Marc4; Roupret, Morgan5; Drouin, Sarah5; Galiano, Marc6; Cathelinau, Xavier6; Lebret, Thierry1; Botto, Henry1. Metabolic syndrome, levels of androgens, and changes of erectile dysfunction and quality of life impairment 1 year after radical prostatectomy. Asian Journal of Andrology 23(4):p 370-375, Jul–Aug 2021. | DOI: 10.4103/aja.aja_88_20
33. Jurys, T., Burzynski, B., Potyka, A., & Paradysz, A. (2021). Post-Radical Prostatectomy Erectile Dysfunction Assessed Using the IIEF-5 Questionnaire – A Systematic Literature Review. International Journal of Sexual Health, 34(1), 55–64. https://doi.org/10.1080/19317611.2021.1936333

34. E. Limoncin, G.L. Gravina, F. Lotti, E. Maseroli, G. Ciocca, G. Corona, M. Maggi, Y. Reisman, G. Balercia, A. Lenzi, E.A. Jannini, PS-06-001 The Masturbation Erection Index (MEI): Validation of a New Psychometric Tool Derived from the International Index of Erectile Function (IIEF-6) and from the Erection Hardness Score (EHS) for Measuring Erectile Function During Masturbation, The Journal of Sexual Medicine, Volume 16, Issue Supplement_2, May 2019, Page S18,
35. G. Fallara, E. Pozzi, F. Belladelli, C. Corsini, M. Raffo, L. Candela, A. Costa, D. Cignoli, N. Schifano, A. D'Arma, P. Capogrosso, L. Boeri, W. Cazzaniga, R. Matloob, V. Mirone, F. Dehó, F. Montorsi, A. Salonia. A0534 - Relevance of self-masturbation-related vs. coital erectile function in the real-life management of patients with erectile dysfunction. European Urology, Volume 81, Supplement 1, 2022, https://doi.org/10.1016/S0302-2838(22)00617-0
36. Rubin, Elizabeth S. MD; Deshpande, Neha A. MD; Vasquez, Peter J. MD; Kellogg Spadt, Susan PhD, CRNP. A Clinical Reference Guide on Sexual Devices for Obstetrician–Gynecologists. Obstetrics & Gynecology 133(6):p 1259-1268, June 2019. | DOI: 10.1097/AOG.0000000000003262
37. F. Kraus, The practice of masturbation for women: The end of a taboo?, Sexologies, Volume 26, Issue 4, 2017, Pages e35-e41, ISSN 1158-1360, https://doi.org/10.1016/j.sexol.2017.09.009.
38. Justin Mehr, Shana Santarelli, Travis P. Green, John Beetz, Saravan Panuganti, Run Wang, Emerging Roles of Penile Traction Therapy and Vacuum Erectile Devices, Sexual Medicine Reviews, Volume 10, Issue 3, 2022, Pages 421-433, ISSN 2050-0521,
39. Hyde Z, Flicker L, Hankey GJ, Almeida OP, McCaul KA, Chubb SA, Yeap BB. Prevalence and predictors of sexual problems in men aged 75-95 years: a population-based study. J Sex Med. 2012 Feb;9(2):442-53. doi: 10.1111/j.1743-6109.2011.02565.x. Epub 2011 Dec 6. PMID: 22145992.
40. Gerressu M, Mercer CH, Graham CA, Wellings K, Johnson AM. Prevalence of masturbation and associated factors in a British national probability survey. Arch Sex Behav. 2008 Apr;37(2):266-78. doi: 10.1007/s10508-006-9123-6. PMID: 17333329.
41. Mulhall JP, Bella AJ, Briganti A, McCullough A, Brock G. Erectile function rehabilitation in the radical prostatectomy patient. J Sex Med. 2010 Apr;7(4 Pt 2):1687-98. doi: 10.1111/j.1743-6109.2010.01804.x. PMID: 20388165.
42. Jo JK, Jeong SJ, Oh JJ, Lee SW, Lee S, Hong SK, Byun SS, Lee SE. Effect of Starting Penile Rehabilitation with Sildenafil Immediately after Robot-Assisted Laparoscopic Radical Prostatectomy on Erectile Function Recovery: A Prospective Randomized Trial. J Urol. 2018 Jun;199(6):1600-1606. doi: 10.1016/j.juro.2017.12.060. Epub 2018 Jan 4. PMID: 29307683.
43. Hawes ZC, Wellings K, Stephenson J. First heterosexual intercourse in the United kingdom: a review of the literature. J Sex Res. 2010 Mar;47(2):137-52. doi: 10.1080/00224490903509399. PMID: 20358457.
44. Laumann EO, Paik A, Rosen RC. Sexual Dysfunction in the United States: Prevalence and Predictors. JAMA. 1999;281(6):537–544. doi:10.1001/jama.281.6.537

45. Walsh PC, Donker PJ. Impotence following radical prostatectomy: insight into etiology and prevention. J Urol. 1982 Sep;128(3):492-7. doi: 10.1016/s0022-5347(17)53012-8. PMID: 7120554.
46. Montorsi F, Wilson TG, Rosen RC, Ahlering TE, Artibani W, Carroll PR, Costello A, Eastham JA, Ficarra V, Guazzoni G, Menon M, Novara G, Patel VR, Stolzenburg JU, Van der Poel H, Van Poppel H, Mottrie A; Pasadena Consensus Panel. Best practices in robot-assisted radical prostatectomy: recommendations of the Pasadena Consensus Panel. Eur Urol. 2012 Sep;62(3):368-81. doi: 10.1016/j.eururo.2012.05.057. Epub 2012 Jun 7. PMID: 22763081.
47. Burnett AL. Erectile function outcomes in the current era of anatomic nerve-sparing radical prostatectomy. Rev Urol. 2006 Spring;8(2):47-53. PMID: 17021626; PMCID: PMC1578536.
48. Hu JC, Gu X, Lipsitz SR, Barry MJ, D'Amico AV, Weinberg AC, Keating NL. Comparative effectiveness of minimally invasive vs open radical prostatectomy. JAMA. 2009 Oct 14;302(14):1557-64. doi: 10.1001/jama.2009.1451. PMID: 19826025.
49. Ficarra V, Novara G, Artibani W, Cestari A, Galfano A, Graefen M, Guazzoni G, Guillonneau B, Menon M, Montorsi F, Patel V, Rassweiler J, Van Poppel H. Retropubic, laparoscopic, and robot-assisted radical prostatectomy: a systematic review and cumulative analysis of comparative studies. Eur Urol. 2009 May;55(5):1037-63. doi: 10.1016/j.eururo.2009.01.036. Epub 2009 Jan 25. PMID: 19185977.
50. Tewari A, Srivasatava A, Menon M; Members of the VIP Team. A prospective comparison of radical retropubic and robot-assisted prostatectomy: experience in one institution. BJU Int. 2003 Aug;92(3):205-10. doi: 10.1046/j.1464-410x.2003.04311.x. PMID: 12887468.
51. Ficarra V, Novara G, Fracalanza S, D'Elia C, Secco S, Iafrate M, Cavalleri S, Artibani W. A prospective, non-randomized trial comparing robot-assisted laparoscopic and retropubic radical prostatectomy in one European institution. BJU Int. 2009 Aug;104(4):534-9. doi: 10.1111/j.1464-410X.2009.08419.x. Epub 2009 Mar 5. PMID: 19281468.
52. Covas Moschovas M, Bhat S, Onol FF, Rogers T, Roof S, Mazzone E, Mottrie A, Patel V. Modified Apical Dissection and Lateral Prostatic Fascia Preservation Improves Early Postoperative Functional Recovery in Robotic-assisted Laparoscopic Radical Prostatectomy: Results from a Propensity Score-matched Analysis. Eur Urol. 2020 Dec;78(6):875-884. doi: 10.1016/j.eururo.2020.05.041. Epub 2020 Jun 24. PMID: 32593529.
53. Eastham JA, Kattan MW, Riedel E, Begg CB, Wheeler TM, Gerigk C, Gonen M, Reuter V, Scardino PT. Variations among individual surgeons in the rate of positive surgical margins in radical prostatectomy specimens. J Urol. 2003 Dec;170(6 Pt 1):2292-5. doi: 10.1097/01.ju.0000091100.83725.51. PMID: 14634399.
54. Guillonneau B, Vallancien G. Laparoscopic radical prostatectomy: the Montsouris experience. J Urol. 2000 Feb;163(2):418-22. doi: 10.1016/s0022-5347(05)67890-1. PMID: 10647644.

55. Menon M, Tewari A, Peabody J; VIP Team. Vattikuti Institute prostatectomy: technique. J Urol. 2003 Jun;169(6):2289-92. doi: 10.1097/01.ju.0000067464.53313.dd. PMID: 12771773.
56. Brown JA, Rodin D, Lee B, Dahl DM. Transperitoneal versus extraperitoneal approach to laparoscopic radical prostatectomy: an assessment of 156 cases. Urology. 2005 Feb;65(2):320-4. doi: 10.1016/j.urology.2004.09.018. PMID: 15708046.
57. Ficarra V, Novara G, Ahlering TE, Costello A, Eastham JA, Graefen M, Guazzoni G, Menon M, Mottrie A, Patel VR, Van der Poel H, Rosen RC, Tewari AK, Wilson TG, Zattoni F, Montorsi F. Systematic review and meta-analysis of studies reporting potency rates after robot-assisted radical prostatectomy. Eur Urol. 2012 Sep;62(3):418-30. doi: 10.1016/j.eururo.2012.05.046. Epub 2012 Jun 1. PMID: 22749850.
58. Tomás Bernardo Costa Moretti, Luís Alberto Magna, Leonardo Oliveira Reis, Surgical Results and Complications for Open, Laparoscopic, and Robot-assisted Radical Prostatectomy: A Reverse Systematic Review, European Urology Open Science, Volume 44, 2022, Pages 150-161, ISSN 2666-1683, https://doi.org/10.1016/j.euros.2022.08.015.
59. Whelan, Patrick; Ekbal, Shahid; Nehra, Ajay. Erectile dysfunction in robotic radical prostatectomy: Outcomes and management. Indian Journal of Urology 30(4):p 434-442, Oct–Dec 2014. | DOI: 10.4103/0970-1591.142078
60. Patel VR, Sivaraman A, Coelho RF, Chauhan S, Palmer KJ, Orvieto MA, Camacho I, Coughlin G, Rocco B. Pentafecta: a new concept for reporting outcomes of robot-assisted laparoscopic radical prostatectomy. Eur Urol. 2011 May;59(5):702-7. doi: 10.1016/j.eururo.2011.01.032. Epub 2011 Jan 25. PMID: 21296482.
61. İnkaya A, Tahra A, Sobay R, Kumcu A, Küçük EV, Boylu U. Comparison of surgical, oncological, and functional outcomes of robot-assisted and laparoscopic radical prostatectomy in patients with prostate cancer. Turk J Urol. 2019 Nov 1;45(6):410-417. doi: 10.5152/tud.2019.48457. PMID: 31603415; PMCID: PMC6788567.
62. Wille S, Heidenreich A, Hofmann R, Engelmann U. Preoperative erectile function is one predictor for post prostatectomy incontinence. Neurourol Urodyn. 2007;26(1):140-3; discussion 144. doi: 10.1002/nau.20314. PMID: 16998858.
63. Clavell-Hernández J, Wang R. PDE-5 inhibitors should be used post radical prostatectomy as erection function rehabilitation? | Opinion: No. Int Braz J Urol. 2017 May-Jun;43(3):390-393. doi: 10.1590/S1677-5538.IBJU.2017.03.04. PMID: 28520337; PMCID: PMC5462128.
64. Messaoudi, R., Menard, J., Ripert, T. et al. Erectile dysfunction and sexual health after radical prostatectomy: impact of sexual motivation. Int J Impot Res 23, 81–86 (2011). https://doi.org/10.1038/ijir.2011.8
65. Potosky AL, Davis WW, Hoffman RM, Stanford JL, Stephenson RA, Penson DF, Harlan LC. Five-year outcomes after prostatectomy or radiotherapy for prostate cancer: the prostate cancer outcomes study. J Natl Cancer Inst. 2004 Sep 15;96(18):1358-67. doi: 10.1093/jnci/djh259. PMID: 15367568.

66. Stephenson AJ, Scardino PT, Eastham JA, Bianco FJ Jr, Dotan ZA, Fearn PA, Kattan MW. Preoperative nomogram predicting the 10-year probability of prostate cancer recurrence after radical prostatectomy. J Natl Cancer Inst. 2006 May 17;98(10):715-7. doi: 10.1093/jnci/djj190. Erratum in: J Natl Cancer Inst. 2012 Mar 7;104(5):423. PMID: 16705126; PMCID: PMC2242430.
67. Goh HJ, Sung JM, Lee KH, Jo JK, Kim KN. Efficacy of phosphodiesterase type 5 inhibitors in patients with erectile dysfunction after nerve-sparing radical prostatectomy: a systematic review and meta-analysis. Transl Androl Urol 2022;11(2):124-138. doi: 10.21037/tau-21-881
68. Raina, R., Pahlajani, G., Agarwal, A. and Zippe, C.D. (2007), The early use of transurethral alprostadil after radical prostatectomy potentially facilitates an earlier return of erectile function and successful sexual activity. BJU International, 100: 1317-1321. https://doi.org/10.1111/j.1464-410X.2007.07124.x
69. Raina R, Agarwal A, Nandipati KC, Zippe CD. 737: Interim Analysis of the Early use of MUSE Following Radical Prostatectomy (RP) to Facilitate Early Sexual Activity and Return of Spontaneous Erectile Function. J Urol. 2005;173(4S):200-201. doi:10.1016/S0022-5347(18)35969-X
70. Meissner VH, Dumler S, Kron M, Schiele S, Goethe VE, Bannowsky A, Gschwend JE, Herkommer K. Association between masturbation and functional outcome in the postoperative course after nerve-sparing radical prostatectomy. Transl Androl Urol. 2020 Jun;9(3):1286-1295. doi: 10.21037/tau.2020.03.19. PMID: 32676412; PMCID: PMC7354343.
71. Alivizatos G, Skolarikos A. Incontinence and erectile dysfunction following radical prostatectomy: a review. ScientificWorldJournal. 2005 Sep 13;5:747-58. doi: 10.1100/tsw.2005.94. PMID: 16170437; PMCID: PMC5936492.
72. Kyriazis, Iason, Theodoros Spinos, Arman Tsaturyan, Panagiotis Kallidonis, Jens Uwe Stolzenburg, and Evangelos Liatsikos. 2022. "Different Nerve-Sparing Techniques during Radical Prostatectomy and Their Impact on Functional Outcomes" Cancers 14, no. 7: 1601. https://doi.org/10.3390/cancers14071601