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EPIDEMIOLOGY & RISK FACTORS

Health-Related Quality of Life, Self-esteem and Sexual Functioning Among Patients Operated for Penile Cancer – A Cross-sectional Study



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ABSTRACT

Background: Penile cancer surgery affects physical, psychological, and sexual well-being, but the patient- and treatment-related factors predisposing to worse health-related quality of life (HRQoL) have not been well characterized.

Aim: We report treatment-related HRQoL changes among penile cancer survivors compared to the general population and the specific deficits that have the most profound effect, and we identify patient-related factors that predispose to a worse perceived HRQoL.

Methods: Patients (n = 107) who underwent operations for invasive penile cancer in two Finnish university hospitals from 2009 to 2019 were sent the Patient Reported Outcomes (PROs) questionnaire designed to measure HRQoL, self-esteem, overall sexual functioning, erections, and change in sexual function. We collected clinical information and socio-demographic characteristics, including age, partner status, children, vocational education, and employment status. Associations between patient- and treatment-related factors and HRQoL were analyzed using descriptive statistics and non-parametric tests. Linear regression models were used to compare the HRQoL differences between patients with penile cancer and the age-standardized average for the Finnish population.

Outcomes: A generic measure of HRQoL (15D), the Rosenberg Self-Esteem Scale, Overall Sexual Functioning Questionnaire, the Erection Hardness Score, and self-reported change in sexual functioning.

Results: Low scores in overall sexual functioning, erectile function, and changes in sexual functioning were associated with a lower HRQoL. An association was found between HRQoL and age, educational level, employment status, and place of residence. The HRQoL had a negative correlation with age. Patients with a high educational level, who were employed, or who lived in urban areas reported higher HRQoL. The mean HRQoL of penile cancer survivors was significantly lower than the age-standardized average HRQoL of the Finnish population.

Clinical Implications: Enhanced support and counseling is needed among penile cancer patients to improve the HRQoL during survivorship.

Strengths & Limitations: A nationwide sample with detailed information allowed comparisons of HRQoL between penile cancer patients and the general population. Due to cross-sectional nature of the study, the time between the surgery and the study intervention was heterogeneous, and this may have affected the results.

Conclusion: Penile cancer patients exhibit significant physical and psychological dysfunction, and the lack of sexual activity in general is what most compromises the QoL of penile cancer survivors. **Harju E, Pakarainen T, Vasarainen H, et al. Health-Related Quality of Life, Self-esteem and Sexual Functioning Among Patients Operated for Penile Cancer – A Cross-sectional Study. J Sex Med 2021;18:1524–1531.**

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Key Words: Health-Related Quality of Life; Penectomy; Penile Cancer; Penile Surgery; Sexual Functioning

INTRODUCTION

Penile cancer (PC) is a rare malignancy with an incidence of <1.0 of 100,000 globally and approximately 2 of 100,000 in Scandinavia.^{1,2} Areas with the highest worldwide incidence are marked by a high prevalence of human papilloma virus infection and phimosis,^{2,3} which, together with low socioeconomic status, are the main predisposing factors for development of PC.³ The incidence of PC peaks in the sixth decade of life, but PC affects younger men as well.

For obvious reasons, organ-sparing PC treatments are the preferred methods for the treatment of non-invasive and localized disease, which can be managed in many cases by topical chemotherapy, laser ablation, or glans resurfacing. Radiotherapy modalities can be considered for selective cases of invasive PC; however, surgery remains the most reliable option for providing a long-lasting cure.² Contemporary surgery for invasive PC aims at complete resection of the tumor with maximal preservation of the penile tissue. Generally, a 3–5 mm margin of healthy tissue is considered sufficient. Despite the best efforts, however, surgical PC treatment inevitably results in various degrees of disfigurement, consequences on the patient's bodily functions, self-image, and relations with a partner.^{4,5}

The relative rarity of the disease has promoted centralization of PC treatments in several countries, including Finland.⁶ This has aided in gaining a better understanding of PC as a disease, as well as increasing attention to the quality-of-life (QoL) aspects of PC treatment. Most studies report compromised QoL among patients with PC and a correlation between the extent of surgery and symptoms.^{7–9} As many as 50% of patients with PC may suffer from symptoms resembling traumatic stress disorder, which underscores the impact of this disease on the patient's psyche. However, no consensus has been reached regarding the optimal metrics for measuring QoL among these patients.⁷ A recent systematic review highlights this shortcoming and reports numerous unmet needs experienced by patients with PC.¹⁰ A need therefore exists for further investigations into the specific deficits that have the most profound effects on the QoL of patients with PC.

In the present study, we dissected the underlying causes of compromised QoL by employing a multi-dimensional tool that incorporates aspects of physical, mental, and social health.¹¹ The questionnaire has 15 dimensions, including sexual activity, with reference values of average QoL based on large population cohorts. We also employed widely used self-administered questionnaires on self-esteem, overall sexual functioning, and erectile function for further characterization of the patients' perceptions.^{9,12–14} We deemed that knowledge on these QoL aspects, together with thorough demographic and clinical data, would help in identifying the specific QoL deficits and their risk factors among patients with PC. We report a cross-sectional study of patients with PC utilizing a well-characterized QoL metric, together with measures of erectile

function, self-esteem, and sexual function. The widely used metrics allowed us to detect treatment-related QoL changes in comparison to the general population and to identify patient-related factors that predispose these patients to a worse perceived QoL. Our specific questions were: How are patient-related factors, self-esteem, overall sexual functioning, erection hardness score, and changes in sexual functioning associated with post-treatment QoL in patients with PC? How does the QoL of patients with PC compare to the mean QoL of the age- and gender-stratified Finnish population?

MATERIALS AND METHODS

Participants

Data on patients with PC who underwent operations in two university hospitals from 2009 to 2019 were collected from the hospital databases. Inclusion criteria were the diagnostic codes (C60, C60.0, C60.1, C60.2, and D07.4) included in the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, with an additional cross search with operation codes (KGB00, KGD00, KGD05, KGC10) according to the Nordic Medico-Statistical Committee (NOMESCO) Classification of Surgical Procedures (NCSP). Additional inclusion criteria were that the participant be living independently in his home and that his native language was either Finnish or Swedish. Exclusion criteria were living in a care facility, intermediate or severe memory disorder, or PC in a palliative phase.

The Patient Reported Outcomes (PRO) questionnaire and consent forms were mailed to the patients ($n = 107$) between May and June 2019 (Hospital 1) and between May and August 2020 (Hospital 2). The questionnaires were mailed again once to those who did not return the questionnaire in the first round. Permission to conduct the study was obtained from the institutional ethics committee (R19026H).

Survey Design

The design of PRO questionnaire started with a literature review of the Medline databases (Ovid, PubMed, Cinalh), PsycINFO, Scopus, and Web of Science databases. The keywords were "Penile cancer" and "Self-esteem" or "Quality of life" or "Sexuality," with synonyms for each keyword. From 168 articles, 11 publications with the best suited questionnaires were selected by consensus. The claims of the indicators were translated into Finnish, and the phrasing was checked three times by researchers and two people outside the research group.

The socio-demographic characteristics included age, partner status, children, vocational education, and employment status. Clinical information was collected from patient charts before the most recent penile surgery. The HRQoL was measured by the 15D, a validated, generic, self-administered measure of HRQoL.

Conceptually, the 15D is based on the World Health Organization definition of physical, mental, and social health. Its 15 dimensions are mobility, vision, hearing, breathing, sleeping, eating, speech, excretion, usual activities, mental function, discomfort and symptoms, depression, distress, vitality, and sexual activity.¹¹ The 15D score can be used as a pooled variable of all 15 dimensions (mean score), or each dimension can be presented separately. The dimensions are ranked into five different levels that describe the current health status of the respondent. The 15D score and the dimensional level values (on a 0–1 scale) are calculated from the health state descriptive system using a set of population-based preference or utility weights, where a higher score indicates a higher HRQoL. Improvement or deterioration of the HRQoL was determined by estimating the minimum clinically significant change for the 15D score as 0.015, and this was also regarded as a significant difference between the groups in cross-sectional analysis.^{15,16}

Global self-esteem was measured using the Rosenberg Self-Esteem Scale (RSES) (12), a 10 item self-reported measure that has shown strong psychometric properties.¹⁷ The items are answered on a four-point scale, ranging from strongly agree to strongly disagree (12). The scale ranges from 0–40. Scores between 15 and 25 are within the normal range, whereas scores below 15 suggest low self-esteem.^{18,12}

Overall sexual functioning was measured by a self-administered Overall Sexual Functioning Questionnaire (OSFQ).⁹ The OSFQ contains various questions divided into six subscales: *Sexual interest*: 0 (no sexual interest) to 4 (normal), *Sexual ability*: 0 (lack of ability) to 4 (no problems), *Sexual satisfaction*: 1 (lacking) to 4 (no change), *Relationship with partner*: 1 (very distressed) to 4 (unchanged, good), *Sexual identity*: 2 (very much changed) to 4 (normal), and *Frequency of coitus*: 1 (no sexual intercourse) to 4 (no reduction).⁹ The scoring of the six subscales was subsequently summarized and classified to form a global score of overall sexual function that, in turn, was divided into five categories: no sexual functioning (5 to 8), severely reduced (9 to 14), moderately reduced (15 to 19), slightly reduced (20 to 22), and normal (23 to 24).⁹

The Erection Hardness Score (EHS) is a single-item Likert scale: grade 0 represents “not enlarged,” grade 1 represents “larger but not hard,” grade 2 represents “hard but not hard enough for penetration,” grade 3 represents “hard enough for penetration but not completely hard,” and grade 4 represents “completely hard and fully rigid.”^{13,14}

The item “How has your sexual ability changed after the penile surgery?” was created for this study. We used a single four-level Likert scale (1= “No change,” 2= “Changed some,” 3= “Changed a lot,” 4= “No sexual function after surgery.”).

Statistical Analysis

Data were described using frequencies, percentages, means, and standard deviations. 15D did not meet the assumption of normality, using the Spearman rank correlation, Mann-Whitney, or Kruskal-Wallis tests to examine associations. Spearman’s

correlation coefficient was used to analyze the relationship between the HRQoL and age. Correlation values were interpreted as follows: a weak relationship ($r < 0.3$), a moderate relationship ($0.3 \leq r \leq 0.5$), and a strong relationship ($r > 0.5$).¹⁹ A few missing responses for any dimensions of the 15D were replaced by predictions from linear regression models with the responses on the other dimensions, age, and gender as explanatory variables. The rule in replacing missing 15D data was that if an observation had missing data on more than three dimensions, replacements were not carried out and the 15D score was left missing.²⁰ The Mann-Whitney and Kruskal-Wallis tests were used to analyze the associations between the dimensions of 15D and other instruments and clinical characteristics. Analyses were done using IBM SPSS statistics Version 25 (IBM Corp., Armonk, New York). The level of statistical significance was set at $P < .05$.

RESULTS

Socio-demographic Characteristics

A total of 68 patients (64%) returned the completed questionnaire. The mean age of the patients was 70 years (SD = 10.2; range 45–91). Sixty-three patients had primary disease. Thirty-four patients had undergone penile resection or penectomy (50%), 32% had undergone glansctomy, and 18% had undergone minor surgery. The HRQoL had a negative correlation with age ($r = -0.316$, $P = .012$). Patients with a high educational level ($P = .003$), who were employed ($P < .001$), and who lived in an urban area ($P = .042$) reported a higher HRQoL (Table 1).

Clinical Characteristics

Patients with high blood pressure ($P < .030$) or vascular disease ($P < .002$) reported a lower HRQoL (Table 2).

Self-esteem, Overall Sexual Functioning, Erection Hardness Score, and Changes in Sexual Functioning

The associations between HRQoL and self-esteem, overall sexual functioning, erection hardness score, and changes in sexual functioning are presented in Table 3. No association was detected between self-esteem and HRQoL ($P = .810$). Overall sexual functioning ($P = .001$) and erection hardness ($P < .001$) were associated with the reported HRQoL ($P = .001$). Patients with no change in sexual functioning ($P = .003$) reported better HRQoL than patients with no sexual function after surgery.

Health-related Quality of Life

The mean of the self-reported HRQoL 15D score was 0.841 (SD 0.109), which corresponds to an average HRQoL (score 0–1) and is significantly below the age-standardized average for the Finnish population ($t = 3.108$; $df 79.6$; $P = .003$) (20). The HRQoL values for the patients and the general population showed statistically significant differences in the dimensions of breathing ($t = 2.181$; $df 70.9$; $P = .032$), sleeping ($t = 2.072$; df

Table 1. a) Socio-demographic and clinical characteristics of patients with penile cancer (n = 68) after surgery. b) Association between socio-demographic characteristics of patients penile cancer (n = 63) and health-related quality of life (HRQoL)

	HRQoL*		P value
	a) n (%)	b) r [†]	
Socio-demographic characteristics			
Age Mean 70 years (SD = 10.2); range 45-91		-0.316	0.012
		Md (Q1; Q3)	P value
Partner status			0.099
Partner	54 (84)	0.86 (0.76;0.94)	
No partner	11 (16)	0.77 (0.56;0.88)	
Children			0.934
Yes	60 (88)	0.86 (0.76;0.93)	
No	8 (12)	0.87 (0.77;0.93)	
Educational level			0.003
High (Polytechnic/ University degree)	33 (49)	0.90 (0.80;0.95)	
Middle (Vocational degree)	15 (22)	0.86 (0.80;0.89)	
Low (None/short qualification)	19 (28)	0.76 (0.71;0.86)	
Missing	1 (1)		
Employment status			<0.001
Employed	19 (28)	0.94 (0.87;0.98)	
Retired/unemployed	49 (72)	0.83 (0.75;0.89)	
Place of residence			0.042
Rural	37 (54)	0.83 (0.75;0.95)	
Urban	31 (46)	0.89 (0.80;0.95)	

*Score 0, poor HRQoL, to 1, good HRQoL.

[†]Spearman's correlation.

64.4; *P* = .042), usual activities (*t* = 2.372; *df* 73.6; *P* = .020), depression (*t* = 3.613; *df* 63.0; *P* = .001), distress (*t* = 2.838; *df* 63.3; *P* = .006), vitality (*t* = 2.640; *df* 69.8; *P* = .010), and sexual activity (*t* = 6.058; *df* 76.7; *P* < .001). Patients with PC were significantly worse off than the general population with regard to these dimensions (Figure 1).

The associations between the dimensions of 15D and self-esteem (RSES), overall sexual functioning (OSFQ), erection hardness score (EHS), and changes in sexual functioning after surgery in patients with PC, as well as their clinical characteristics, are presented in Table 4.

DISCUSSION

This study demonstrated that the quality of erections, perceived change in sexual functions, and overall sexual function correlate to the post-treatment HRQoL. Lack of sexual activity, in general, is the associating factor responsible for the compromised HRQoL among patients with PC. Level of education, employment status,

Table 2. a) Clinical characteristics of patients with penile cancer (n = 68) after surgery b) Association between clinical characteristics of patients with penile cancer (n = 63) and health-related quality of life (HRQoL)

Clinical characteristics	HRQoL*		P value
	a) n (%)	b) Md (Q1; Q3)	
Phimosis			0.962
Yes	34 (50)	0.86 (0.76;0.93)	
No	34 (50)	0.87 (0.75;0.94)	
HPV			0.188
HPV 16 or HPV 18	13 (19)	0.86 (0.83;0.96)	
No/Missing	55 (81)	0.85 (0.76;0.92)	
Lichen sclerosus			0.115
Yes	13 (19)	0.90 (0.88;0.95)	
No	55 (81)	0.84 (0.76;0.93)	
High blood pressure			0.030
Yes	30 (44)	0.80 (0.75;0.90)	
No	38 (56)	0.88 (0.80;0.95)	
Diabetes			0.318
Yes	14 (21)	0.85 (0.71;0.90)	
No	54 (79)	0.86 (0.77;0.94)	
Vascular disease			0.002
Yes	19 (22)	0.77 (0.66;0.86)	
No	49 (72)	0.88 (0.80;0.95)	
Tobacco use			0.178
Yes	15 (22)	0.81 (0.74;0.88)	
No	53 (78)	0.87 (0.76;0.94)	
BMI			0.588
<25	20 (30)	0.858 (0.76;0.88)	
25-30	19 (28)	0.877 (0.78;0.94)	
>30	22 (32)	0.864 (0.71;0.95)	
Missing	7 (10)		
G-stage			0.711
G1	22 (33)	0.87 (0.77;0.94)	
G2	20 (29)	0.86 (0.76;0.97)	
G3	19 (28)	0.86 (0.76;0.90)	
Missing	7 (10)		
T-stage			0.427
PT0/ pTis/pTa	10 (15)	0.90 (0.83;0.95)	
pT1	25 (36)	0.86 (0.76;0.95)	
pT2	21 (31)	0.85 (0.76;0.92)	
pT3	10 (15)	0.81 (0.74;0.88)	
Missing	2 (3)		
N-stage			0.305
N0	49 (73)	0.86 (0.77;0.94)	
N1	7 (10)	0.90 (0.66;0.96)	
N2	5 (7)	0.75 (0.74;0.83)	
N3	2 (3)	0.76 (0.66; X)	
Missing	5 (7)		
Primary operation			0.509
Minor surgery (circumcision)	12 (18)	0.86 (0.74;0.98)	
Glansectomy/resurfacing	22 (32)	0.88 (0.78;0.94)	

(continued)

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Table 2. Continued

Clinical characteristics	a) n (%)	HRQoL*	P value
		b) Md (Q1; Q3)	
Penile resection	27(40)	0.86 (0.76;0.91)	
Penectomy	7 (10)	0,77 (0.70;0,90)	
Lymphadenectomy			0.687
No	13 (19)	0.92 (0.85;0.95)	
With primary operation	24 (35)	0.87 (0.75;0.92)	
After primary operation	31 (46)	0.84 (0.75;0.90)	
Number of operations			0.508
1	28 (41)	0.92 (0.85;0.95)	
2	24 (35)	0.87 (0.75;0.92)	
Multiple	16 (24)	0.84 (0.75;0.90)	
Complications of primary operation			0.175
No	48 (71)	0.87 (0.78;0.94)	
Difficulties urinating	5 (7)	0.90 (0.70;0.97)	
Other complication (infection, edema)	15 (22)	0.76 (0.71;0.91)	
Adjuvant therapy			0,53
Yes	6 (9)	0.75 (0.74;0.86)	
No	60 (88)	0.87 (0.77;0.94)	
Missing	2 (3)		
Year of operation			0.371
2010–2016	36 (53)	0.88 (0.76;0.94)	
2017–2019	32 (47)	0.85 (0.76;0.92)	

*Score 0, poor HRQoL, to 1, good HRQoL. X = no values.

and place of residency are patient-related factors that have a significant association with the post-treatment HRQoL.

The general HRQoL of patients with PC was worse than that of the age- and gender-stratified Finnish population. Similar results have been reported in earlier studies.^{7–9} The main finding of this investigation was that overall sexual functioning, the ability to have erections, and the experienced change in sexual capacity were the main associating factors of post-treatment HRQoL. A correlation between the invasiveness of treatment and QoL has been reported.^{8,9} Some studies do, however, report contrasting findings of unaltered post-treatment QoL.²¹ In this investigation, we found no correlation between the extent of disease and the post-treatment QoL, for reasons that can only be speculated: Our series had a high proportion of cases with invasive disease who had undergone radical surgical treatment. Possibly, with more advanced disease, even mutilating surgery can be seen as a relief, whereas with superficial disease, even non-invasive treatments can cause psychological trauma, resulting in a compromised QoL.^{9,22}

The extent of the disease and the treatment seem to be obvious factors that are associated with the need for support during and after treatment. However, apart from these, little is known regarding other patient-related factors that correlate with post-treatment QoL. Furthermore, no consensus has been reached in terms of the

Table 3. Self-esteem (RSES), overall sexual functioning (OSFQ), erection hardness score (EHS), and change in sexual functioning after surgery in patients with penile cancer and associations between HRQoL

	(n = 68) n (%)	HRQoL ‡ (n=63) Md (Q1;Q3)	P value
RSES* Mean 15,4; SD 2,7			0.810
Normal self-esteem	45 (66)	0.84 (0.76;0.94)	
Low self-esteem	20 (30)	0.83 (0.77;0.91)	
Missing	3 (4)		
OSFQ † Mean 12,5; SD 5,4			0.001
No sexual functioning or early problems	13 (19)	0.72 (0.62;0.87)	
Severely reduced	30 (44)	0.83 (0.76;0.90)	
Normal or Slightly/ Moderately reduced	17 (25)	0.91 (0.86;0.99)	
Missing	8 (12)		
EHS			<0.001
Penis does not enlarge—not hard enough for penetration	33 (49)	0.81 (0.73;0.88)	
Penis is completely hard and fully rigid	28 (41)	0.91 (0.86;0.96)	
Missing	7 (10)		
Change in sexual functioning			0.003
No change	18 (26)	0.92 (0.77;0.99)	
Changed some	16 (24)	0.90 (0.80;0.94)	
Changed a lot	12 (18)	0.87 (0.81;0.94)	
No sexual function after surgery	19 (28)	0.80 (0.66;0.86)	
Missing	3 (4)		

*Score 0–40, Scores between 15 and 25 are within normal range; scores below 15 suggest low self-esteem (12).

†Score 0–24.

‡Score 0, poor HRQoL, to 1, good HRQoL.

optimal metrics that should be used to measure QoL in patients with PC. A recent study by Draeger et al.⁷ used a validated tool in conjunction with another newly developed metric to overcome these shortcomings. They found that PC and its surgery result in a compromised overall QoL, and they identified specific symptoms responsible for this finding.⁷ Our investigation was partly motivated by the same observation of a lack of standardized tools for measuring QoL among this patient group. In contrast to previous investigations, we were able to utilize a widely used QoL tool with age- and gender-stratified reference values. This, together with other questionnaires of sexual health, enabled us to detect specific deficits in sexuality and their correlation with HRQoL.

The need for better risk factor assessment and subsequent counseling is obvious, as recently pointed out by Paterson and coworkers.¹⁰ They systemically reviewed the literature and evaluated the evidence for unmet supportive care needs of men

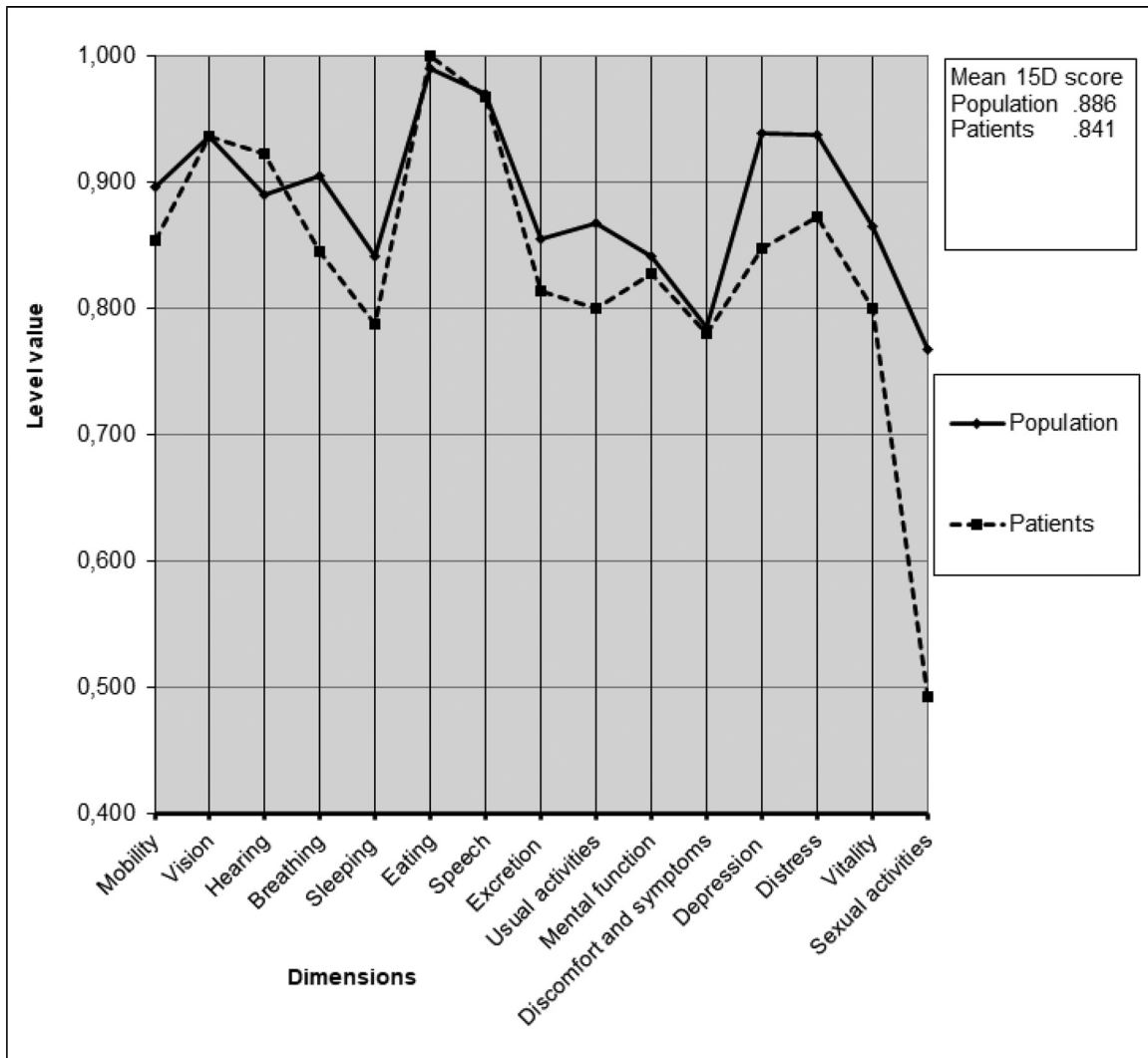


Figure 1. 15D profiles and scores of patients with penile cancer ($n = 63$) and the age- and gender-standardized general Finnish population (Score 0, poor HRQoL, to 1, good HRQoL).

affected by PC. Numerous needs of support were identified, and the study underscored a deficit in interdisciplinary services that could work together in a patient-centered fashion to provide optimal care and support from diagnosis to survivorship. In the present investigation, not surprisingly, we found that a low level of education, unemployment, and rural residency put the patient at higher risk of poor post-treatment QoL. The need for these types of services is clearly individual; therefore, identification of those patients most prone to isolation and psychological stress seems paramount.

The strengths of this study are the nationwide sampling and the detailed information on the characteristics of the patients. The scope of the surgical methods and recovery time from surgery were very heterogeneous in our study population. While the size of the sample was relatively large, it was not sufficient for a multivariate analysis. The response rate of the study, albeit acceptable at 64%, may have been affected by the research topic and the relative complexity of the questionnaire in relation to the resources of

the patients. We overcame a selection bias caused by the response rate by performing a non-responder analysis, which indicated that the primary operations of the non-responders did not differ from those of the responders. Due to the nature of a cross-sectional study, the time between the surgery and the study intervention was heterogeneous in our study population, and this may have affected the findings on HRQoL. Another possibility is that one general HRQoL scale oversimplifies the concept of HRQoL.

CONCLUSIONS

In conclusion, we found that patients with PC exhibit significant physical and psychological dysfunction. The lack of sexual activity in general is what most compromises the QoL of PC survivors. By contrast, no evidence was found for an association between post-treatment QoL and the surgical methods, pre-surgery staging, or pathology results. Furthermore, we identified

Table 4. The relations between the dimensions of 15D and self-esteem (RSES), overall sexual functioning (OSFQ), erection hardness score (EHS), and change in sexual functioning after surgery and the clinical characteristics in patients with penile cancer

	HRQoL/dimensions of 15D													
	Breathing		Sleeping		Usual activities		Depression		Distress		Vitality		Sexual activity	
	Md (Q1;Q3)	P	Md (Q1;Q3)	P	Md (Q1;Q3)	P	Md (Q1;Q3)	P	Md (Q1;Q3)	P	Md (Q1;Q3)	P	Md (Q1;Q3)	P
RSES		0.929		0.770		0.123		0.560		0.125		0.857		0.273
Normalself-esteem	1.00 (0.70;1.00)		0.76 (0.76;1.00)		0.72 (0.72;1.00)		1.00 (0.77;1.00)		1.00 (0.73;1.00)		0.77 (0.77;1.00)		0.44 (0.13;0.71)	
Lowself-esteem	1.00 (0.70;1.00)		0.76 (0.76;1.00)		0.72 (0.49;1.00)		1.00 (0.77;1.00)		0.73 (0.73;1.00)		0.77 (0.77;1.00)		0.35 (0.13;0.71)	
OSFQ		0.027		0.044		0.140		<0.001		0.038		0.004		<0.001
No sexual functioning or early problems	0.70 (0.70;1.00)		0.76 (0.35;0.76)		0.72 (0.41;1.00)		0.64 (0.35;0.76)		0.73 (0.48;1.00)		0.77 (0.52;0.77)		0.13 (0.13;0.25)	
Severely reduced	1.00 (0.70;1.00)		0.76 (0.76;1.00)		0.72 (0.72;1.00)		0.77 (0.77;1.00)		1.00 (0.73;1.00)		0.77 (0.71;1.00)		0.35 (0.13;0.71)	
Normal or Slightly/Moderately reduced	1.00 (1.00;1.00)		1.00 (0.76;1.00)		1.00 (0.72;1.00)		1.00 (1.00;1.00)		1.00 (0.86;1.00)		1.00 (0.77;1.00)		1.00 (0.44;1.00)	
EHS		0.010		0.110		0.002		0.368		0.238		<0.001		<0.001
Penis does not enlarge –not hard enough for penetration	0.70 (0.70;1.00)		0.76 (0.76;1.00)		0.72 (0.72;1.00)		0.88 (0.77;1.00)		1.00 (0.73;1.00)		0.77 (0.77;0.77)		0.25 (0.13;0.44)	
Penis is completely hard and fully rigid	1.00 (1.00;1.00)		0.76 (0.76;1.00)		1.00 (0.72;1.00)		1.00 (0.77;1.00)		1.00 (0.73;1.00)		1.00 (0.77;1.00)		0.71 (0.44;1.00)	
Change in sexual functioning		0.270		0.458		0.005		0.165		0.045		0.007		<0.001
No change	1.00 (0.70;1.00)		0.76 (0.76;1.00)		1.00 (0.72;1.00)		1.00 (0.77;1.00)		1.00 (1.00;1.00)		1.00 (0.77;1.00)		0.71 (0.19;1.00)	
Changed some	1.00 (0.70;1.00)		0.76 (0.76;1.00)		0.86 (0.72;1.00)		1.00 (0.77;1.00)		1.00 (0.73;1.00)		0.77 (0.77;1.00)		0.71 (0.71;1.00)	
Changed a lot	1.00 (0.77;1.00)		0.88 (0.76;1.00)		0.72 (0.72;1.00)		0.88 (0.77;1.00)		1.00 (0.79;1.00)		0.77 (0.77;1.00)		0.35 (0.16;0.44)	
No sexual function after surgery	0.70 (0.70;1.00)		0.76 (0.51;1.00)		0.72 (0.41;0.72)		0.77 (0.77;1.00)		0.73 (0.73;1.00)		0.77 (0.52;0.77)		0.13 (0.13;0.23)	
Clinical characteristics														
Primary operation		0.888		0.915		0.187		0.337		0.619		0.232		0.231
Minor surgery (circumcision)	1.00 (0.70;1.00)		0.76 (0.57;1.00)		0.86 (0.72;1.00)		0.88 (0.77;1.00)		1.00 (0.73;1.00)		0.77 (0.77;1.00)		0.44 (0.25;0.93)	
Glansectomy/resurfacing	1.00 (0.70;1.00)		0.76 (0.76;1.00)		0.86 (0.72;1.00)		1.00 (0.77;1.00)		1.00 (0.73;1.00)		0.77 (0.58; 1.00)		0.58 (0.16;1.00)	
Penile resection	1.00 (0.70;1.00)		0.76 (0.76;1.00)		0.72 (0.72;1.00)		0.77 (0.77;1.00)		1.00 (0.73;1.00)		0.77 (0.77;1.00)		0.44 (0.13;0.71)	
Penectomy	0.85 (0.59;1.00)		0.76 (0.70;1.00)		0.72 (0.41;0.72)		0.77 (0.51;1.00)		0.73 (0.73;1.00)		0.77 (0.52;0.77)		0.13 (0.13;0.44)	
High blood pressure		0.026		0.010		0.791		0.516		0.117		0.284		0.113
Yes	0.70 (0.70;1.00)		0.76 (0.51;0.88)		0.72(0.72;1.00)		0.77 (0.77;1.00)		0.86 (0.73;1.00)		0.77 (0.77;0.77)		0.25 (0.13;0.71)	
No	1.00 (0.70;1.00)		0.76 (0.76;1.00)		0.72 (0.72;1.00)		1.00 (0.77;1.00)		1.00 (0.73;1.00)		0.77 (0.77;1.00)		0.44 (0.13;1.00)	
Vascular disease		0.021		0.034		0.002		0.869		0.389		0.027		0.091
Yes	0.70 (0.48;1.00)		0.76 (0.51;1.00)		0.72 (0.41;0.72)		1.00 (0.77;1.00)		1.00 (0.73;1.00)		0.77 (0.52;0.77)		0.25 (0.13;0.71)	
No	1.00 (0.70;1.00)		0.76 (0.76;1.00)		1.00 (0.72;1.00)		1.00 (0.77;1.00)		1.00 (0.73;1.00)		0.77 (0.77;1.00)		0.44 (0.13;0.78)	

P = P value.

patient-related factors that have an effect on the post-treatment QoL. The challenge for the future is to improve and standardize the psychosocial aspects of care for patients with PC and to better identify patients in need of enhanced support.

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E.H. and A.K. conceived, wrote the manuscript, and secured funding; T.P., H.V., I.P. and A.K. collected data; T.P. and M.T. conceived and wrote manuscript; E.H. and M.H. performed data analyses; and H.V., M.H. and I.P. provided expertise and feedback.

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