

Quality of Life and Sexual Activity after Stereotactic Hypofractionated Radiotherapy of Prostate Cancer Patients

Monika Rucinska^{1,2*}, Anna Kieszkowska-Grudny³, Wojciech Strzelczyk¹, Katarzyna Bielez¹ and Sergiusz Nawrocki⁴

¹Department of Oncology, University of Warmia and Mazury in Olsztyn, Poland

²Department of Radiation Oncology, Independent Public Health Care Facility of the Ministry of the Interior with Warmia and Mazury Oncology Centre in Olsztyn, Poland

³Minds of Hope, and Polish Association of Cognitive and Behavioural Therapy, Warsaw, Poland

⁴Department of Oncology and Radiotherapy, Medical University of Silesia, Katowice, Poland

*Corresponding author: Monika Rucinska, Department of Oncology, University of Warmia and Mazury in Olsztyn Al. Wojska Polskiego 37, Poland, Tel: 48895398310; Fax: 48895398310; E-mail: m_rucinska@poczta.onet.pl

Rec date: June 13, 2016; Acc date: July 07, 2016; Pub date: July 13, 2016

Copyright: © 2016 Rucinska M. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract

Background: Quality of life (QoL) is an important factor for the cancer patients after treatment. The study aimed to investigate QoL and sexual activity in patients who had undergone stereotactic hypofractionated radiotherapy (HRT).

Methods: The analysis included 82 prostate cancer patients: 40 patients treated by HRT (33.5 Gy in 5 fractions) and 42 patients treated by standard three-dimensional conformal radiation treatment 3DCRT (70-82 Gy in 35-41 fractions); and 50 healthy men without any type of cancer. The subjects filled out the questionnaires: EORTC QLQ-C30 (version 3.0.) and the prostate cancer-specific EORTC QLQ-PR25. The median follow-up was 21 months for HRT patients and 28 months for 3DCRT patients.

Results: The tolerance for stereotactic HRT was shown to be good. The QoL and the general health status of HRT patients were higher than of 3DCRT patients and even of healthy men. Most patients treated by HRT felt that they had lost their masculinity. However, they were still interested in having sex; one third of them were sexually active, most reported satisfaction with their sex life.

Conclusions: HRT for prostate cancer patients was an attractive treatment in relation to patients' QoL assessment in the short term analysis.

Keywords: Quality of life; Sexual activity; Prostate cancer; Radiation therapy; Stereotactic hypofractionated radiotherapy

The objective of this study was to investigate QoL and sexual activity in patients who had undergone stereotactic HRT.

Introduction

Prostate cancer is the most prevalent solid tumor diagnosed in men in developed countries. The standard treatment for early stage prostate cancer is surgery (prostatectomy) or radiotherapy. To improve local control, the radiation dose should be escalated [1-3]. Three-dimensional conformal radiation treatment (3DCRT) increases local control rates while decreasing toxicity rates [4-7]. Recent data suggest that, to achieve high local control of prostate cancer with acceptable toxicity, hypofractionated radiotherapy (HRT) could be used [8,9]. Short-duration HRT (5-7 fractions) is an attractive option compared with a 7-to-8-week course of standard radiotherapy in terms of logistics; the patient's job, daily activities, and emotions; the availability of accelerators, and the cost of prolonged treatment. Quality of life (QoL) has become one of the most significant issues in treatment decisions in prostate cancer. In the case of QoL measurement after radical prostatectomy, brachytherapy, or external beam radiotherapy, all types of prostate cancer treatment were shown to be associated with changes in the QoL domains related to urinary, bowel, and sexual functions [10,11].

Material and Methods

A prospective single-center study was done on clinically localized prostate cancer patients with low- and intermediate-risk (according to the NCCN) adenocarcinoma of the prostate. Patients who were deemed eligible for stereotactic HRT should have had previously untreated, histologically confirmed adenocarcinoma of the prostate. All patients underwent X-ray of the thorax, ultrasonography of the abdomen, magnetic resonance imaging of the pelvis, and bone scintigraphy. Patients were prepared for treatment and immobilized according to a customized protocol. Fused CT and MR images were used in treatment planning. IMRT (step-and-shoot) plans were done. Patients received 33.5 Gy in 5 fractions twice weekly for a median of 15 days. The dose of 33.5 Gy in 5 fractions is equivalent to the conventional 78-Gy dose in 39 fractions at 2 Gy [12,13].

As reference, a group of prostate cancer patients treated by standard 3DCRT and a group of healthy men (without any type of cancer) were chosen. The prostate cancer patients in the standard 3DCRT group received 70-82 Gy in 35-41 fractions once daily for 5 days weekly over a period of 7 to 8 weeks (the median and mean doses were both 74 Gy).

The subjects filled out the questionnaire EORTC QLQ-C30 (version 3.0.) and the prostate cancer-specific questionnaire EORTC QLQ-PR25, which were chosen to obtain a better understanding of specific prostate cancer symptoms. The median follow-up was 21 months (range, 18-30 months) for HRT patients and 28 months (range, 8-71 months) for 3DCRT patients.

The research protocol was approved by the local ethics review board of the University of Warmia and Mazury in Olsztyn, Poland. All patients signed a consent form.

Results

The analysis included first 40 men (age, 55-83 years; mean, 72; median, 73) treated with HRT at the Department of Radiation Oncology of Independent Public Health Care Facility of the Ministry

of the Interior with Warmia and Mazury Oncology Centre in Olsztyn, Poland. The clinical stage was T2a-T2cN0M0, the combined Gleason score was 5-7 (mean and median, 6), and the prostate-specific antigen (PSA) level was 5.6-20 ng/ml (mean, 10.9; median, 9.9). A total of 33 patients (82.5%) received neoadjuvant androgen deprivation therapy beginning at 6 months before radiotherapy. Hormonal therapy was stopped after 6 months for 18 patients (45% of all subjects); androgen blockade for 2 to 3 years was planned for 15 patients (37.5%).

Furthermore, 42 patients treated by conventional 3D radiotherapy (age, 55-83 years; mean, 69; median, 70) were included. The clinical stage was T2a-T3cN0M0, the combined Gleason score was 4-9 (mean and median, 6), and PSA level was 2-109 ng/ml (mean, 19.9; median, 10.3). In the 3DCRT group, 81% of patients were treated by hormonal therapy; 57.1% of patients in 2-3 years (Table 1).

		HRT patients		3DCRT patients		healthy men
Age (years)						
	range	55-83		55-83		55-84
	mean	72		69		69
	median	73		70		69
		number	%	number	%	number
		40	100	42	100	50
Gleason score						
	≤6	23	57.5	25	59.5	
	≥7	17	42.5	17	40.5	
NCCN stage						
	Low-risk	14	35.0	15	35.7	
	Intermediate-risk	26	65.0	14	33.3	
	High-risk	0	0	13	31.0	
Hormonal therapy						
	Non	7	17.5	8	19.0	
	6 months	18	45.0	10	23.9	
	2-3 years	15	37.5	24	57.1	

Table 1: Group's characteristic.

50 healthy men (without any type of cancer and free from diseases associated with prostate and other urologic illnesses) were included in the study (age, 55-84 years; median and mean, 69) as a control group.

The tolerance for stereotactic HRT was found to be good. No grade 3 or higher late gastrointestinal or genitourinary toxicities (according to the RTOG/EORTC classification) were reported by the HRT patients. No urinary incontinence was observed in the HRT group. Some problems with urination reported 72% of patients after HRT and 90% of patients who had undergone 3DCRT. Among the healthy men, 76% reported some problems with urination.

After stereotactic HRT for prostate cancer, the patients reported a good QoL. More than 80% of patients rated both their general health and general QoL as 5 or better (based on a 7-point scale) 6 or more months after the end of radiotherapy; in the 3DCRT group, only 36% and 55% of patients gave their general health and general QoL, respectively, a minimum rating of 5. In the group of healthy men, a little over 50% of responders gave the same ratings (55% and 58%, respectively). The univariate analysis of variance (ANOVA) in these two areas showed significant differences in general health status (F(2,129)=7.205; p<0.05) and a marginal trend toward significance differences in general QoL (F(2, 129)=2.944; p=0.056) between all groups. The post hoc analysis revealed that the general health status of

the HRT patients was higher than that of the 3DCRT patients and even of the healthy men (Table 2).

Factors	Groups		Mean differences*	SD	p value	95% confidence intervals	
						lower limit	upper limit
How would you rate your general health during the past week? [range 1-7]	HRT patients	3DCRT patients	.86190	.18333	P < 0.05	.4157	1.3081
		healthy men	.66000	.23433	P < 0.05	.0923	1.2277
	3DCRT patients	HRT patients	-.86190	.18333	P < 0.05	-1.3081	-.4157
		healthy men	-.20190	.23600	n.s.	-.7734	.3696
	healthy men	HRT patients	-.66000	.23433	P < 0.05	-1.2277	-.0923
		3DCRT patients	.20190	.23600	n.s.	-.3696	.7734
How would you rate your general QoL during the past week? [range 1-7]	HRT patients	3DCRT patients	.45714	.19201	n.s.	-.0101	.9244
		healthy men	.52000	.22324	n.s.	-.0208	1.0608
	3DCRT patients	HRT patients	-.45714	.19201	n.s.	-.9244	.0101
		healthy men	.06286	.24293	n.s.	-.5257	.6514
	healthy men	HRT patients	-.52000	.22324	n.s.	-1.0608	.0208
		3DCRT patients	-.06286	.24293	n.s.	-.6514	.5257

n.s. - non significant; 95% confidence intervals - 95% of chances that obtained results are correct or 5% of chance that they are incorrect;

*positive results show that factor presented at left site in Groups had higher mean results that this at right site; negative results show that factor presented at left site in Groups had lower mean results that this at right site.

Table 2: Post hoc analysis of differences between studies' groups in general health status and overall quality of life.

The results showed significant ($p < 0.05$) differences between groups also in the QoL subscales in the physical, emotional, cognitive, and social functioning domains (Table 3). Specific significant variations ($p < 0.05$) were also observed in the post hoc test (Table 4).

	Test Levene'a	df	p	F	p
Physical functioning	5.837	129	$p < 0.05$	5.856	$p < 0.01$
Role functioning	4.456	129	$p < 0.05$	1.757	n.s.
Emotional functioning	7.445	129	$p = 0.001$	15.261	$p < 0.001$
Cognitive functioning	3.006	2	n.s.	3.658	$p < 0.05$
Social functioning	13.929	129	$p < 0.001$	6.096	$p < 0.05$
QoL related to general functioning	7.913	129	$p = 0.001$	10.500	$p < 0.001$
Fatigue	1.094	2	n.s.	7.467	$p = 0.001$
Nausea and vomiting	8.074	129	$p < 0.001$	2.426	n.s.
Pain	6.420	129	$p < 0.01$	11.809	$p < 0.001$
Dyspnea	10.401	129	$p < 0.001$	7.027	$p = 0.001$
Insomnia	1.000	2	n.s.	3.043	n.s.
Appetite lost	22.458	129	$p < 0.001$	5.713	$p < 0.01$
Constipation	1.870	2	n.s.	1.988	n.s.
Diarrhea	13.354	129	$p < 0.001$	4.265	$p < 0.05$

Finance's difficulties	17.473	129	p<0.001	4.658	p<0.05
Symptoms' scale	10.750	129	p<0.001	10.893	p<0.001
Overall QoL	8.183	129	p<0.001	5.223	p<0.05

df - degrees of freedom; F- Fisher test for variance; n.s. - non significant

Table 3: Differences between HRT, 3DCRT and healthy men groups in main QoL scale, subscales of QoL and scales of symptoms (univariate analysis of variance ANOVA).

Factors	Groups		Mean differences [†]	SD	p value	95% confidence intervals	
						lower limit	upper limit
Physical functioning ^{###}	HTR patients	3DCRT patients	-1.56071	.63840	p<0.05	-3.1139	-.0076
		healthy men	-2.27500	.59899	p<0.05	-3.7262	-.8238
	3DCRT patients	HRT patients	1.56071	.63840	p<0.05	.0076	3.1139
		healthy men	-.71429	.73969	n.s.	-2.5080	1.0794
	healthy men	HRT patients	2.27500	.59899	p<0.05	.8238	3.7262
		3DCRT patients	.71429	.73969	n.s.	-1.0794	2.5080
Emotional functioning ^{###}	HTR patients	3DCRT patients	-1.93690	.39365	p<0.05	-2.8947	-.9791
		healthy men	-2.65500	.47000	p<0.05	-3.7928	-1.5172
	3DCRT patients	HRT patients	1.93690	.39365	p<0.05	.9791	2.8947
		healthy men	-.71810	.53277	n.s.	-2.0088	.5726
	healthy men	HRT patients	2.65500	.47000	p<0.05	1.5172	3.7928
		3DCRT patients	.71810	.53277	n.s.	-.5726	2.0088
Cognitive functioning [#]	HTR patients	3DCRT patients	-.56190	.27392	n.s.	-1.2263	.1025
		healthy men	-.68000	.26301	p<0.05	-1.3180	-.0420
	3DCRT patients	HRT patients	.56190	.27392	n.s.	-.1025	1.2263
		healthy men	-.11810	.25951	n.s.	-.7476	.5114
	healthy men	HRT patients	.68000	.26301	p<0.05	.0420	1.3180
		3DCRT patients	.11810	.25951	n.s.	-.5114	.7476
Social functioning ^{###}	HTR patients	3DCRT patients	-.58214	.20839	p<0.05	-1.0891	-.0752
		healthy men	-.90500	.24451	p<0.05	-1.4968	-.3132
	3DCRT patients	HRT	.58214	.20839	p<0.05	.0752	1.0891
		healthy men	-.32286	.28762	n.s.	-1.0197	.3740
	healthy men	HRT patients	.90500	.24451	p<0.05	.3132	1.4968
		3DCRT patients	.32286	.28762	n.s.	-.3740	1.0197
QoL related to general functioning ^{###}	HTR patients	3DCRT patients	-5.04405	1.3322	p<0.05	-8.2851	-1.8030
		healthy men	-7.10500	1.45469	p<0.05	-10.6267	-3.5833
	3DCRT patients	HRT patients	5.04405	1.33223	p<0.05	1.8030	8.2851
		healthy men	-2.06095	1.73765	n.s.	-6.2721	2.1502

	healthy men	HRT patients	7.10500	1.45469	p<0.05	3.5833	10.6267
		3DCRT patients	2.06095	1.73765	n.s.	-2.1502	6.2721
Fatigue [#]	HRT patients	3DCRT patients	-1.24762	.47675	p<0.05	-2.4040	-.0912
		healthy men	-1.74000	.45777	p<0.05	-2.8504	-.6296
	3DCRT patients	HRT patients	1.24762	.47675	p<0.05	.0912	2.4040
		healthy men	-.49238	.45168	n.s.	-1.5880	.6032
	healthy men	HRT patients	1.74000	.45777	p<0.05	.6296	2.8504
		3DCRT patients	.49238	.45168	n.s.	-.6032	1.5880
Pain ^{##}	HRT patients	3DCRT patients	-1.04167	.31142	p<0.05	-1.7993	-.2840
		healthy men	-1.61500	.30109	p<0.05	-2.3444	-.8856
	3DCRT patients	HRT patients	1.04167	.31142	p<0.05	.2840	1.7993
		healthy men	-.57333	.36687	n.s.	-1.4629	.3162
	healthy men	HRT patients	1.61500	.30109	p<0.05	.8856	2.3444
		3DCRT patients	.57333	.36687	n.s.	-.3162	1.4629
Dyspnea ^{##}	HRT patients	3DCRT patients	-.44167	.14706	p<0.05	-.7994	-.0839
		healthy men	-.63500	.15923	n.s.	-1.0205	-.2495
	3DCRT patients	HRT patients	.44167	.14706	p<0.05	.0839	.7994
		healthy men	-.19333	.18834	n.s.	-.6498	.2631
	healthy men	HRT patients	.63500	.15923	p<0.05	.2495	1.0205
		3DCRT patients	.19333	.18834	n.s.	-.2631	.6498
Appetite lost ^{##}	HRT patients	3DCRT patients	-.13929	.08395	n.s.	-.3435	.0649
		healthy men	-.42500	.12914	p<0.05	-.7374	-.1126
	3DCRT patients	HRT patients	.13929	.08395	n.s.	-.0649	.3435
		healthy men	-.28571	.14201	n.s.	-.6295	.0581
	healthy men	HRT patients	.42500	.12914	p<0.05	.1126	.7374
		3DCRT patients	.28571	.14201	n.s.	-.0581	.6295
Diarrhea ^{##}	HRT patients	3DCRT patients	-.28095	.11827	n.s.	-.5687	.0068
		healthy men	-.04000	.07776	n.s.	-.2288	.1488
	3DCRT patients	HRT patients	.28095	.11827	n.s.	-.0068	.5687
		healthy men	.24095	.11338	n.s.	-.0344	.5163
	healthy men	HRT patients	.04000	.07776	n.s.	-.1488	.2288
		3DCRT patients	-.24095	.11338	n.s.	-.5163	.0344
Finance's difficulties [#]	HRT patients	3DCRT patients	-.44762	.16561	p<0.05	-.8493	-.0459
		healthy men	-.42000	.15901	p<0.05	-.8057	-.0343
	3DCRT patients	HRT patients	.44762	.16561	p<0.05	.0459	.8493
		healthy men	.02762	.15690	n.s.	-.3529	.4082

	healthy men	HRT patients	.42000	.15901	p<0.05	.0343	.8057
		3DCRT patients	-.02762	.15690	n.s.	-.4082	.3529
Symptoms' scale ^{##}	HRT patients	3DCRT patients	-3.91026	1.00980	p<0.05	-6.3672	-1.4533
		healthy men	-5.43692	1.05892	p<0.05	-8.0007	-2.8732
	3DCRT patients	HRT patients	3.91026	1.00980	p<0.05	1.4533	6.3672
		healthy men	-1.52667	1.30901	n.s.	-4.6995	1.6462
	healthy men	HRT patients	5.43692	1.05892	p<0.05	2.8732	8.0007
		3DCRT patients	1.52667	1.30901	n.s.	-1.6462	4.6995
Overall QoL ^{##}	HRT patients	3DCRT patients	1.31905	.34365	p<0.05	.4827	2.1554
		healthy men	1.18000	.43910	p<0.05	.1164	2.2436
	3DCRT patients	HRT patients	-1.31905	.34365	p<0.05	-2.1554	-.4827
		healthy men	-.13905	.45306	n.s.	-1.2362	.9581
	healthy men	HRT patients	-1.18000	.43910	p<0.05	-2.2436	-.1164
		3DCRT patients	.13905	.45306	n.s.	-.9581	1.2362
[#] post hoc Bonferroni's test, ^{##} post hoc C Dunnett's test [*] positive results show that factor presented at left site in Groups had higher mean results that this at right site; negative results show that factor presented at left site in Groups had lower mean results that this at right site n.s. - non significant; 95% confidence intervals - 95% of chances that obtained results are correct or 5% of chance that they are incorrect.							

Table 4: Post hoc analysis of differences between study's groups in mail scale of QoL. Subscales of QoL and scales of symptoms (only comparison of significant factors in univariate analysis of variance ANOVA is presented).

The results revealed more differences in QoL between people over 65 years old and those in younger age groups. In patients over 65 years old, significant differences were found in both the main scale of QoL and all subscales. In addition, older people showed significant differences in almost all symptoms (except nausea and vomiting, insomnia, constipation, and diarrhea).

Among the prostate cancer patients treated by HRT, 77.5% felt that they had lost their masculinity as a result of the illness or treatment. However, 65% of patients who had undergone HRT were still interested in having sex; 37.5% of them were sexually active, most of whom (80%) reported satisfaction with their sex life. In the 3DCRT group, 57% of patients reported having decreased masculinity. However, about half of the group was still interested in having sex; 35.5% were sexually active, 81% of who were satisfied with their sex life. In the healthy group, 50% of men believed that their masculinity had decreased, but most (72%) were still interested in having sex; 62% of the responders without prostate cancer were sexually active, and all of them were satisfied with their sex life.

Discussion

Hypofractionation (with a few high fractions of external beam irradiation) has emerged as a novel treatment for patients with early stage prostate cancer. In this therapy, the volume of irradiation is relatively small, and the region of high dosage is decreased. Preliminary data have shown that this approach leads to successful tumor control without increasing the rate of complications [14]. In the present study, no grade 3 or higher late gastrointestinal or

genitourinary toxicities were observed; similarly to the SHARP trial and King study [15,16]. Older men usually have some problems with urination. In our analysis, only 24% of patients without prostate cancer reported having no such problems. A similar percentage of prostate cancer patients who had undergone HRT (28%) had no urinary problems; however, only 10% of patients who had received 3DCRT had no problems with urination.

In general, QoL of prostate cancer patients treated with radiotherapy is good. Yarbrow and Ferrans [17] showed that radiotherapy had little impact on QoL deterioration. Our research confirms that QoL of prostate cancer patients who had undergone radiotherapy, especially HRT, was at a satisfactory level some months after the end of treatment; QoL of HRT patients was also better than that of patients who had received 3DCRT and even of patients without prostate cancer. More than 80% of patients in the HRT group assessed both their general health and general QoL as being at a high level, whereas only around 50% of the healthy respondents gave the same high ratings. This finding can be explained by the specific psychological condition of cancer patients after treatment; that is, they are satisfied with having completed the treatment, are changing their approach to life, and are seeing their problems from a different perspective; some are simply enjoying life more after the successful treatment. Some authors have suggested that oncological treatment can enhance QoL because it improves functioning in many areas [18,19]. We demonstrated that, regardless of the method of treatment, men who were suffering more pain, fatigue, dyspnea, or insomnia had a worse QoL.

Healthy men were more interested in having sex and had a more active sexual life compared with prostate cancer patients who had undergone radiotherapy; however, the healthy respondents were younger. Similarly to other authors, who reported that only one third of prostate cancer patients could have sex [20-22], we observed that this issue was significant in both radiotherapy groups. Of course, usage of hormonal therapy is considered to be one of the most influencing factors to the sexual activities. However, in the present study, fewer patients reported dissatisfaction with their sex life. There were no significant differences in sexual activity and satisfaction with sex life between patients treated by HRT and those who received 3DCRT.

Conclusion

The knowledge of how treatment influence patients' QoL are important factors in therapeutic decision-making for both physicians and cancer patients. Stereotactic hypofractionated radiotherapy for prostate cancer patients seems to be an attractive treatment in terms of patients' QoL assessment in the short term. Generally, the health status and QoL of HRT patients are good and even better than those of patients treated with three-dimensional conformal radiation treatment. However, longer follow-up is needed to assess long-term QoL.

Acknowledgement

We are grateful to colleagues in the participating hospital for their support and to all patients and participating healthy men for their collaboration.

This study was an academic study and did not receive any financial support.

References

1. Pollack A, Hanlon AL, Horwitz EM, Fengeberg SJ, Uzzo RG, et al. (2004) Prostate cancer radiotherapy dose response: An update of the Fox Chase experience. *J Urol* 171: 1132-1136.
2. Zelefsky MJ, Fuks Z, Hunt M, Lee HJ, Lombardi D, et al. (2001) High dose radiation delivered by intensity modulated conformal radiotherapy improves the outcome of localized prostate cancer. *J Urol* 166: 876-881.
3. Khuntia D, Reddy CA, Mahadevan A, Klein EA, Kupelian PA (2004) Recurrence-free survival rates after external-beam radiotherapy for patients with clinical T1-T3 prostate carcinoma in the prostate-specific antigen era: What should we expect? *Cancer* 100: 1283-1292.
4. Dearnaley DP, Khoo VS, Norman AR, Meyer L, Nahum A, et al. (1999) Comparison of radiation side-effects of conformal and conventional radiotherapy in prostate cancer: a randomized trial. *Lancet* 353: 267-272.
5. Beard CJ, Kaplan ID, Coleman CN (1993) The challenge for conformal therapy for prostate cancer. *Int J Radiat Oncol Biol Phys* 26: 705-707.
6. Fiorino C, Reni M, Cattaneo GM, Bolognesi A, Calandrino R (1997) Comparing 3-, 4- and 6-fields techniques for conformal irradiation of prostate and seminal vesicles using dose-volume histograms. *Radiother Oncol* 44: 251-257.
7. Michalski JM, Purdy JA, Winter K, Roach M 3rd, Vijayakumar S, et al. (2000) Preliminary report of toxicity following 3D radiation therapy for prostate cancer on 3DOG/RTOG 9406. *Int J Radiat Oncol Biol Phys* 46: 391-402.
8. Fowler JF (2005) The radiobiology of prostate cancer including new aspects of fractionated radiotherapy. *Acta Oncol* 44: 265-276.
9. Macias V, Biete A (2009) Hypofractionated radiotherapy for localised prostate cancer. Review of clinical trials. *Clin Transl Oncol* 11: 437-445.
10. Evans JR, Zhao S, Daignault S, Sanda MG, Michalski J, et al. (2015) PROSTQA Study Consortium. Patient-reported quality of life after stereotactic body radiotherapy (SBRT), intensity modulated radiotherapy (IMRT), and brachytherapy. *Radiother Oncol* 116: 179-184.
11. Fossa SD, Dahl AA (2015) Global Quality of Life after curative treatment for prostate cancer: What matters? A study among members of the Norwegian Prostate Cancer Patient Association. *Clin Genitourin Cancer* 13: 518-524.
12. Fowler JF, Ritter MA, Chappell RJ, Brenner DJ (2003) What hypofractionated protocols should be tested for prostate cancer? *Int J Radiat Oncol Biol Phys* 56: 1093-1104.
13. Fowler J, Chappell R, Ritter M (2001) Is alpha/beta for prostate tumors really low? *Int J Radiat Oncol Biol Phys* 50: 1021-1031.
14. Spyropoulou D, Kardamakis D (2012) Review of hypofractionated radiotherapy for prostate cancer. *ISRN Oncol* 2012: 410892
15. Madsen BL, Hsi RA, Pham HT, Fowler JF, Esaqui L, et al. (2007) Stereotactic hypofractionated accurate radiotherapy of the prostate (SHARP), 33.5 Gy in five fractions for localized disease: first clinical trial results. *Int J Radiat Oncol Biol Phys* 67: 1099-1105.
16. King CR, Brooks JD, Gil H, Presti JC (2012) Long-term outcomes from a prospective trial of stereotactic body radiotherapy for low-risk prostate cancer. *Int J Radiat Oncol Biol Phys* 82: 877-882.
17. Yarbro CH, Ferrans CE (1998) Quality of life of patients with prostate cancer treated with surgery or radiation therapy. *Oncol Nurs Forum* 25: 685-693.
18. Nowicki A, Staniewska J, Tesmer I (2007) Ocena jakosci zycia chorych na raka gruczolu krokowego hospitalizowanych w trakcie radioterapii radykalnej. Czesc I. *Wspolczesna Onkol* 11: 412-418.
19. Nowicki A, Staniewska J, Tesmer I (2007) Ocena jakosci zycia chorych na raka gruczolu krokowego hospitalizowanych w trakcie radioterapii radykalnej. Czesc II. *Wspolczesna Onkol* 11: 449-454.
20. Monga U, Kerrigan AJ, Garber S, Monga TK (2001) Pre- and post-radiotherapy sexual functioning in prostate cancer patients. *Sex Disabil* 19: 239-252.
21. Fransson P, Widmark A (2011) Does one have a sexual life 15 years after external beam radiotherapy for prostate cancer? Prospective patient-reported outcome of sexual function comparison with age-matched controls. *Urol Oncol* 29: 137-144.
22. Howlett K, Koettters T, Edrington J, West C, Paul S, et al. (2010) Changes in sexual function on mood and quality of life in patients undergoing radiation therapy for prostate cancer. *Oncol Nurs Forum* 37: E58-E66.