



The level of physical activity in long-term survivors of testicular cancer

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Abstract

The aim of this study was to estimate the level of physical activity (LPA) in a large cohort of testicular cancer survivors (TCSs) and compare these results with observations from men in the same age range in the general population (GenPop). We also wanted to identify parameters that influenced physical activity. The study populations consisted of 1276 TCSs treated with surgery, radiotherapy or chemotherapy with or without surgery (mean observation time was 12 years), and 20391 male inhabitants from a Norwegian county (GenPop). All completed a question investigating two sub-levels of physical activity. The logistic regression analysis adjusting for different covariates, showed significantly more physically active men among the TCSs compared with the GenPop (43 versus 37%) (adjusted odds ratio (aOR)= 1.32 (95% Confidence Interval (CI) 1.10–1.58)). The results indicate that the experience of testicular cancer increases rather than reduces the LPA in TCSs, independent of treatment given.

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1. Introduction

Testicular cancer (TC) is a life-threatening malignant disease that occurs in a phase of life when young adult men are usually at the peak of their physical health, starting their professional career and planning to have a family. Unavoidably, both the malignancy itself and its treatment may have profound influence on the young man's life.

Approximately 90% of the patients with TC are cured today by the use of multimodal therapy, i.e. surgery, radiotherapy and cisplatin-based chemotherapy [1]. However, during the acute phase, the treatment of these young patients represents a considerable psychological and somatic challenge, which for some patients persists for several years after treatment. With the background of the high cure rate and the intensive treatment, a series

of studies focusing on long-term side-effects have recently been performed in this group of patients. The most frequent somatic long-term side-effects are peripheral sensory neuropathy, Raynaud's-like phenomena, ototoxicity and infertility [2–4]. Increased serum cholesterol, low serum testosterone, cardiovascular disorders, and/or increased body mass index (BMI) are particularly often described after chemotherapy [5–10]. Nord and colleagues found a higher annual increase of BMI among young survivors of testicular cancer (TCSs) compared with men in the same age group from the general population (GenPop) [11].

Some reports have addressed psychological sequelae such as, anxiety, depression and quality of life in TCSs [12–14]. Fatigue has been described in 16% of the TCSs compared with 11% in men in the same age range in the GenPop [15]. TCSs below 30 years of age displayed an especially high prevalence of fatigue. Increased fatigue, somatic sequelae and psychological problems may lead to a low level of physical activity (LPA) in TCSs. So far,

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no investigators have evaluated this topic in detail, which generally is of great importance for the overall well-being of young men.

In the present cross-sectional study, we therefore estimated the LPA in a large cohort of TCSs, and compared the results with observations from men in the same age range in the GenPop. We also tried to identify parameters that influenced physical activity. The hypothesis was that chemotherapy, in particular, would have a deteriorating impact on the LPA in TCSs, even many years after the treatment.

2. Patients and methods

2.1. Study populations

2.1.1. Testicular cancer survivors (TCSs)

Between 1999 and 2001, consecutive Norwegian TCSs from the whole country were invited to participate in a cross-sectional study assessing somatic and psychosocial health by a mailed questionnaire. All participants also underwent a clinical examination at the oncological department responsible for the primary treatment. The patients had been treated for unilateral TC between 1980 and 1994, and were aged 18–75 years at the time of invitation. Patients with bilateral TC, extragonadal germ cell cancer, previous unilateral orchiectomy due to a benign condition and mental retardation were excluded. The present report comprises only those patients who were aged 20–59 years ($n=1634$), as non-TC-related comorbidity is thought to increase with increasing age, and the assumption that the definition of the term ‘physical activity’ also might change with increasing age. Details as to the diagnosis and treatment given were retrieved from the hospital records.

All patients had undergone unilateral orchiectomy. They were subsequently allocated to one of three groups according to their treatment: (1) Surgery only. In patients with non-seminoma, retroperitoneal lymph node dissection (RPLND) was the only postorchiectomy treatment or the patients were followed using a surveillance strategy; (2) Infradiaphragmatic radiotherapy only (30–36 Gy/3–3½ weeks), given to non-metastatic patients with seminoma; and (3) Cisplatin-based combination chemotherapy with or without surgery (mostly retroperitoneal lymph-node dissection) as the standard treatment for patients with metastatic non-seminoma.

2.1.2. General population (GenPop)

From 1995 to 1997, all of the inhabitants of the county of Nord-Trøndelag in Norway aged 18 years and above were invited to take part in a cross-sectional study of physical and psychosocial health

(www.hunt.ntnu.no). The individuals were asked to complete a questionnaire and to have a physical examination, including an assessment of height and weight. The participation rate was 71%. The present report comprises only men aged 18 and 59 years ($n=20\,391$).

2.2. Variables

The variables included in the present analyses were identical in both cohorts. The main outcome was the LPA assessed by one question which should assess two sub-levels of physical activity. One describing a low level of physical activity, such as walking, and the other, a high level of physical activity that leads to sweating and breathlessness (Fig. 1). Forms with missing values for both responses were excluded from the analyses. When only one of the responses was missing, we assumed that only one of the categories was relevant for the responders, and the missing value was defined as ‘no’ activity.

The participants were divided into three groups, dependent on their LPA (Fig. 1):

Group 1. ‘Inactive’: no low-level activity or low-level activity < 1 h per week and no high-level activity.

Group 2. ‘Minimally active’: low-level activity ≥ 1 h per week, and either no high-level activity or < 1 h per week.

Group 3. ‘Highly active’: independent of the level of low-level activity, high-level activity ≥ 1 h per week.

In the multivariate analysis, Groups 2 and 3 were combined into one group (‘physically active’), and compared with Group 1 (‘physically inactive’).

Other variables included in the present analyses were age, body mass index (kg/m^2 , BMI), education (number of years), living as a couple (no versus yes), comorbidity and daily smoking (no versus yes). Comorbidity was defined as any physical or psychological disorder or injury, which had reduced daily life functions during the last 12 months. Daily smoking included the use of cigarettes only.

2.3. Statistical analysis

The *t*-test, Bonferroni and Chi-squared tests assessed differences in demographic and treatment variables. These tests also assessed differences between the compliant subjects and non-compliant subjects, the treatment groups, and TCSs and GenPop. A *P* value of less than 0.05 was considered statistically significant.

The extent of LPA in TCSs compared with the GenPop was also evaluated using a logistic regression analysis adjusting for the different covariates. The adjusted odds ratio (aORs) are presented with 95% Confidence Intervals (95% CI).

Due to missing values for some of the explanatory variables, we explored models that included categories for missing values to retain all of the cases in the analysis, and models excluding cases with missing values for

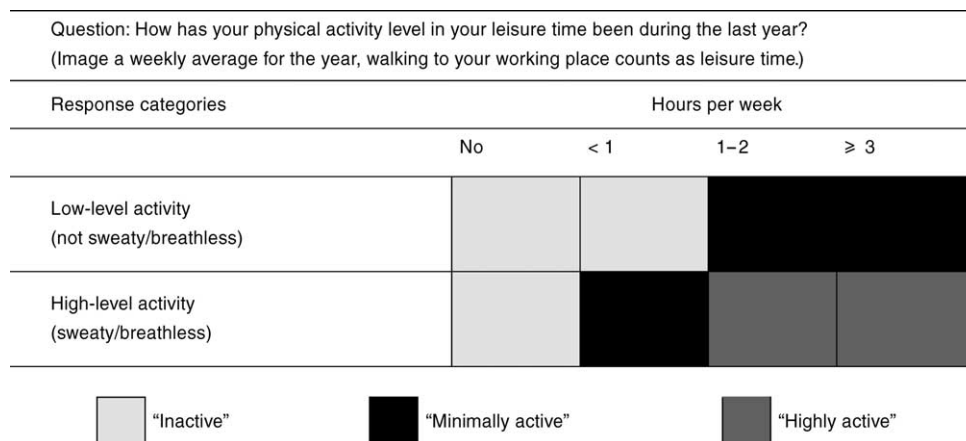


Fig. 1. The assessment of the level of physical activity (LPA).

one or more conditions. Both approaches gave similar results, and only the results of the first approach are presented here.

All analyses were performed using the Statistical Package for the Social Sciences (SPSS) for Windows (PC version 10.0).

Table 1
Compliant versus non-compliant TCSs

	Compliant TCSs	Non-compliant TCSs	P value
Number of patients	1276	358	
Age (years) ^a			
Pretreatment	31 (7.7)	30 (7.4)	<0.01
Long-term follow-up	43 (8.0)	43 (8.0)	0.27
Years since diagnosis ^a	11 (4.1)	13 (4.3)	<0.001
Treatment ^b			
Surgery group	21% (266)	26% (93)	0.07
Radiotherapy group	42% (530)	36% (129)	
Chemotherapy group	38% (480)	38% (136)	

S.D., standard deviation; TCS, survivors of testicular cancer.

^a % (number of patients)/Mean (S.D.)/independent sample *t*-test.

^b Pearson Chi-square.

Table 2
Differences between the treatment groups in the TCSs

	Surgery group	Radiotherapy group	Chemotherapy group	P value
Number of patients	266	530	480	
Age (years) ^a				
Pretreatment	30 (7.7)	34 (6.8)	29 (7.5)	<0.0001
Long-term follow-up	42 (7.9)	45 (7.3)	40 (8.1)	<0.0001
Years since diagnosis ^a	12 (4.0)	11 (4.0)	11 (4.2)	0.062
Physical activity ^b				
'Inactive'	35 (13%)	75 (14%)	64 (13%)	0.984
'Minimally active'	118 (44%)	227 (43%)	213 (44%)	
'Highly active'	113 (42%)	228 (43%)	203 (42%)	

^a Mean (S.D.)/Bonferroni.

^b Number of patients (%) / Pearson Chi-square.

3. Results

A total of 1634 TCSs were invited to participate in the study, 323 did not answer the questionnaire. An additional 35 TCSs were excluded due to missing answers to both questions related to their LPA. This left 1276 to be included in the analysis. The final compliance rate was therefore 78%.

Non-compliant TCSs tended to be younger at orchiectomy than compliant patients ($P=0.01$). However, there were no differences between compliant and non-compliant TCSs in the long-term follow-up, both groups having a mean age of 43 years (Table 1). The compliant TCSs also had a shorter interval from treatment to the time of this survey compared with the non-compliant TCSs ($P<0.001$). As expected, patients in the radiotherapy group were older, both at pretreatment and at the time of the survey, than those from the other two groups ($P<0.0001$) (Table 2). The percentages of inactive, minimally active and highly active TCSs were similar in the three treatment groups. These three groups were therefore combined in the subsequent analyses.

The two cohorts differed with respect to age, years of education, partnership, comorbidity and daily smoking

Table 3

Comparison between survivors of testicular cancer (TCSs) and men in the general population sample (GenPop)

	TCSs	GenPop	P value
	<i>n</i> = 1276	<i>n</i> = 20 391	
Age at questionnaire (years) ^a	43 (8.0)	41 (10.6)	<0.0001
Mean (S.D.)			
Body mass index (kg/m ²) ^a	27 (3.9)	26 (3.5)	0.12
Mean (S.D.)			
Education ^b			
Primary/secondary school	16 (202)	21 (4314)	<0.0001
High school	45 (569)	54 (11 005)	
College/university <4 year	20 (249)	14 (2840)	
College/university ≥4 year	20 (251)	10 (2010)	
Missing	0.4 (5)	1 (222)	
Living as a couple ^b			
No	14 (179)	13 (2566)	<0.0001
Yes	75 (954)	62 (12 696)	
Missing	11 (143)	25 (5129)	
Comorbidity ^b			
No	71 (909)	78 (15 899)	<0.0001
Yes	23 (295)	19 (3943)	
Missing	6 (72)	3 (549)	
Daily smoking ^b			
No	54 (689)	66 (13 555)	<0.0001
Yes	35 (445)	29 (5836)	
Missing	11 (142)	5 (1000)	
Physical activity ^b			
'Inactive'	14 (174)	18 (3709)	<0.0001
'Minimally active'	44 (558)	45 (9152)	
'Highly active'	43 (544)	37 (7530)	

GenPop, General population.

^a Independent sample *t*-test.

^b % (number of patients)/Mean (S.D.) Pearson Chi-square.

(Table 3). There were significantly more highly active men among the TCSs compared with the GenPop (43 versus 37%, respectively) ($P < 0.000$).

The logistic regression analysis showed that the TCSs were more physically active than the GenPop (aOR 1.32 (95% CI 1.10–1.58)) (Table 4). We also found that the LPA increased with increasing years of education. The LPA was lower among those with comorbidity compared with those without. Finally, the LPA was higher among non-smokers than smokers.

4. Discussion

Twelve years after treatment, the principal treatment for TCSs did not impact on the LPA. In fact, the TCSs were significantly more physically active compared with men in the GenPop. As expected, there were significant associations between the LPA and the levels of education and smoking [16–18].

The major strength of this study is the big sample size in both groups. The response rates were satisfactory,

and it is unlikely that the minor differences between the compliant and non-compliant subjects bias our results. The GenPop sample is representative because it includes all subjects in the county of Nord-Trøndelag with the same sex and age range as the TCSs. The difference in the “time from treatment to the start of the study”, among the TCSs is in our opinion not clinically relevant, and the age differences found between the treatment groups are well known [19].

The present study is based on retrospective reports of lifestyle factors and health. Information bias could be a source of error when individuals have to recall past disease status. Cross-sectional studies are most vulnerable to such bias. However, there is no reason to think that TCSs and the GenPop would recall differently the lifestyle factors that were included in this study.

Questionnaire-based assessments of physical activity always have problems with validity [20,21]. However, self-report multi-items questionnaires are often applied to evaluate LPA in population-based studies. To divide the LPA into two main groups reflecting ‘physically active’ and ‘inactive’ individuals has also been recommended [22]. Reliability- and validity-studies on self-reported physical activity have shown that grouping physical activity into two categories (high intensity versus less than high intensity) resulted in a higher reliability and validity than setting the cut-off point between low or no activity [23]. The main purpose of the present study was to provide descriptive information and conduct simple analyses of the differences between groups.

There has been some debate regarding the impact of unavoidable long-term effects of the diagnosis and treatment of TC on posttreatment quality of life and general health [5,9]. It was expected that TCSs would be less physically active than the GenPop due to sensory neuropathy, Raynaud’s-like phenomena, low serum testosterone, and fatigue. Joly and colleagues demonstrated that cured testicular cancer patients do not express impairment of their physical function and are not more fatigued compared with the GenPop [24]. Fosså and colleagues also reported that 3 years or more after cure, patients feel stronger and fitter than an age-matched control group [25]. Arai and colleagues found a significant reduction in the capacity to exercise in the chemotherapy group compared with the radiotherapy group [26]. No difference in the LPA was found between the treatment groups in the present study.

This study adds to the long-term studies in TCSs the observation of similar or even better LPA in TCSs than in the GenPop. One possible explanation for the surprising findings is a psychological one: the loss of one testicle may cause psychological distress related to the feeling of decreased masculinity and changed body image. To compensate for this loss, it is understandable that TCSs intentionally perform more physical activity. An alternative explanation could be that the TCSs had a

Table 4

Results of a multivariate logistic regression analysis with physical exercise as the outcome

	'Physically active'		cOR	aOR (95% CI)
	No (0)	Yes (1)		
	18 (3883)	82 (17784)		
GenPop (1) ^a	18 (3709)	82 (16682)	1.0	1.0
TCSs (2) ^a	14 (174)	86 (1102)	1.32	1.32 (1.10–1.58)
Age (years) ^b				
Long-term follow-up	41.5 (10.3)	40.7 (10.5)	0.98	1.00 (0.99–1.01)
Body mass index (kg/m ²) ^b	26.7 (3.9)	26.3 (3.4)	0.99	0.97 (0.96–0.98)
Education ^a				
Primary/secondary school (0)	26 (1174)	74 (3342)	1.0	1.0
High school (1)	18 (2117)	82 (9457)	1.57	1.45 (1.33–1.59)
College/university <4 years (2)	11 (351)	89 (2738)	2.74	2.43 (2.13–2.78)
College/university ≥4 years (3)	9 (195)	91 (2066)	3.72	3.10 (2.63–3.65)
Living as a couple ^a				
No (0)	17 (458)	83 (2287)	1.0	1.0
Yes (1)	17 (2384)	83 (11266)	0.95	0.95 (0.85–1.06)
Comorbidity ^a				
No (0)	17 (2867)	83 (13941)	1.0	1.0
Yes (1)	21 (871)	79 (3367)	0.80	0.88 (0.81–0.96)
Daily smoking ^a				
No (0)	16 (2261)	84 (11983)	1.0	1.0
Yes (1)	23 (1452)	77 (4829)	0.63	0.69 (0.64–0.75)

cOR, crude odds ratio; aOR, adjusted odds ratio. 95% CI, 95% Confidence Interval.

^a % (number).^b Mean (S.D.).

lower tolerance for physical activity, and thus are being categorised as physical active. A last explanation may be that the experience of the life-threatening disease has led to a more health-conscious attitude compared with the GenPop. However, the increased prevalence of smokers among TCSs would argue against this latter view.

5. Conclusions

Approximately 12 years after their treatment, young and middle-aged TCSs have a slightly higher level of self-reported physical activity than the GenPop. Thus, different treatment groups of testicular cancer in the subjects of this study did not impact on self-reported physical activity.

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