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Physical Activity and Survival After Prostate Cancer

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Abstract

Background: Despite the high global prevalence of prostate cancer (PCa), few epidemiologic studies have assessed physical activity in relation to PCa survival.
Objective: To evaluate different types, intensities, and timing of physical activity relative to PCa survival.
Design, setting, and participants: A prospective study was conducted in Alberta, Canada, in a cohort of 830 stage II–IV incident PCa cases diagnosed between 1997 and 2000 with follow-up to 2014 (up to 17 yr). Prediagnosis lifetime activity was self-reported at diagnosis. Postdiagnosis activity was self-reported up to three times during follow-up.
Outcome measurements and statistical analysis: Cox proportional hazards models related physical activity to all-cause and PCa-specific deaths and to first recurrence/progression of PCa.
Results and limitations: A total of 458 deaths, 170 PCa-specific deaths, and, after first follow-up, 239 first recurrences/progressions occurred. Postdiagnosis total activity (>119 vs ≤42 metabolic equivalent [MET]-hours/week per year) was associated with a significantly lower all-cause mortality risk (hazard ratio [HR]: 0.58; 95% confidence interval [CI], 0.42–0.79; p value for trend <0.01). Postdiagnosis recreational activity (>26 vs ≤4 MET-hours/week per year) was associated with a significantly lower PCa-specific mortality risk (HR: 0.56; 95% CI, 0.35–0.90; p value for trend = 0.01). Sustained recreational activity before *and* after diagnosis (>18–20 vs <7–8 MET-hours/week per year) was associated with a lower risk of all-cause mortality (HR: 0.66; 95% CI, 0.49–0.88). Limitations included generalisability to healthier cases and an observational study design.
Conclusions: These findings support emerging recommendations to increase physical activity after the diagnosis of PCa and would inform a future exercise intervention trial examining PCa outcomes.
Patient summary: In a 17-yr prostate cancer (PCa) survival study, men who survived at least 2 yr who were more physically active postdiagnosis or performed more recreational physical activity before and after diagnosis survived longer. Recreational physical activity after diagnosis was associated with a lower risk of PCa death.

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1. Introduction

In Canada, 5-yr survival from prostate cancer (PCa) is high at 81%, yet 1 in 27 men will die from PCa [1]. Worldwide in 2012, an estimated 1.1 million new PCa cases were diagnosed [2]. Given the high disease burden, there is clear interest in identifying inexpensive, noninvasive strategies for improving PCa survival.

Three studies have assessed associations between postdiagnosis physical activity and PCa progression or survival [3–5]. Kenfield et al [3] evaluated postdiagnosis activity in 2705 PCa cases over 9.7 yr on average. Risk of PCa-specific death was significantly 61% lower for men reporting ≥3 versus <1 h per week vigorous activity. Furthermore, men who maintained the highest versus lowest level of vigorous activity pre- and postdiagnosis experienced a nonsignificant 60% lower PCa mortality risk. In the second study [4], 1455 men with localised PCa were followed 22 mo on average. Men who walked briskly ≥3 versus <3 h per week had a 57% significantly lower risk of progression. A third study [5] followed 4623 localised PCa survivors up to 15 yr. Postdiagnosis moderate walking/bicycling ≥20 versus <20 min per day and moderate-vigorous exercise ≥1 versus <1 h per week were associated with 39% and 32% significantly lower risks of PCa mortality, respectively.

Given limited epidemiologic evidence relating physical activity to survival, we conducted a prospective cohort study of PCa survivors in Alberta, Canada, to identify all deaths and first recurrences/progressions of PCa. We aimed to evaluate the type, intensity, and timing of activity associated with survival, the role of occupational sedentary behaviour, and associations with physical activity changes across the diagnostic period. We hypothesised that men who were more active before and after diagnosis would survive longer. Our goal was to inform a potential phase 3 trial on this question as well as clinical recommendations for survivors.

2. Patients and methods

2.1. Participants

Cases were participants in a case-control study [6], and subsequently our case-only survival analysis, who resided in Alberta with incident, histologically confirmed, clinically significant stage II–IV invasive PCa. Incident cases were identified through the Alberta Cancer Registry (ACR) from 1997 to 2000. Eligibility included no previous cancer except nonmelanoma skin cancer, English speaking, Alberta resident, not physician excluded, and age <80 yr. Permission to contact patients was sought through referring physicians. The case-control study received ethics approval from the former Alberta Cancer Board (ACB) and the University of Calgary. All cases provided written informed consent for the cohort study, beginning in 2000, and to recontact their physicians for missing medical data.

2.2. Data collection

2.2.1. Prediagnosis lifestyle

In-person interviews on lifetime physical activity were completed on average 4.3 mo (standard deviation: 1.3) after diagnosis. The Lifetime Total Physical Activity Questionnaire (LTPAQ) [7] was administered using cognitive interviewing methods and a recall calendar to assess the frequency, duration, and intensity of occupational, household, and recreational activities from childhood until diagnosis (Supplement 1). Each respondent reported demographic and personal health information, PCa screening history, prostate conditions/surgeries, family history of cancer, lifetime smoking, and alcohol consumption. Participants reported their usual diet for the year before diagnosis [8] and usual height and weight for each decade aged 20–60 yr. The interviewer took anthropometric measurements using standardised methods and calibrated scales.

2.2.2. Vital status

Vital status was checked periodically over 14 yr from 2000 to 2014 (Fig. 1). Death information was provided monthly by Vital Statistics Alberta (a legislated population-based registry) to the ACR with cause of death from Statistics Canada. The time between actual death and reporting to ACR was 3 mo on average. For men who left Alberta postdiagnosis but remained in Canada, vital status linkages were made with other provinces. For men not known to have died, annual linkage with the Alberta Health registration file allowed for vital status determination when last residing in Alberta. For men who left Alberta and vital status was unknown by end of study, censoring time was the date of leaving Alberta.

2.2.3. Postdiagnosis lifestyle

Postdiagnosis activity was measured up to three times per participant (Fig. 1) on average 2.5, 4.7, and 6.8 yr postdiagnosis. At first follow-up, in-person interviews assessed activity undertaken since the prediagnosis activity interview using the LTPAQ modified for a shorter time frame. Cases reported diet, smoking, alcohol, and comorbidities using the same questions as at diagnosis. Anthropometric measurements were taken. In the second follow-up, physical activity since first follow-up was assessed using a mailed version of the LTPAQ that we developed and validated [9] to capture the past 1–2 yr of activity. Similarly, a third follow-up was completed by mail, querying time since last follow-up.

2.2.4. Chart abstractions

In 2002 the first medical chart review was completed and data abstracted on staging, treatments, vital status, comorbidities, non-PCa diagnoses, and recurrences/progressions. Recurrence was defined as further disease, identified through prostate-specific antigen (PSA) changes and secondary treatments, following a significant disease-free period. Recurrence date was when second-line treatment began or a decision was made not to treat. Progression occurred if PSA did not drop to undetectable levels following radical prostatectomy, if a patient's condition became progressively worse, if treatment produced no positive results, or if distant metastases at diagnosis became clinically stable and then progressed. Progression date was when increased/abnormal PSA was recorded or other diagnostic testing indicated progression. Charts were sought from ACB treatment centres and, if necessary, attending physicians. Chart abstractions were performed by ACR health record technicians with no access to physical activity data; TNM staging followed American Joint Committee on Cancer guidelines [10], and interrater reliability of abstraction was assessed. Two additional abstractions were completed in 2008 and 2014. Personalised letters were mailed to physicians or a health record technician made office visits to obtain missing chart information.

2.3. Statistical analysis

The Compendium of Physical Activities [11] was used to assign metabolic equivalent (MET) values to each self-reported activity. Individual total physical activity was estimated as the sum of

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