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# Influence of Insolation on Osteoporosis Progression in Androgen Deprived Nonmetastatic Prostate Cancer Patients

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## ABSTRACT

*Prostate cancer is a major public health problem in all the developed countries. Increasing numbers of men with nonmetastatic prostate cancer are receiving long-term androgen deprivation therapy (ADT). ADT is associated the loss of bone mineral density and a increased risk of bone fractures. The standard recommendations for male bone health include above all optimizing calcium and vitamin D intake, and exercise. Vitamin D<sub>3</sub> is an essential factor in the maintenance of bone health and calcium homeostasis. The main supply of vitamin D<sub>3</sub> is obtained through photosynthesis in the skin. The aim of this study was to investigate the influence of insolation on osteoporosis progression in androgen deprived nonmetastatic prostate cancer patients. We divided our androgen deprived prostate cancer patients in 2 groups. The first group (A) consists of 224 patients with insolation rate less then 3h per week. The second group (B) consists of 174 patients with insolation rate greater then 10h per week. With a questionnaire we determined, that patients from both groups were 70 to 80 years old, body mass index was 25–30 kg/m<sup>2</sup>, androgen deprivation was 4–6 years and received no vitamin D supplements. In the group A 21.86% suffered pathologic fractures do to osteoporosis. In the group B 10.92% patients suffered from osteoporotic bone fractures. The risk for pathological bone fractures is significantly greater in the group A. In conclusion higher insolation in androgen deprived nonmetastatic prostate cancer patients significantly decreases the osteoporosis progression and the risk of pathologic bone fractures.*

**Key words:** androgen deprivation, insolation, male osteoporosis, pathologic bone fractures, vitamin D

## Introduction

Prostate cancer is a major public health problem facing man today in all the developed countries<sup>1</sup>. Prostate cancer now outnumbers the lung cancer as the most common cancer in American men<sup>1</sup>. The incidence of prostate cancer is rapidly increasing in the Primorsko-Goranska County of Croatia<sup>1</sup>.

Increasing numbers of patients with nonmetastatic prostate cancer are receiving long-term androgen deprivation therapy (ADT)<sup>2,3</sup>. ADT is associated with the loss of bone mineral density and a significantly increased risk of bone fractures in patients with prostate cancer<sup>2,4,5</sup>.

Male osteoporosis is an increasing health problem in developed countries<sup>6</sup>. Almost one in four men older than 60 years of age will have an osteoporosis-related fracture<sup>6</sup>. Androgen deprivation therapy, most commonly with luteinizing hormone releasing hormone agonists or orchiectomy, increases the risk of male osteoporosis<sup>7</sup>.

Sex hormones, insulin-like growth factor 1, vitamin D and calcium are essential for maintenance of bone health<sup>8</sup>.

The standard recommendations for male bone health include optimizing calcium and vitamin D intake, and

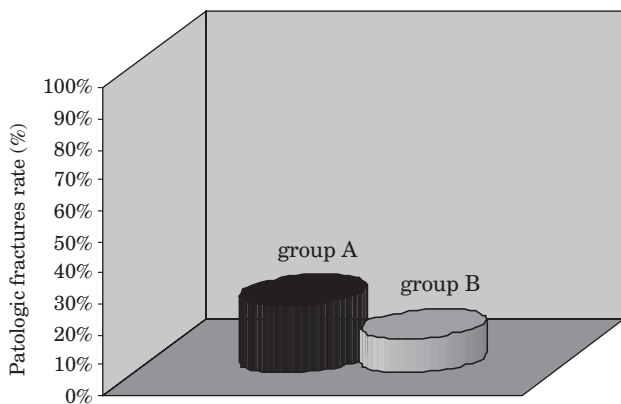


Fig. 1. Pathologic fractures rate (%) according to insolation rate groups. Group A (insolation rate <3 h/week), and group B (insolation rate >10 h/week).

exercise<sup>9</sup>. Vitamin D deficiency and insufficiency, hypogonadism, glucocorticoids, and excess alcohol are the most common causes of secondary bone loss in men<sup>10</sup>.

Vitamin D<sub>3</sub> in human is mainly obtained through photosynthesis in the skin, and food ingestion contributes to a small extent only<sup>11–17</sup>. So, sunlight is a necessary part in the synthesis of cutaneous vitamin D<sup>12–17</sup>.

## Materials and Methods

The study included 398 androgen deprived nonmetastatic prostate cancer patients. Bone metastases were excluded by clinical staging. We divided our patients in two groups. Group A consists of 224 patients with insolation rate less than 3h per week. Group B consists of 174 patients with insolation rate greater than 10h per week.

Patients from both groups were 70–80 years old, body mass index was 25–30 kg/m<sup>2</sup>, androgen deprivation duration was 4–6 years and received no vitamin D supplements.

All above mentioned parameters were obtained from a baseline questionnaire completed by the subjects. Osteoporotic bone fractures were detected by X-ray examination. Anamnestically we excluded severe traumatic injuries.

### Statistical analysis

Conventional software, Statistica 6.1 (StatSoft, Inc., Tulsa, OK, USA) was used for standard statistical analysis.  $p < 0.05$  was considered statistically significant.

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## Results

In the group A (insolation rate <3 h/week) 49 (21.86%) patients suffered pathologic fractures do to osteoporosis. In the group B (insolation rate >10 h/week) 19 (10.92%) patients suffered bone fractures do to osteoporosis ( $p < 0.05$ , Figure 1).

The difference in osteoporotic bone fractures rate between two groups is statistically significant ( $p < 0.05$ ). The risk for pathologic fractures is significantly greater in group A.

## Discussion and Conclusion

Our results are clearly showing that the greater insolation rate significantly decreases the risk of pathologic bone fractures do to osteoporosis in androgen deprived nonmetastatic prostate cancer patients.

As seen in previous studies, the prevention and management of osteoporosis in men receiving androgen deprivation therapy, is an important issue of health care<sup>2,3</sup>. Do to the constant increase of prostate cancer incidence and number of men receiving long-term androgen deprivation therapy, the number of severe osteoporosis cases is growing<sup>1–7,9,10</sup>.

Several new studies suggested that vitamin D supplements and exercise can prevent severe osteoporosis in men<sup>3,6,7</sup>. Others claimed that limiting alcohol consumption, smoking cessation, optimizing calcium and vitamin D intake, and exercise are crucial for male bone health<sup>4,5,9</sup>. It has also been proved that vitamin D deficiency and insufficiency contribute to secondary bone loss in men<sup>10–17</sup>. It is well known that vitamin D<sub>3</sub> is essential in the maintenance of healthy bone metabolism<sup>11–17</sup>. The main supply of vitamin D<sub>3</sub> is obtained through photosynthesis in the skin<sup>11–17</sup>.

Our results are consistent with above mentioned findings. In the group A (insolation rate <3h/week) 21.86% of patients suffered osteoporotic fractures, but in the group B (insolation rate >10h/week) only 10.92% suffered pathologic fractures. Also the risk for osteoporotic fractures is significantly greater in the group A of androgen deprived nonmetastatic prostate cancer patients. The decreased rate of osteoporotic fractures in group B is a consequence of greater insolation rate and vitamin D<sub>3</sub> synthesis. Furthermore the greater insolation rate is probably combined with greater physical activity rate per week.

In conclusion greater exposure to the sun has multiple positive effects on androgen deprived prostate cancer patients and severe osteoporosis prevention.

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## **UTJECAJ INSOLACIJE NA NAPREDOVANJE OSTEOPOROZE U BOLESNIKA S NEMETASTATSKIM KARCINOMOM PROSTATE POD ANDROGENOM DEPRIVACIJOM**

### **S A Ž E T A K**

Karcinom prostate je vodeći javno-zdravstveni problem razvijenih zemalja. Raste broj bolesnika s nemetastatskim karcinomom prostate, koji su na dugotrajnoj androgenoj deprivaciji. Androgena deprivacija povezana je sa smanjenjem mineralne gustoće kostiju i povećanim rizikom od patoloških fraktura. Preporuke za očuvanje koštanog zdravlja u muškaraca uključuju povećanje unosa vitamina D, kalcija te fizičke aktivnosti. Vitamin D<sub>3</sub> je nužni čimbenik u očuvanju koštanoga zdravlja i ravnoteže metabolizma kalcija. Glavni izvor vitamina D<sub>3</sub> je fotosinteza u koži. Cilj ove studije bio je istražiti utjecaj insolacije na napredovanje osteoporoze u bolesnika s nemetastatskim karcinomom prostate pod androgenom deprivacijom. Bolesnike pod androgenom deprivacijom podijelili smo u dvije grupe. Grupi A čine 224 bolesnika s vremenom insolacije manjim od 3h/tjedan. Grupi B čine 174 bolesnika s vremenom insolacije većim od 10h/tjedan. S anketnim upitnikom utvrdili smo kako su bolesnici u obje grupe stari između 70 i 80 godina, indeks tjelesne mase iznosio je 25–30 kg/m<sup>2</sup>, trajanje androgene deprivacije 4–6 godina te nisu uzimali nadomjesnu terapiju s vitaminom D. U grupi A u 21,86% bolesnika dokazali smo osteoporotične prijelome kostiju, a u grupi B u svega 10,92%. Rizik pojavnosti patoloških fraktura kostiju bio je značajno veći u grupi A. Zaključno dulja insolacija u bolesnika pod androgenom deprivacijom značajno smanjuje napredovanje osteoporoze i rizik od patoloških fraktura kostiju.