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Low Levels of Testosterone as a Risk Factor of Hip Fractures in Men Above the Age of Sixty-Five - A Case Series Study

Labinot Bekteshi

University Clinic of Surgical Diseases 'St. Naum Ohridski'

Krsto Nikolikj

University Clinic of Surgical Diseases 'St. Naum Ohridski'

Simon Trpeski

University Clinic of Traumatology and Orthopedics

Nebojsa Nastov

University Clinic of Surgical Diseases 'St. Naum Ohridski'

Abstract: Hip fractures are a major cause of morbidity and mortality in elderly men. Various factors contribute to hip fractures, including osteoporosis, falls, and metabolic imbalances. Recent research suggests that hormonal deficiencies, particularly low testosterone levels, may play a crucial role in bone health and fracture risk. The aim of this study is to evaluate the correlation between low testosterone levels and hip fractures in men above the age of sixty-five. This case series study was conducted at the University Clinic for Surgical Diseases 'St. Naum Ohridski – Skopje' in North Macedonia. The study included 10 male patients above 65 years of age who presented with hip fractures, while the control group comprised 10 randomly selected age- and race-matched men without fractures. Testosterone and Vitamin D levels were measured in both groups. The average testosterone levels in the fracture group were 181.97 ng/dl, whereas in the control group, they were 360.006 ng/dl. Average Vitamin D levels in the fracture group were 9.185 ng/ml, compared to 21.232 ng/ml in the control group. These findings suggest that low levels of testosterone and Vitamin D may be significant risk factors for hip fractures in men over 65 years old. Further research is required to establish definitive prevention protocols incorporating hormonal assessments for elderly males at risk of fractures.

Keywords: Testosterone, Hip fracture, Osteoporosis, Prevention protocols, Vitamin D

Introduction

Osteoporosis is becoming a world – wide concern in the elderly population. A significant cause of morbidity and mortality among elderly individuals are hip fractures, especially in men above 65 years of age (Cooper et al., 1992). Osteoporosis, falls and metabolic imbalances also contribute to hip fractures (Cummings & Melton, 2002). Hormonal deficiencies especially low levels of testosterone have an important role in bone density and the risk of hip fracture (Golds et al., 2017). Bone mineral density (BMD) and muscle strength, which are critical factors for fracture prevention, depend on testosterone levels (Shigehara et al. 2021). The aim of this study is to find out whether low levels of testosterone and vitamin D contribute to hip fractures in elderly men. In addition, we want to evaluate the necessity of forming prevention protocols for osteoporosis in men above 65 years old.

Method

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- Selection and peer-review under responsibility of the Organizing Committee of the Conference

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This case series study was conducted at the University Clinic for Surgical Diseases ‘St. Naum Ohridski – Skopje’ in North Macedonia during the period February 2022 – October 2022. The participants of this study are 20 male patients above the age of 65, of which 10 male participants are patients with hip fractures admitted to the hospital for further treatment and 10 male age- and race – matched participants without hip fracture who are randomly selected from the outpatient clinic. Patients with pathological fractures (metastatic disease), chronic corticosteroid therapy, chronic liver and kidney disease, active malign disease, acute hypogonadism (surgical or pharmacological castration), chronic alcoholism and patients who refuse consent to participate are excluded from this study.

Data Collection

Laboratory testing was done to all the participants in order to determine testosterone and vitamin D levels. The blood was taken between 07 – 10 am having in consideration the circadian rhythm. Testosterone levels were measured using chemiluminescent immunoassay (ng/dl) while Vitamin D Levels were measured using electrochemiluminescence immunoassay (ng/ml). The data from the laboratory results were analyzed. Comparative and descriptive methods were used to analyze the levels of testosterone and Vitamin D between the fracture and control groups.

Results and Discussion

The results show a significant difference between the fracture and control group. The average age in the fracture group is 80.8 years, 93 being the oldest and 71 being the youngest participant. The average age in the control group is 73.5 years, 93 being the oldest and 66 being the youngest participant. The average level of testosterone in the fracture group is 181.97 ng/dl, 395.29 ng/dl being the highest and 9.02 ng/dl being the lowest value. The average testosterone in the control group is 360.006 ng/dl, 548.38 ng/dl being the highest and 33.71 ng/dl being the lowest value. The average level of vitamin D in the fracture group is 9.185 ng/ml, 19.89 ng/ml being the highest and 3 ng/ml being the lowest value. The average level of vitamin D in the control group is 21.232 ng/ml, 35.33 ng/ml being the highest and 13.21 ng/ml being the lowest value (Table 1).

Table 1. Average values in fracture and control groups

Group	Average age (years)	Age range (years)	Average testosterone (ng/dl)	Testosterone range (ng/dl)	Average Vitamin D (ng/ml)	Vitamin D range (ng/ml)
Fracture group	80.8	71 – 93	181.97	9.02 – 395.29	9.185	3 – 19.89
Control group	73.5	66 – 93	360.006	33.71 – 548.38	21.232	13.21 – 35.33

According to these results, there is a significant difference in the levels of testosterone and Vitamin D between the fracture and the control group. The average testosterone levels from the control group are twice higher than the average testosterone levels from the fracture group (Figure 1). In addition, the average Vitamin D levels from the control group are 2.3 times higher than the average Vitamin D levels from the fracture group (Figure 2).

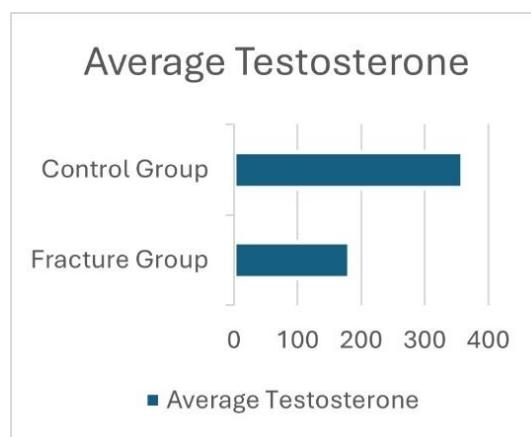


Figure 1. Average testosterone level

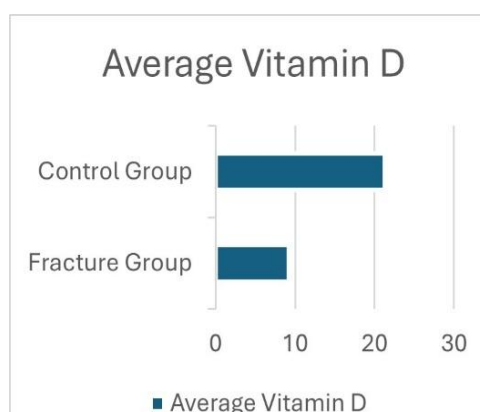


Figure 2. Average Vitamin D level

According to the results, the participants with hip fracture had significant lower testosterone and Vitamin D levels in comparison to the control group. This suggests that there may be a correlation between low levels of testosterone and Vitamin D with hip fractures in men above the age of 65. Testosterone levels enhance bone mineral density (BMD) and muscle strength which are critical factors for fracture prevention (Shigehara et al., 2021). Similarly, low levels of Vitamin D decrease calcium absorption and contribute to bone fragility (Dawson-Hughes et al., 1997). Low levels of testosterone correlate with increased hip fracture risk as a consequence of reduced bone strength in men above the age of 65. In addition, maintaining normal levels of Vitamin D helps in the prevention of hip fractures in elderly individuals (Han et al. 2020). According to the results, there is a need for well standardized screening in elderly men, who then might join a well-designed preventive protocol against hip fractures. We have to keep in mind that the sample size of this study is limited in the number of participants. On the other hand, these results suggest that further research with a larger number of participants is needed in order to have statistically relevant results.

Conclusion

This study emphasizes the eventual correlation between low levels of testosterone and Vitamin D with hip fractures in men older than 65 years of age. Even though this study has a small number of participants, the results suggest that there should be a well-established screening protocol for men above the age of 65 and hormonal supplementation therapies should also be incorporated in the prevention protocols to lower the risk of hip fractures in this population.

Recommendations

According to our results and analysis of this study we recommend testosterone and Vitamin D screening for all men above the age of 65 and hormonal supplementation protocols for those in need. We also recommend educational courses for healthcare providers to increase the awareness about this important topic.

Scientific Ethics Declaration

* The authors declare that the scientific ethical and legal responsibility of this article published in EPHELS journal belongs to the authors.

Conflict of Interest

* The authors declare that they have no conflicts of interest.

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Author(s) Information

Labiot Bekteshi

University Clinic of Surgical Diseases ‘St. Naum Ohridski’, Skopje, North Macedonia
Address: 53, 11th October Ave., 1000, Skopje, North Macedonia
Contact e-mail: bekteshilabinot@gmail.com

Krsto Nikolikj

University Clinic of Surgical Diseases ‘St. Naum Ohridski’, Skopje, North Macedonia
Address: 53, 11th October Ave., 1000, Skopje, North Macedonia

Simon Trpeski

University Clinic of Traumatology and Orthopedics – Mother Theresa Skopje
Address: 17, Mother Teresa (Vodnjanska), 1000, Skopje, North Macedonia

Nebojsa Nastov

University Clinic of Surgical Diseases ‘St. Naum Ohridski’, Skopje, North Macedonia
Address: 53, 11th October Ave., 1000, Skopje, North Macedonia

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