

Urinary Levels of Cross-Linked N-terminal Telopeptides of Type I Collagen are Higher in Athletes with Stress Fracture

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Introduction

Stress fractures, resulting from repetitive mechanical loading or the influence of systemic factors, are common in athletes. They involve the physiological processes of microdamage production and remodeling; the microdamage production may activate bone remodeling to remove bone which has become fatigue damaged; or accelerated bone remodeling increases remodeling space, resulting in the increase in mechanical loading on deteriorated bone and the subsequent accumulation of microdamage. Thus, a stress fracture is associated with the acceleration of bone remodeling. Clinically, however, the usefulness of bone turnover markers as the indices of bone remodeling in diagnosing a stress fracture has not been established. The main purpose of this study was to determine whether the urinary levels of cross-linked N-terminal telopeptides of type I collagen (NTX), a specific marker of bone resorption, were higher in athletes with a stress fracture than in those without any such fracture.

Material and Methods

Fourteen athletes who suffered from a stress fracture (Fr group) and 27 athletes without any such fracture (control group) were studied. The urinary NTX levels, measured by ELISA, were compared between the two groups by unpaired t-test, and then the maturation-related changes in the urinary NTX levels were examined by single regression analysis.

Result

Eight athletes were male and 6 were female in the Fr group, while 16 athletes were male and 11 were female in the control group. The mean age was 19.0 years (range: 13~23 years) in the Fr group and 19.3 years (range: 13-23 years) in the control group. The respective body mass index (BMI) was 20.3 and 20.2 kg / m², and the respective urinary NTX levels were 168.9 and 95.0 nmol BCE / mmol Cr. There were no significant differences in the age and BMI as well as the sport level between the two groups. However, the urinary NTX levels were significantly higher in the Fr group than in the control group (P<0.05). In the both groups, a significant correlation was found between the age and urinary NTX levels ($r = -0.672$, P<0.01 in the Fr group and $r = -0.712$, P<0.0001 in the control group).

Conclusion

The results of this study suggest that the urinary NTX levels decrease with maturation in young and adolescent athletes, and a stress fracture is associated with the higher levels of the urinary NTX. The urinary NTX may have the potential to be a useful marker in determining the situation of bone growth and skeletal maturation and in diagnosing a stress fracture in young and adolescent athletes.

Key word: Stress fracture, Athletes, Bone turnover, Urinary NTX