

TROCHANTER TERTIUS INCIDENCE IN A BULGARIAN POPULATION
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ABSTRACT

Trochanter tertius (TT) is an accessory bony protuberance of the proximal femur, thought to be involved in the function of the gluteal muscles. Reports of its incidence give variable rates in different samples. Moreover, its functional significance is not completely clear.

The aim of this study is to determine the incidence of TT in a Bulgarian population and to examine possible correlations with other peculiarities of the proximal femur.

The examination was performed on 61 dry femurs (32 right, 29 left), available at the osteological collection of the Department of Anatomy, Faculty of Medicine in Stara Zagora, Bulgaria. TT was distinctive in 7 right and 6 left bones (21,9% and 20,9%, respectively). When compared with control bones with the same length, it was demonstrated, that the incidence of TT is not associated with a significant difference in the size of trochanter major and/or trochanter minor. Therefore, we could not associate the incidence of TT with other peculiarities of the femur.

Despite the incidence of TT is not considered a significant/progressive evolutionary trait, its functional importance is not completely elucidated. Further studies, possibly with assessment of the involvement of TT in peritrochanteric fractures, should include a biomechanical study of the attachments of the gluteal muscles.

Keywords: *trochanter tertius, gluteal muscles, anthropometry, osteology*

INTRODUCTION

The third trochanter, or trochanter tertius (TT) is an accessory bony protuberance of the proximal femur. It is located on the posterolateral surface of the bone, distally from the intratrochanteric crest (crista intertrochanterica) and caudally to the greater trochanter (Lozanoff et al., 1985). It is closely associated with the gluteal tuberosity, as shown on Figure 1. Due to the latter it is viewed as an accessory attachment site of the great gluteal muscle, m. gluteus maximus.

TT is not present in every human, and is therefore considered to be a variable trait. Different investigations have reported different occurrence rates, ranging between 6,2% and 72% (Bolanowski et al., 2005). Higher occurrence rates of TT have been reported in females. (Apostolakis, 1931; Pittard et al, 1946)

Due to its position TT is often associated with the gluteal muscles. Since it can be viewed as an extension of the gluteal tuberosity, it could be associated with relative strengthening and greater mechanical forces exerted by the muscle. It was also speculated that it can provide a variance in the angle of insertion of the great gluteal muscle and therefore be of mechanical importance (Bolanowski et al., 2005).

Despite the assumptions about the mechanical significance of TT, no factual functionality has been established for this bony tubercle. Nevertheless, it is often included in antropometric and comparative studies as an attribute of descriptive osteology (Finnegan, 1976). Its variable incidence in different populations might be of certain anthropological interest.

The incidence of TT has not been reported in a Bulgarian population. Our study therefore aims to address this lack of data and report the incidence of TT in Bulgarian individuals. Furthermore, we aim to determine if the incidence of TT is associated with any other morphological peculiarities of the femur.

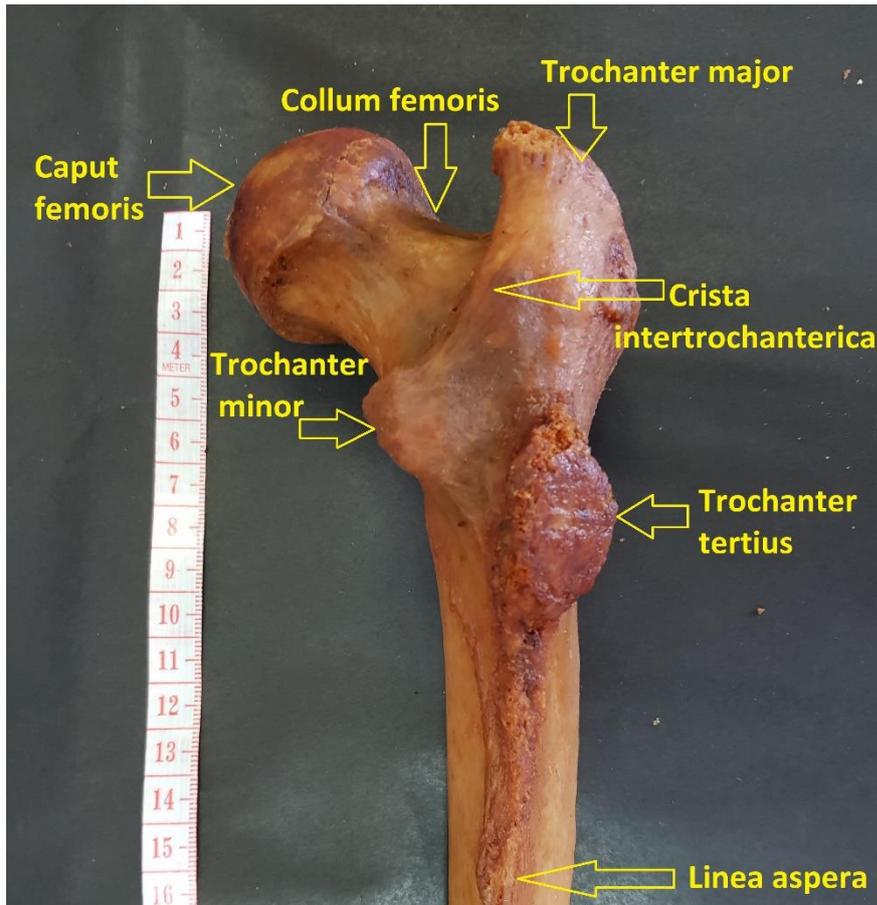


Figure 1. A photograph of the proximal end of a right femur, showing a particularly prominent third trochanter

MATERIALS AND METHODS

The study was performed on a collection of dry osteological specimens available at the osteological collection of the Department of Anatomy, Faculty of Medicine in Stara Zagora, Bulgaria. A total of 61 dry femurs (32 right, 29 left) were optically examined to determine the presence or absence of the third trochanter. Femurs showing TT were measured and compared to control femurs without TT of similar size. Size (longitudinal and transverse diameter) was recorded for each of the observed third trochanters, as well as for the greater and lesser trochanters (longitudinal and sagittal diameter) for all bones. All findings were carefully photographed.

Statistical analysis of the results was performed using GraphPad Prism 6 (GraphPad Software Inc., USA) using analysis of variance (ANOVA) followed by Tukey-Kramer's post-hoc test for multiple comparisons. The significance level was set at $p < 0.05$. All data hereafter is presented as mean values \pm standard deviation.

RESULTS

From the 61 femurs examined, 13 (21,3%) were noted for the presence of TT. 7 of the bones were right and 6 were (21,9% and 20,9% incidence per side, respectively). No statistical significance ($p > 0,05$) in the incidence of TT between left and right femurs was found.

The mean size (longitudinal x transversal diameter) of TT was $6,08 \pm 0,98 \times 1,48 \pm 0,42$ cm for the left bones and $4,24 \pm 2,53 \times 1,54 \pm 0,97$ cm for the right bones. Despite the slight tendency for having larger left TTs, the difference was insignificant ($p > 0,05$).

The comparative analysis of the size of the other two proximal femoral protuberances did not show any significant difference between bones with and without TT. The results are illustrated on Figure 2.

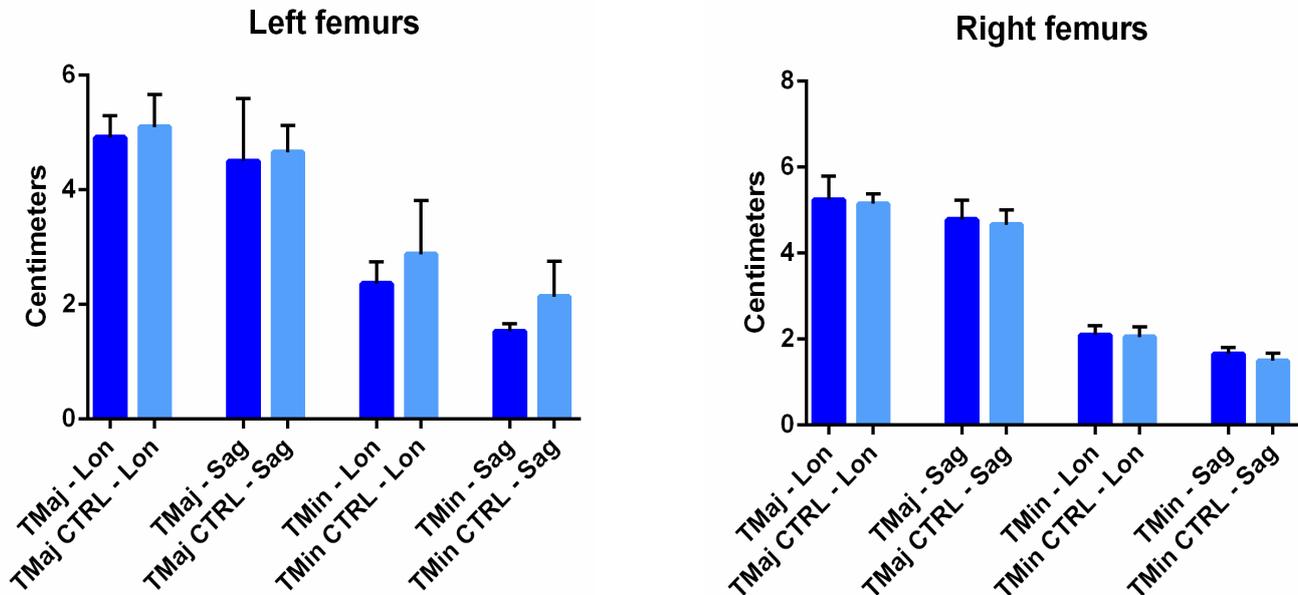


Figure 2. ANOVA of the size of the greater and lesser trochanter of femurs with (dark blue) and without (light blue) TT. TMaj – trochanter major; TMin – trochanter minor, Sag – sagittal diameter; Lon – longitudinal diameter, CTRL – control femurs (i.e. without TT). All data as mean \pm SD.

DISCUSSION AND CONCLUSIONS

The present study is the first one to describe the incidence of TT in a Bulgarian population. We believe that our results might be useful in future anthropological studies in Bulgaria.

The reported incidence rates are comparable to other samples (Bolanowski et al., 2005). We confirm the notion, that TT occurs without significant side to side dimorphism (Lozanoff et al., 1985). TTs documented by us were significantly larger in size than the ones reported by other authors (Chhapparwal et al., 2017). However, without a comparison of the total length of the femoral shaft in both studies, no certain conclusions can be made.

We did not establish any association between the presence of TT and the size of the other two trochanters. Therefore, linking TT to greater strength of the muscles around the hip joint (which attach, among all, to the other two trochanters) wouldn't be justified. We tend to attribute its presence to more or less altered function of the gluteal muscles (Bolanowski et al., 2005).

A drawback of our report is the inability to provide a reliable statistical analysis of the presence of TT in males and females, due to the specific setting the study was performed in. Analysis of a larger sample with clearly defined demographics should solve this issue. Furthermore, a biomechanical in vivo study might shed some light on the functional importance of the third trochanter.

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