



The Calcaneal Bohler's Angle in Nigerians: A Radiologic Study

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Abstract

The Bohler's Angle is a parameter used in assessing the integrity of the Calcaneus in the foot. A fracture will bring about a reduced Bohler's Angle. This study was aimed at arriving at the normal range and means of Bohler's angle in adult Nigerians especially the minimum value. The normal range has not been previously established. A total of 302 normal radiographs of the foot were analyzed, comprising of 249 males and 53 females. The radiographs were all reported normal by the radiologists. The Bohler's angle was measured and the mean and range established for both sexes and the general population. The mean angle of the general population was 32.83 ± 2.84 and the range was $28^{\circ} - 38^{\circ}$ there was no significant difference between the males and the females, comparison to other populations was made and differences noted. Given the wide range of normal values, we recommend a comparison to the contralateral foot where there is a high index of suspicious. This study shows the differences with other populations and reinforces the need for establishing normal values in a given population. It will be of great benefit to the orthopedic surgeon in the management of Calcaneal fracture.

Key words: Bohler's Angle, Calcaneus, Orthopedic Surgeons, Radiographs.

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Introduction

The Calcaneus is the largest tarsal bone and forms the heel pad of the foot. It articulates with the talus navicular and the cuboid. The Bohler's angle also called the "The Tuber Angle" is described as one indicating the configuration of the calcaneus measured from radiographs of the lateral projections of the foot. It is formed by a line drawn from the posterior margin of the talocalcaneal joint, through

the posterior superior margin of the calcaneus with a second line drawn from the posterior superior margin of the talocalcaneal joint to the superior articular margin of the calcaneocuboid joint. [1]. The range of this angle was given as $25^{\circ} - 40^{\circ}$ as widely quoted in older texts. [2, 3].

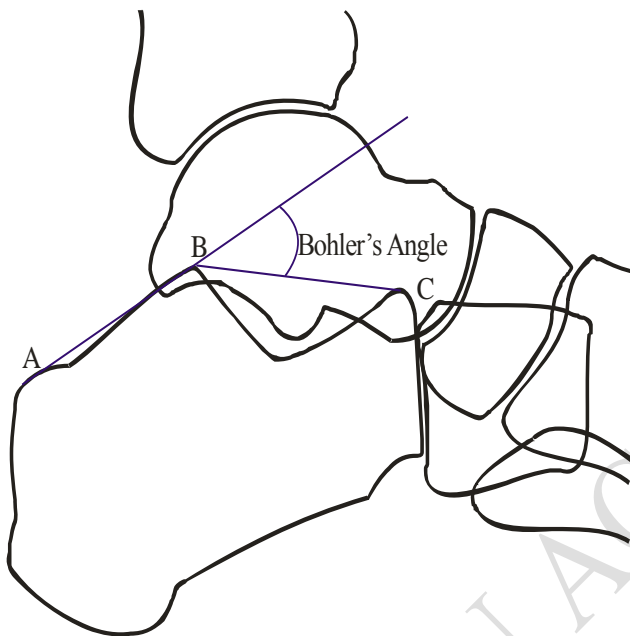
It was generally believed that Bohler's angle less than 28° should arouse suspicious of a fracture. Chen et al [4] however got a false positive abnormal cases of up to 31% if 28° is taken as the lower limit of normal and therefore suggested 20° as the lower limit. The Saudi population also recorded a range of $16^{\circ} - 47^{\circ}$ [5]. Other authors have also studied the Bohler's angle in different populations and have given different values. [6, 7].

The Bohler's angle is widely used in the fracture of the Calcaneus [8, 9, 10, 11]. A reduction in the angle has been associated with a fracture and [8] demonstrated that Calcaneal fracture with a markedly diminished Bohler's angle carry a poorer prognosis. Bohler's angle has also been found to show no significant differences in the adult age groups, gender and side of body (2, 3, 4, 5) however

in a study of paediatric Bohler's angle it was found to be less than that of adults and significantly so [12].

The aim of this study therefore is to find out the values for the normal Bohler's Calcaneal Angle in our Nigerian adults and compare same with the documented values of other populations. This will serve as a reference guide in Nigeria as to the best of our knowledge no such study has been done.

Schematic Drawing of the Bohler's Angle



Materials and Methods

A total of 302 radiographs of the foot and ankle joint of adult Nigerians comprising 249 males and 53 females were utilized for this research. They were obtained from the archives of radiology departments of the University of Port Harcourt Teaching Hospital, Port Harcourt and the Brathwaite Memorial Specialist Hospital Port Harcourt. The sex of the individuals were recorded. The films were the ones with no deformities and were reported normal by the radiologists. The proximal tarsal bones were quite clear and all measurements taken under the same conditions.

The following measurement were taken:-

Two lines are drawn. The first line is drawn from the highest part of the posterior margin of the Calcaneus

(A) To the posterior point of the Tala Calcaneal joint (B). This line is extended upwards.

The 2nd line is from the Superior articular point of the Calcaneocuboid joint to the Tala Calcaneal joint at point B. The angle made at Intersection of these two lines as in the figure is the Calcaneal Bohler's Angle.

Results

From the result, the mean Male Calcaneal Bohler's Angle was $32.84 \pm 2.86^{\circ}$ while that of the Female was $32.81 \pm 2.70^{\circ}$. The difference was not significant ($P > 0.05$). The total population mean was 32.83 ± 2.84

From the table, the distribution of the percentages in the range was fairly constant though the highest was in the mid range of $(32 - 33)^{\circ}$ with about 26%, all the others got less than 20%. The least being the range of $(28 - 29)^{\circ}$.

Discussion

The Bohler's angle is an important parameter in the assessment and diagnosis of the Calcaneal fracture. It is reduced in such cases. Values from different populations have shown marked variability especially the minimum value acceptable before any conclusions are made. [5, 6, 7]. From our research, the mean value for males was $32.84 \pm 2.86^{\circ}$ while that of females was $32.81 \pm 2.70^{\circ}$ there was expectedly no significant difference ($P > 0.05$). The mean total population value was 32.83 ± 2.84 with a range of $28^{\circ} - 38^{\circ}$. This makes acceptable lower limit value of Bohler's angle as 28° in Nigeria compared to other populations, the British range was from $24.7 - 48.9^{\circ}$ [6] the Turks from $20 - 46^{\circ}$ [7] while the Saudi Arabians recorded $16 - 47^{\circ}$ range [5]. There is a considerable wide range of normal values in all studies done on the Bohler's angle and the minimum values also differ as shown above. It is therefore recommended that a comparative radiograph of the contralateral side is advised to assess if the presence of fracture is ambiguous, this is also the recommendation of Wilmoh et al [6].

In conclusion, this study has shown the range of values of Bohler's angle in Nigeria and compared with other populations. There is therefore need to establish a normal range in a given population so as not to have a high percentage of false positive abnormal cases of Calcaneal fracture.

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