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STUDY OF PATTERNS OF TALAR ARTICULAR FACETS OF HUMAN CALCANEI AND OCCURRENCE OF ENTHESOPHYTES & IT'S SIGNIFICANCE .

KEYWORDS: Calcaneum, Talar articular facets, Enthesophytes

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ABSTRACT

Introduction: There are three facets over upper side of Talo-calcaneal joint: anterior talar facet, middle and posterior. There is considerable variations in the number and arrangement of these facets. Present study was done to determine patterns of the talar facets of calcanei and occurrence of enthesophytes & their clinical implications in the population of telengana Materials & methods: Forty five dry human calcaneum were studied in Department of anatomy, Osmania Medical College, Hyderabad. All bones were examined for pattern of talar articular facets and classified accordingly. Meticulous examination was carried out to evaluate the incidence of enthesophytes. Results: Pattern I morphologic variant was the most frequently encountered type (30 out of 45)(66.7%), Pattern II is the next common type (14 out of 45)(31.2%), followed by pattern V (1 out of 45)(2.2%). Pattern III, IV were not observed. Enthesophytes were observed in 30 (66.7%) bones, predominant number of bones(19bones) with two enthesophytes (medial and dorsal) , followed by single enthesophytes either dorsal (6bones) or medial enthesophyte (5 bones). Conclusion: The articular facets of subtalar joint on calcanei show racial and individual differences. Study population may be at greater risk of developing subtalar arthritis due to predominant pattern I calcanei as compared to the Europeans who present pattern II commonly. It was noted that pattern I was the most common morphological variant. Medial tubercular and Dorsal enthesophytes were most common type of abnormal bony outgrowths of calcaneum.

INTRODUCTION :

Calcaneum is the biggest and longest among the tarsal bones. It forms talocalcaneal joint with talus. There are three facets over upper side of talocalcaneal joint: anterior talar facet, middle and posterior (1). There is considerable variations in the number and arrangement of these facets(2,3). Using parameters such as degree of separation, fusion, and shape, several workers have described calcaneum into different types in certain population groups like African, Indian, British, Egyptian, and Spanish (4,5,6,7,8). Most researchers view these differences in facet configuration as anatomical variations of no functional significance. But ,Bruckner (1987) in contrast, argues that the subtalar joints formed by calcanei which had the pattern II facet configuration were comparatively more stable and had less chances of developing arthritis. There are two separate facets, anterior and middle, in the anterior 1/3 rd of the calcaneum with the pattern II facet configuration. These two facets along with the posterior facet provide an 'osseous tripod' for the talus to sit on and to prevent excess motion of the talar head. Thus, the subtalar joint with this tripod support is less likely to suffer trauma or biomechanical stress and the incidence of osteoarthritis is also less in such cases. Unstable joints are more likely to suffer trauma, accidents or other biomechanical stress as a result of uneven weight distribution (10). The racial and individual differences of the anatomic construction of the calcaneum play a key role on static and kinetic dynamic on the foot(11,12) .

The present study was planned to determine patterns of the talar facets of calcanei and to find out association of enthesophytes of calcanei with racial factors, if any. Entheses is connective tissue between tendon or ligament and bone. Enthesophytes are abnormal bony projections at the attachment of a tendon or ligament. Plantar calcaneal enthesophytes are the bony outgrowths from calcaneum. Osseous outgrowths at the plantar aspect of calcaneum was first reported in 1900 and were called Kalkaneussporn (calcaneal spur). Calcaneal spurs are of two types: Dorsal/posterior spurs and plantar/inferior spurs. In this study, we have evaluated the incidence of enthesophytes in dry calcaneal bone. Anterior, middle and posterior facets on the superior aspect of talus forms the joint with talus. Review of literature suggests that posterior facet is most constant among these facets, anterior and middle shows considerable variations (9-13). Joint pathologies in subtalar region is more common in certain morphological varieties of facets (14). Such variations influence subtalar joint stability and mobility (15). The objective of this study was to find out facet variations, report the incidence of enthesophytes of calcaneum.

MATERIALS & METHODS :

The study was conducted in Department of Anatomy, Osmania Medical College, Hyderabad using 45 dry calcaneum. Bones with developmental abnormalities and pathological changes including healed fractures were excluded . Sexual dimorphism was not considered. Each calcaneum was carefully examined for various patterns of articulating facets for talus and were categorised into five patterns.

1. Fusion of anterior and middle talar facets as pattern I;
2. Anterior and middle facets are separate is pattern II;
3. Absence of anterior facet is pattern III;
4. Fusion of anterior, middle and posterior is pattern IV; and
5. fusion of middle and posterior facet is pattern V.

All calcanei bones were meticulously observed with handheld magnifying glass for tubercles and incidence of enthesophytes

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were recorded. All observations were made twice and Incidence of various patterns were tabulated.

RESULTS:

Out of 45 dry calcanei studied, 23 were right and 22 were left sided. Pattern I with fused middle and posterior facet was found in 30 (66.6%)bones, pattern II in 14(31.3%) bones. There were no bones with type III and type IV pattern observed in this study. There was one bone(2.2%) with type V pattern (table-1). Enthesophytes are observed in 30 (66.7%) bones(table-2,3&4). Enthesophytes are more on right side when compared to leftside. Medial plantar enthesophytes were predominant (Figure 1&2). Spurs varied in length and morphology and the details were not considered in present study. Out of these thirty specimens with enthesophytes, nineteen were type-I pattern and eleven were type-II pattern. Out of these thirty specimens with enthesophytes, 16 bones have both plantar and dorsal enthesophytes(fig-1), 6 bones have only dorsal enthesophytes(fig-3),5 bones have plantar enthesophytes(fig-2) , 3 bones with Medial, lateral plantar & dorsal Enthesophytes.

Table- I: Incidences of various patterns talar articular facets in human calcanei.

Side of bone	Number of bones	Type- I	Type-II	Type-III	Type-IV	Type-V
Right	23	16	7	0	0	0
Left	22	14	7	0	0	1
Total	45	30(66.6 %)	14(31.3 %)	0	0	1(2.2%)

Table- 2 : Incidence of Enthesophytes found in the study

Side of bone	Number of bones	Bones with enthesophytes	Bones without enthesophytes
Right	23	17	6
Left	22	13	9
Total	45	30(66.6%)	15(33-3%)

Table- 3: Incindce of types of Enthesophytes found in the study

Side of bone	Number of bones with enthesophytes	Medial plantar enthesophyte	Medial plantar&dorsal enthesophytes	Medial,lateral plantar&dorsal enthesophytes	Dorsal (or) posterior enthesophyte
Right	17	3	7	3	4
Left	13	2	9	0	2
Total	30	5(16.7%)	16(53.3%)	3(10%)	6(20%)

Table-4 : Incidence of Enthesophytes in different types of calcaneum

Side of bone	Number of bones with enthesophytes	Type-I	Type-II
Right	17	11	6
Left	13	8	5
Total	30	19(63-3%)	11(36.7%)

DISCUSSION:

Pattern I calcaneal type was found to be dominant in the present study. Our findings confirmed the observations of other Indian studies [3,8,17,18,19]. In African studies [6,14], also, Pattern I was common. But pattern II was predominant in Europeans [6,8], whereas in Americans, pattern I with fused anterior and middle facets was commoner than pattern II [13]. All these findings indicated that there was a correlation between the calcaneal facet pattern and race. But the unusual feature of the present study was the finding of one calcaneum with the pattern V talar facet (2.2%), which was the rarest pattern which has been rarely reported in the literature. In pattern V, the middle and the posterior facets are fused and a distinct anterior facet is seen. A comparison of the adult African, Indian and European calcaneal bones by Bunning and Barnett [6] revealed a distinct racial difference for which no functional explanation can readily be offered thus indicating that they were probably genetically determined and were not developmental responses to physical activities. But,Buckner [10], stated that sustentaculum tali facet variations are functionally important because they influence subtalar joint stability; to test this hypothesis, 191 calcanei were analysed for correlations between sustentaculum tali facet morphology and osteoarthritis of the subtalar joint by Verhagen FD [13]. Calcanei with two separate sustentaculum tali facets had a lower frequency of arthritic changes associated with joint instability than calcanei with other facet configurations. This finding supports Buckner's hypothesis that subtalar joint facet configuration is a factor in foot mobility. Knowledge of the talar facets of the calcaneum is essential for the orthopaedic surgeons who perform 'Lengthening-distraction wedge calcaneal osteotomy and interposition bone graft', to correct the deformities in Pes planus. In this procedure, the identification of the interval between the anterior and the middle facets is important for the exact placement of the retractor, since the line of osteotomy usually passes through the same interval [20]. This technique is suitable for Europeans who predominantly have calcanei with pattern II facets for the tali (with separate middle and anterior facets). Since pattern I calcanei (with fused middle and anterior facets) are found to be dominant in study population (Indians), the surgeons here have to be careful while applying this technique or a suitable modification may be required. It establishes that the awareness about the variations in the talar facets of the calcaneum is vital in the surgical management of foot deformities [19] .

In this study we have determined the incidence of patterns of talar articular facets and occurrence enthesophytes. In this study, the most frequently found pattern is type I and in this pattern calcaneum, enthesophytes were encountered maximum. Our study goes according to many of the previous workers [21,22] . Incidence of enthesophytes is considerably higher in comparison to many of the previous reports. Our results are similar to previous studies by Bassiouni [23] and Banadda[22] et al.Thus, the higher incidence of enthesophytes in this study, may be due to considering calcaneum of older people. Since many of the spurs were from medial tubercle, it is suggested that out of these structures, attachment of plantar aponeurosis and flexor digitorum brevis plays a crucial role in formation of enthesophytes. There are reports that subtalar arthritis is most common in type I pattern . So, this study shows light on possible role of pattern of calcaneal articular facet in occurrence of arthritis in a particular locality.

CONCLUSION :

In Forty five human dry calcaneum pattern of articular facet and enthesophytes were studied. It was noted that pattern-I was the most common morphological variant as compared to the Europeans who present pattern II commonly. Medial tubercular enthesophytes were most common type of abnormal bony outgrowths of calcaneum. The knowledge about variations in morphology is important for all surgeries in subtalar regionThis fact necessitates the orthopaedic surgeons in India to modify the surgical techniques when they perform calcaneal osteotomy to suit the Indian scenario.

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Fig -1: Showing both plantar and dorsal enthesophytes

Fig -2:Showing only plantar enthesophytes.

Fig -3: Showing only dorsal Enthesophyte and type-I Calcaneum.

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