

RESEARCH ARTICLE**THE TRABECULAR PATTERN OF THE TALUS****¹Raza SMG, ¹*Raza HKT and ¹Upadhyay Sachin****¹Department of Orthopaedics, Traumatology and Rehabilitation, N.S.C.B Medical College Jabalpur - 482003 MP India****ARTICLE INFO****Article History:**

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INTRODUCTION

The trabecular pattern of bones is a reflection of stresses to which they are subjected. Changes in the stress pattern of bones may bring about reflective changes in the internal architecture of the bones. Although this fact is known, understanding of trabecular patterns has centered mainly around the head and neck of femur (Singh et al, 1970).

The Senior Author has been studying the trabecular pattern of various bones in a three dimensional perspective especially of proximal and distal femur, proximal and distal tibia, the talus and the calcaneum (Raza HKT, 1988; Guha BK and Raza HKT, 1989; Raza HKT, 1989; Raza HKT, 1991; Raza HKT, 1993,) 2,3,4,5,6,7,8. The current study on the trabecular pattern of the Talus was undertaken with the aim of understanding the lines of stresses across the talus. The hypothesis was that this study would help understand stresses across the ankle, subtalar joint and the rest of the foot.

MATERIAL AND METHODS

20 Cadaveric talar bones formed the material for the study (Fig.1). The bones were subjected to supero-inferior and lateral radiographs. 5 mm coronal and sagittal sections were obtained of seven bones each by cutting with a sharp saw. Similar transverse sections were made of six bones. The trabecular patterns of these sections were studied by naked eye

ABSTRACT

The trabecular pattern of bones apart from proximal femur has not been studied with the study was undertaken to observe the trabecular pattern of talus to explain stress patterns in hind foot. The trabecular pattern of the talus was studied by obtaining, 5 mm coronal, transverse and Sagittal sections of 20 human cadaveric talar bones. The sections were subjected to gross examination with a magnifying glass and after obtaining radiograph of sections. The main feature was a group of trabeculae in the superior medial part of head of Talus and a second in the lateral part of body of the talus. There was a sparse zone running obliquely from lateral part of head of Talus into medial part of the body. It was also noted that these group of trabeculae were part of arching trabeculae from distal end of Tibia through head of talus into the navicular and through distal end of Tibia through the talus into the calcaneum respectively. It was concluded that the trabecular patterns reflect the stresses of movements at the ankle & subtalar joints and the pattern in the talus has to be viewed along with the patterns in distal tibia, calcaneum & navicular.

observation/magnifying glass, and after obtaining radiographs of all the sections. Lateral view radiographs of ankles were also observed to reconstruct the trabeculae in continuation between trabeculae of distal end of tibia, talus, calcaneum and navicular.



Figure 1Material for the study (Intact Talus and sections)

Observations: The following were the observations after studying the sections:

A .Coronal Sections: (Fig. No 2 & 3).

1. The trabeculae are more homogenously distributed in superior two-third of anterior sections (head).
2. Trabeculae are sparse in middle sections (neck) especially in medial half.

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3. Lateral half of posterior sections (body) is dense with vertically and obliquely traversing trabeculae.



Figure 2 Coronal Sections separated out for examination.

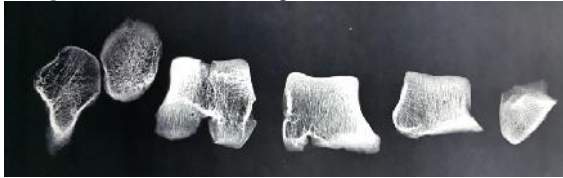


Figure 3 Radiograph of Coronal Sections

B. Transverse Sections: (Fig. No. 4 & 5)

1. Here also the most dense trabeculae are seen in posterior half (body) of talus, especially laterally.
2. Anteriorly placed horizontal/oblique thick trabeculae are more prominent in middle sections.
3. Weakest zone: The least trabeculae are placed in an oblique zone in inferior sections.



Figure 4 Transverse Sections



Figure 5 Radiograph of Transverse Sections

Sagittal sections: (fig. No. 6 & 7)

1. There is a sparse zone in medial sections in anterior inferior part of head.
2. There are transversely placed trabeculae in upper half of head in medial and middle sections.
3. There are dense obliquely placed trabeculae in body of talus in lateral sections.



Figure 6 Sagittal Sections



Figure 7 Radiograph of Sagittal Sections

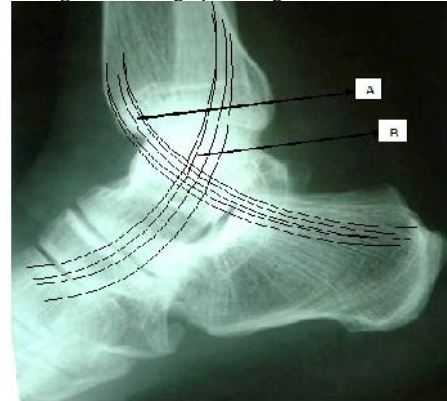


Figure 8 lateral Radiograph of the Ankle & Foot

RESULTS

After analysis of the above observations the final conclusions drawn were:

A. Sparse Zones

1. Antero—medial and inferior part of head.
2. Inferior half of neck.
3. Oblique zone between antero-medial and postero lateral group of trabeculae.

B. Dense Zones

1. Medial part head especially superior half.
2. Lateral half of the body of talus.

Observation of the lateral Radiograph of the Ankle & Foot along with lateral view of Talus (Fig.No.8)

1. The most important feature was the arcuate arrangement of trabeculae continuous with the anterior part of lower end of tibia arching downwards, posteriorly and laterally into Talus and Calcaneum.(A)
2. Second group of trabeculae arch from posterior part of lower end of tibia: inferiorly, medially and distally into talar head and then into the navicular.(B)

Supero-Inferior View of Talus (Fig.No.9)

There are two groups of Trabeculae.

1. **Anteromedial:** In head of Talus which arch from medial side of talar neck forwards and laterally into the Head. The trabeculae are thicker.

2. **Posterolateral:** Fine trabeculae closely arranged. More criss cross configuration (some oblique, some horizontal, some vertical in a three dimensional perspective). Dense trabeculae were observed near facet for lateral malleolus.

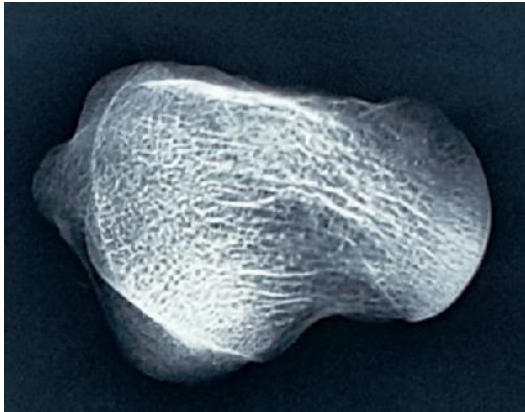


Figure 9 Supero inferior radiograph of Talus



Figure 10 Diagrammatic representation of Trabeculae as seen in lateral view radiograph of ankle & foot

DISCUSSION

The trabecular pattern of bones has not been studied in a three dimensional perspective even today. World literature has little to offer regarding the detailed trabecular pattern of bones, even more so of small bones like the talus. Raza (1993) (Fig. No. 7, 8) in a study of the three dimensional trabecular pattern of the Calcaneum had pointed out a relation of between the trabecular patterns in the Calcaneum with trabecular pattern of the talus and the trabecular pattern of the distal tibia (Figs. 8 & 10). Senior author pointed out that the trabecular pattern of the calcaneum cannot be taken in violation. It has to be visualized along with the architecture of the whole foot. We have tried to incorporate the observations of his study with the findings of our present study. A three dimensional picture of the trabecular pattern has emerged from the study of the coronal, Sagittal and transverse sections of the talus. There are two main groups of

trabeculae one in the anterior medial and superior part of the head of the talus. On observing these trabeculae in the lateral radiograph of the ankle joint, the trabeculae form a band of trabeculae posteriorly with arching trabeculae from the base of tuber calcanei upwards and forwards through medial part of the talus into the navicular and first metatarsal. This may be to give strength to the medial longitudinal arch by providing for an arching beam. There is another group of arching trabeculae starting from the posterior border of distal end of tibia curving through body and head of talus to join the first group to continue into the navicular. These may be the coarse trabeculae seen in anterior part of the head of talus medially. A third group of trabeculae is seen arching backwards, downwards and laterally from the anterior cortex of distal end of tibia through the body of talus into the upper half of the calcaneum. These are the laterally placed trabeculae in body of talus. The second and third groups of trabeculae form a decussation in the body of talus in lateral (Sagittal) view representing the stresses of dorsiflexion and plantar flexion. The decussation here is similar to the lines of stress seen on a loaded beam fixed at one end in the famous Meyer-culmann model. (Moss, M.L., 1980). This pattern is seen in three planes in the proximal femur as movements occur in three planes in the hip but only in one plane in distal femur. This is thus true for the decussation in the talus.

We thus see that the trabeculae reflect the stress across the talus. The oblique sparse zone represents areas through which fracture lines pass in fractures of the neck of talus. Cannulated cancellous screws are thus best passed obliquely from the medial side of head of talus posteriorly and laterally to engage the thick trabeculae of body of talus laterally.

CONCLUSION

The study has clearly identified lines of stresses across the talus. It has also explained the fracture geometry of talar neck fractures through the obliquely placed sparse zone as well as given an understanding for reduction and fixation of talar neck fractures. It is hoped that this study will help in better understanding of stresses in the ankle and foot in abnormal conditions.

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