

# Incidence and Clinical Implications of Peroneal Sesamoid of the Foot

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## ABSTRACT

**Introduction:** Os Peroneum (OP) is a sesamoid bone with an incidence of 5-26%, located in the tendon of peroneus longus adjacent to the lateral aspect of the cuboid bone. OP functions to protect the peroneus longus but can actually be responsible for peroneal tendon damage; acting as the focal point of mechanical stress it can lead on to fracture. OP fractures may be difficult to differentiate from the commonly encountered bipartite OP. Plantar lateral foot pain is a common presenting complaint in ankle sprain with many predisposing factors; pathology related to OP is often overlooked and neglected.

**Aim:** To study the normal position, location, incidence, distribution and morphology of OP in the radiographs of foot.

**Materials and Methods:** Retrospective 1000 radiographs of the foot, both anteroposterior and oblique view were observed for the presence, incidence, location and morphology of OP. Statistical analysis was done by applying descriptive statistics.

**Results:** Incidence of OP was 10.2%, being more common in males than females, with predominantly round or ovoid shaped. OP was more often located on the lateral aspect of calcaneocuboid junction.

**Conclusion:** Orthopaedician and radiologists must be aware of such bony variants in the foot and ankle, in order to prevent their misinterpretation, which assists as an aid in the early evaluation and management of undiagnosed plantar lateral foot pain.

**Keywords:** Calcaneocuboid junction, Lateral foot pain, Os peroneum

## INTRODUCTION

Sesamoid bones are small more or less rounded bones which occur embedded within the tendons, which are related to joint surfaces, which prevent friction between muscle and bone and also tend to modify the pull of muscle by altering the direction of muscle. Os Peroneum (OP) also known as peroneal sesamoid is an accessory bone with an incidence of 5-30% located on the lateral aspect of the cuboid on its plantar surface, within the distal part of peroneus longus tendon which arches around the cuboid [1]. Its position, shape and size may vary, but usually it is located adjacent to the lateral or plantar aspect of cuboid. OP may be bipartite or multipartite due to variable number of ossification centres, which can mimic fracture. It can predispose the peroneus longus or brevis tendon for rupture at the cuboid level with or without concomitant fracture, while an enlarged OP can entrap and prevent movement at the cuboid tunnel leading to peroneal tears [2-4].

Painful Os Peroneum Syndrome (POPS) refers to a variety of conditions presenting with pain localized on the lateral aspect of the cuboid area. It occurs either due to fracture of OP, diastasis of a multipartite OP with or without callus formation, Peroneus longus tenosynovitis, ruptures of peroneal tendons; presence of an enlarged peroneal tubercle can entrap the peroneus longus tendon during inversion and eversion of the foot. Once inversion injury at ankle occurs leading to rupture of peroneal tendons it is very difficult for repair of the tendons because of the inability to access the tendon as it courses deep within the midfoot [5,6].

POPS is often missed due to lack of knowledge and suspicion pertaining to OP, its variants such as bipartite and multipartite OP, or even our basic concept of functions of sesamoid bones that they protect the tendon from injury [1]. Awareness of various anatomical, clinical and radiological findings can help in early evaluation of undiagnosed lateral plantar foot pain. Hence, the present radiographic study on peroneal sesamoid of the foot was taken up in our institute.

## MATERIALS AND METHODS

Convenient sampling method was used and X-rays were retrospectively taken from September 2016 onwards at ESIC Medical

College and PGIMSR, Chennai, Tamil Nadu, India. Study was conducted for a period of one year between January 2017-December 2017. Consecutive 1000 X-rays of foot both anteroposterior and oblique view of foot radiographs of both sexes in the age group 12-80 years were used for the study, which were examined for the presence, number, location and morphology of accessory ossicles of the foot such as Os Peroneum and Os Vesalianum. OP has been reported for its clinical importance. Radiograph of patients with incorrect patient positioning, any foot deformity or known diseases, and any fracture of metatarsal and tarsal bones were excluded. Data collected by reading of both anteroposterior and lateral radiographs of the foot were recorded and analysed. Data analysis was done by applying descriptive statistics.

## RESULTS

Out of 1000 radiographs of the foot, 102 cases of OP were observed with varying shape and size accounting for 10.2% incidence. Shape of the OP observed in present study varied from round, oval, elongated [Table/Fig-1]. Other anatomical variants such as bipartite and tripartite OP were also noted in the study. In the present study we noticed that location of OP with respect to cuboid and base of fifth metatarsal varied, in majority of cases it was present near calcaneocuboid articulation [Table/Fig-2] and near the middle of cuboid bone [Table/Fig-3] and a very few of the radiographs showed OP along the anterior end and plantar surface of cuboid at the level of insertion of peroneal tendon [Table/Fig-4]. OP in the study showed distinct margins between adjoining bones, which were separated from the cuboid and fifth metatarsal by a radiolucent line, with a well-corticated edge.

OP was more common in females on left side but in males, it was more commonly seen on the right side [Table/Fig-5], however the incidence of OP was more in males compared to females. Bipartite sesamoids [Table/Fig-6] were more common in females in comparison with males [Table/Fig-7]. Tripartite sesamoid was seen in one male case on the left side with an incidence of 0.169% [Table/Fig-8]. OP was more commonly located at calcaneocuboid junction and next common location being lateral to cuboid [Table/Fig-9]. Shape of OP was commonly small and round in the present study, while large and ovoid being the next common shape [Table/Fig-10].



**[Table/Fig-1]:** Radiograph foot oblique view showing an elongated linear type of os peroneum.



**[Table/Fig-2]:** Radiograph foot oblique view depicting os peroneum at the level of calcaneo-cuboid joint.



**[Table/Fig-6]:** Radiograph foot oblique view showing bipartite os peroneum.



**[Table/Fig-3]:** Radiograph of the foot oblique view showing a well-defined rounded sesamoid at the level of middle of the body of cuboid bone.



**[Table/Fig-4]:** Radiograph foot oblique view depicting sesamoid at the level of insertion of peroneal tendon.

Sex and Side	No. of Radiographs	Incidence	Percentage (%)
Male Right	313	0	0
Male Left	276	1	0.36
Female Right	200	1	0.5
Female Left	211	3	1.42
Total	1000	5	0.5

**[Table/Fig-7]:** Indicating the incidence of bipartite.

Sex	No. of Radiographs	Incidence	Percentage
Males	589	1	0.169
Females	411	0	0
Total	1000	1	0.1

**[Table/Fig-8]:** Indicating the incidence of tripartite.

Location	Incidence	Percentage
Near Calcaneocuboid Junction	52	50.9
At body of Cuboid	32	31.3
Anteriorly at the level of insertion	18	17.6
Total	102	100

**[Table/Fig-9]:** Indicating the incidence of location of os peroneum.

Shape	Incidence	Percentage
Small and rounded	50	49.0
Larger and Ovoid	30	29.4
Linear	22	21.5
Total	102	100

**[Table/Fig-10]:** Showing the incidence of various shapes of os peroneum.

Sex and Side	No. of Radiographs	Incidence	Percentage (%)
Male Right	313	33	10.5
Male Left	276	27	9.7
Female Right	200	18	9.0
Female Left	211	24	11.37
Total	1000	102	10.2

**[Table/Fig-5]:** Indicating the incidence of os peroneum.

## DISCUSSION

There are many sesamoids and accessory ossicles in the foot. Many are asymptomatic while some are known to be associated with painful syndromes, such as Os trigonum, Os navicular, Os Peroneum which may be caused due to different etiologies such as trauma, infection, degenerative changes [1-6]. Peroneus longus muscle originates from the lateral surface of the shaft of fibula and adjoining surface of head

of tibia, passes beneath the Osseo fibrous tunnel on plantar surface of cuboid and inserts into the inferolateral surface of the base of the first metatarsal and adjacent medial cuneiform. In about 20% of the population, OP is located at the calcaneocuboid joint [3,7,8].

OP is an accessory ossicle, round or oval, within the substance of the peroneus longus tendon [1]. Pain in the lateral aspect of the foot may be caused due to dislocation or subluxation of the peroneal tendon, injury to the talofibular ligament or calcaneofibular ligament, or fractures in the fifth metatarsal, anterior process of the calcaneus or cuboid, OP as a cause of this is often neglected [1].

Sudden inversion or supination in the presence of Os peroneal fracture can lead to rupture of peroneus longus tendon. It compresses



the OP against the cuboid, resulting in fracture and rupture of the peroneus longus tendon. Os peroneum can predispose to distal rupture of peroneus longus tendon due to potential increased friction with adjacent structures [4] as well as development of stenosing peroneus longus tenosynovitis [9].

POPS refers to a variety of conditions presenting with pain localized on the lateral aspect of the cuboid area. The syndrome occurs due to local acute trauma such as ankle sprains or chronic overuse. OP can show changes in its morphology or position, in tears of the peroneus longus tendon because of its intra-tendinous location. Bianchi S et al., has proposed a classification peroneus longus tears based on its relation of OP into three subtypes: type I as tears located proximal to the OP, type II located at the level of OP and type III located distal to OP. These tears present with different changes on OP morphology or location [5]. POPS occur in two forms acute and chronic, acute form presents with history of trauma, along with ankle sprain leading to fracture or diastasis of OP with or without peroneal tendon rupture [1,6,10]. Chronic presentation is closely linked to a healing process of a fracture with subsequent calcification, remodelling, or chronic diastasis of the OP with a variable frequency of tenosynovitis of the peroneus longus tendon [1-6,10]

Several imaging techniques are available to visualise OP, it usually appears as an oval shaped ossicle with corticated margins situated more often near to calcaneocuboid junction. While bipartite or multi partite OP appear as two or more oval fragments with well-defined corticated margins. Accurate evaluation of the bone margins is of the utmost importance for differential diagnosis with a fracture [5]. It is very difficult to differentiate between Os peroneal fracture and partite OP, fractured Os has non-sclerotic margins and the bone fragments fit together while in partite sesamoid margins are rounded and sclerotic and do not fit in together. But in chronic cases the fractured edges resemble more or less like partite bones due to the process of bone remodelling [6]. If the distance between the fragments of OP is greater than 5 mm, must indicate the diagnosis of fracture [4].

OP can be differentiated from fracture of cuboid bone. The marginal continuity of cuboid is lost in cuboid fracture while OP appears as a separate corticated ossicle without obliterating the borders of cuboid bone [11]. In MRI the ossicle appears isointense to bone marrow nearer to cuboid bone, while in ultrasonography it can be easily identified, as it appears as an echogenic area with posterior acoustic shadow. CT and MRI can also be used, especially to evaluate other possible associated abnormalities [12].

### Embryological Basis

Sesamoid bones arise with an interaction between various mechanical and biological factors commonly associated with locomotion and muscular contraction [13]. Sesamoids initially arise as cartilaginous nodules which later undergo endochondral ossification somewhere between 3 and 12 years, [13] these develop within tendons in areas which experience both tendinous pull and hydrostatic compressive mechanical stresses. During ontogeny in humans and other animals, fibrous tendon tissue can form regions of fibrocartilage in areas that wrap around bony prominences, which give rise to sesamoid bones [13].

Treatment options for peroneus longus tendon ruptures with or without os peroneum fracture include fixation of the fracture, excision of the

bone with direct repair of the tendon and tenodesis of the peroneus longus to the peroneus brevis tendon with anchoring of the proximal peroneus longus tendon segment to the cuboid or calcaneus [14-16].

### LIMITATION

Although radiographs act as initial mode of investigation, but higher imaging modalities such as ultrasonography, and MRI, can give a much clear view of the ossicle along with adjoining soft tissue mass and play an important role in the early diagnosis and management of POPS.

### CONCLUSION

OP involvement in peroneal tendon pathologies is frequently misdiagnosed by radiologists, imaging is often necessary to confirm the clinical suspicion and for deciding between surgical and medical line of treatment. In peroneus longus tendon tears, the OP can show changes in its morphology or position; depending on the location of the tendon's tear, even the location of OP itself can lead to peroneal tear if it is located nearer to insertion of peroneal tendons during the movements of foot. Hence the surgeons should be aware of the such normal anatomical variant of the ossicles of foot in order to manage cases of peroneal tears appropriately.

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