

SESAMIODS OF THE FEET: A CADAVERIC STUDY ON THE INCIDENCE AND MORPHOLOGY IN SOUTH INDIAN POPULATION

Vijaianand M ^{*1}, Ravichandran Doraiswamy ².

^{*1} Assistant Professor, Department of Anatomy, Karpagam Faculty Of Medical Sciences and Research, Coimbatore, India.

² Professor, Department of Anatomy, Karpagam Faculty Of Medical Sciences and Research, Coimbatore, India

ABSTRACT

Background: Sesamoid bones are tiny seed like bones embedded in the tendons or joint capsule. They prevent friction and protect the tendons from direct injuries. The largest sesamoid bone, the patella is given much importance when compared to the sesamoids of the feet. The sesamoids of the feet are classified into-hallucal sesamoids, lesser toe sesamoids of the metatarsophalangeal joints of 2nd through 5th toe and lesser toe sesamoids of the interphalangeal joints of 2nd through 5th toe. The sesamoids show bipartism which can often be mistaken for fractures in radiographs. The incidence and morphology of the sesamoid bones in South Indian population is hitherto unreported. The present study aims to assess the incidence of sesamoid bone and their morphological features in South Indian population by dissection method.

Materials and Methods: 46 lower limbs were utilized for the present study. Of which 23 belonged to right and 23 belonged to left. By standard dissection methods the sesamoids of the feet were exposed. Their occurrence, shape, partition, fragmentation and size were macroscopically noted.

Results: The incidence of hallucal sesamoids was 100%. Bipartism in hallucal sesamoids was noted to be 4.3%. Hallucal sesamoids of the interphalangeal joint was 15.2 %. Sesamoid of the fifth toe (metatarsophalangeal) was 6.5%. The average diameter of the hallucal sesamoids, interphalangeal sesamoid of the hallux, metatarsophalangeal sesamoid of the 5th toe was 9mm, 5mm and 2mm respectively. All the sesamoids were semi-oval in shape

Conclusion: The importance of sesamoid in clinical practice is often under estimated. Bipartite sesamoids are often mistaken for fractures. Chronic sesamoiditis and osteonecrosis are common differential diagnoses in chronic foot pain involving the ball of the toes. The present study discusses the clinical importance, incidence and morphology of the sesamoids of the feet.

KEY WORD: Sesamoids, Hallucal, Metatarsophalangeal, Fractures, Osteonecrosis.

Address for Correspondence: Dr. Vijaianand M, Assistant Professor of Anatomy, KFMSR, Coimbatore, 7, Tarun kudil, IK garden, Gokul Nagar Annexe, Chinnathirupathi, Salem-636008, Tamil Nadu, India. Mobile: (0) 9655246467 **E-Mail:** dr.vijaitarun7474@gmail.com

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INTRODUCTION

The tiny seed like bones present in the limbs were termed as 'Sesamoid bones' by Galen. He has described these bones in detail in his

account on the 'Osteology for the beginners'[1].The word sesamoid derives its root from 'Semsem' in Arabic language which means sesame seed. Ancient Hebrews believed that

these sesamoid bones were indestructible and housed the soul after death [2].

Sesamoid bones are partially or completely ossified and are embedded in tendons. Unlike the major bones they are not connected to one another. These bones reduce the friction of the tendons acting over the joints and also protect the tendon from direct injuries [3]. The incidence and clinical significance of sesamoids has been reported variably in the literature [4, 5]. The sesamoids noted in the feet include the hallucal (great toe), lesser toes metatarsophalangeal joint sesamoids and interphalangeal joint sesamoids of great toe. The Hallucal sesamoids are said to be physiologic in nature and is very rarely absent. They are embedded in the tendon of Flexor hallucis brevis and are always present on the plantar aspect of the 1st metatarsophalangeal joint. They are usually two in number namely medial and lateral. The medial one commonly shows bipartism [6, 7]. An inconstant sesamoid is often reported in the interphalangeal joint of the great toe. The sesamoids in the 2nd through 5th toe are rarely encountered and if found are usually embedded in the plantar aspect of the joint capsule [3, 8]. Sesamoids appear in the 12th week of fetal life and get ossified at an earlier age in females [9, 10]. However, a controversy exists regarding the age of completion of ossification between males and females [9, 11]. Associated pathology related to sesamoids are not uncommon. The array of clinical conditions related to these little bones includes fractures, infection, arthritis, osteonecrosis, absence, hypoplasia and fragmentation.

However, in day-to-day clinical practice not much importance is given to sesamoid bones. Studies on the incidence of sesamoid bones in various population including Turkish, Malavian, Sudanese, Japanese, Nigerians and Bahrainis are available. To our knowledge the incidence and morphology of sesamoid bones in South Indian population is hitherto not reported. Therefore, the aim of the present study is to find out the incidence and variations of sesamoid bones in the local population.

MATERIALS AND METHODS

46 lower limbs (right side 23 & left side 23)

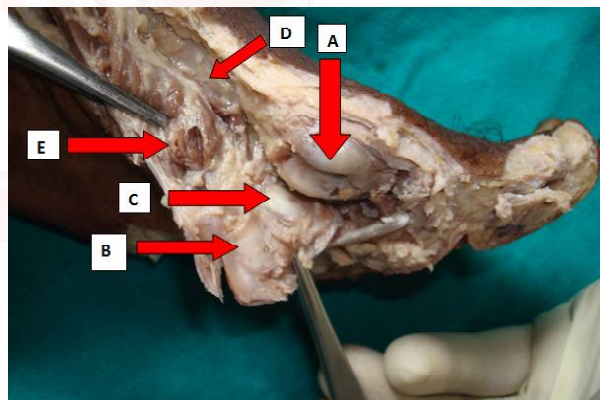
available in the department of Anatomy, KFMSR were utilized for the proposed study. Age and gender of the cadavers were not considered. Sole was dissected as per standard guidelines [12]. The presence or absence of the sesamoid bones in the usual sites such as metatarsophalangeal and interphalangeal joints of 1st-5th toe were noted. Using the magnifying lens, the gross features including shape, average diameter, fragmentation, hypoplasia and partition were noted. The results were analyzed statistically.

OBSERVATIONS AND RESULTS

Table 1: The results and observation are tabulated as follows.

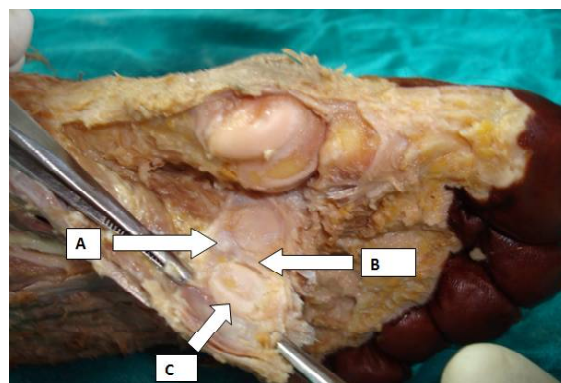
Sesamoid type	Location	Incidence	Side	Shape	Diameter	Partition
Hallucal sesamoids: Metatarsophalangeal	Flexor hallucis brevis tendon	100%	23-Right and 23-Left	Semi-oval	9 mm	Bipartism (4.3%)
Interphalangeal	Interphalangeal joint capsule	15.80%	05-Right and 02-Left	Semi-oval	5 mm	Nil
Lesser toe sesamoids 5th toe	Metatarsophalangeal joint	6.50%	01-Right and 01-Left	Semi-oval	2 mm	Nil

Fig. 1: Shows the hallucal sesamoid



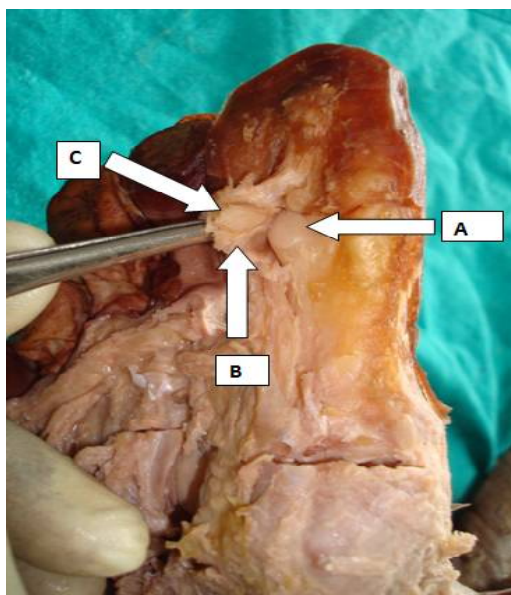
A: Head of the first metatarsal, B: Medial hallucal sesamoid, C: Lateral hallucal sesamoid, D: Lateral head of flexor hallucis brevis, E: Medial head of flexor hallucis brevis

Fig. 2: Shows bipartism in the hallucal sesamoid.



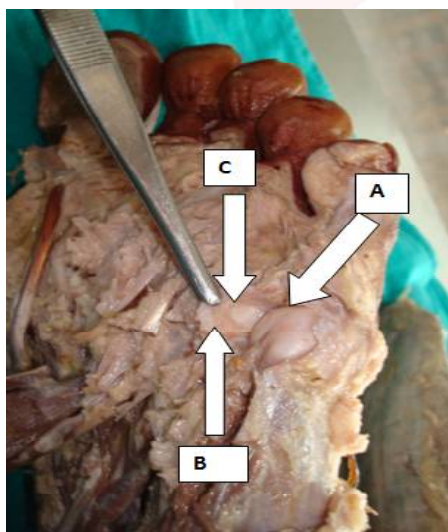
A: Bipartite lateral hallucal sesamoid, B: Intersesamoid ligament, C: Medial hallucal sesamoid

Fig. 3: Shows sesamoid at interphalangeal joint (IP) level of the great toe.



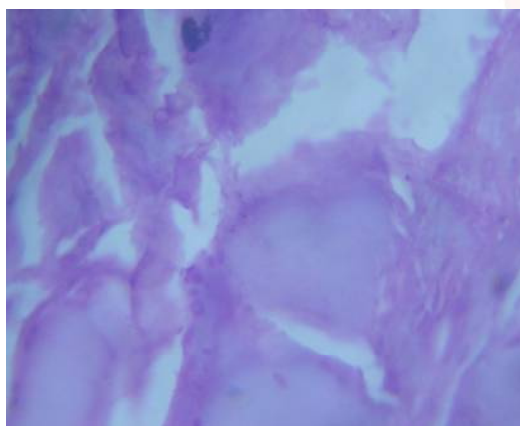
A: IP joint, B: IP joint capsule, C: Sesamoid bone embedded in the IP joint capsule

Fig. 4: Shows sesamoid at the metatarsophalangeal (MTP) joint of fifth toe.



A: Head of fifth metatarsal, B: Capsule of MTP joint, C: Sesamoid bone embedded in the MTP joint capsule.

Fig. 5: HPE showing cartilage to bone transformation in the sesamoid bone seen in the metatarsophalangeal joint of the 5th toe.



DISCUSSION

Sesamoid bones are semi-oval shaped seed like bones or cartilages with an average diameter of about 10 mm. As many as 42 sesamoid bones have been noted in a single individual (13). Patella is the largest and the most common sesamoid present in the tendon of the quadriceps femoris muscle. In the feet, the hallucal sesamoids are the most common. The medial hallucal sesamoid is larger and elongated and the lateral hallucal sesamoid is smaller and ovoid. The medial hallucal sesamoid receives the insertion of flexor hallucis brevis (medial head) and abductor hallucis. The lateral receives the insertion of lateral head of flexor hallucis brevis and adductor hallucis. The medial and lateral hallucal sesamoids are attached to each other by a thick intersesamoid ligament [14]

The incidence of hallucal sesamoids have been reported as 99.9% by most of the authors (4,15-17). Cadaveric prevalence was found to be 99.9% (1355 feet were examined) and radiographic prevalence was found to be 99.6% (11,711 feet were examined). About 5 in 10,000 feet shows absence of hallucal sesamoids. In the present study, we have observed a 100% incidence (in all 46 limbs). Absence of hallucal sesamoid was not encountered in our study. The incidence of hallucal sesamoids in South Indian population is almost equal to the overall incidence reported by other authors (Fig. 1).

The medial hallucal sesamoids are more commonly injured than the lateral, as it receives most of the load than the lateral [18]. Hallucal bones are commonly injured in extension stresses of the great toe. Chronic pain in the ball of the great toe is commonly attributed to chronic sesamoiditis, painful bipartite sesamoids and chronic non unions. The studies by Scranton and Rutkowski [19] based on his dissection and radiographic studies, associates the anatomic variations of the first ray including rotational deformities of the first metatarsophalangeal joint, enlarged medial hallucal sesamoid and long first metatarsal bone as a cause for chronic sesamoiditis.

The concept of "sesamoid drift" was described in detail by Jared P. Frankel and Joan Harrington [20]. It describes mainly the abutment of the

medial sesamoid on the first metatarsal head and drift of the lateral sesamoid into the first interspaces in hallux abducto valgus deformity.

In the present study the incidence of bipartism was 4.3%. Whereas, Mefert [21] reported an incidence of 7%. Medial hallucal sesamoid shows bipartism more commonly than the lateral. In our study we observed 2 limbs (01-Right and 01-Left) with bipartism. One showed bipartism in the medial hallucal sesamoid and other showed bipartism in the lateral hallucal sesamoid (Fig.2). In cases of hallux valgus deformity bipartism of the medial hallucal sesamoid is observed thrice more commonly than the lateral [22]. Partitions may be mistaken for fractures.

The hallucal sesamoids at interphalangeal joint are usually embedded within the joint capsule and are noted on the plantar aspect. The incidence of these sesamoids in our study is 15.2%. In our study we observed in 7 limbs (05-Right and 02-Left) with interphalangeal hallucal sesamoids (Fig.3). The incidence of this sesamoid ranges between 2-13 % [23]. In case of interphalangeal joint dislocations, these sesamoids if present can interpose between the particular surfaces thus hindering the reduction [24].

The lesser metatarsal sesamoids in the 2nd, 3rd, 4th and 5th toes are usually found in the medial side, embedded in the joint capsule. They may present with or without partition. The incidence of 5th metatarsophalangeal joint sesamoid in the present study is 4.3% (Fig.4 & 5). In our study we observed these sesamoids in 2 limbs (01-Right and 01-Left). Our results coincide with the results of Coskun et al [25]. These sesamoids don't carry much clinical significance. However it may get infected if a nearby soft tissue infection is present resulting in pain in the ball of the little toe.

The prevalence of 2nd, 3rd and 4th toe has been reported as 0.4%, 0.2% and 0.1 % respectively. In our study, we never came across a sesamoid bone in the 2nd through 4th toes.

The sesamoids receive blood supply from the plantar aspect. The blood supply is rich in the proximal part. Because of this, the distal aspect is more prone for osteonecrosis [26]. Partitions

in the sesamoid bone (more commonly on the medial hallucal) has been attributed to incomplete ossification [27].

CONCLUSION

The tiny sesamoid bones of the feet carry clinical significance. However, the importance given to them in practice is too little. The present study highlights the incidence and morphology of the sesamoids of the feet in south Indians. The authors have conducted the study with limited samples in cadaveric specimen. We further recommend studies in live individuals using imaging techniques including age and gender with larger samples in future.

Conflicts of Interests: None

REFERENCES

- [1]. Van Dam Scott BE, Dye F, Wilbur Westin G. Etymology and the Orthopaedic Surgeon: Onomasticon (Vocabulary) Iowa Orthop J., 1991;11:84-90.
- [2]. Inge GAL, Ferguson AB. Surgery of the sesamoid bones of the great toe. Arch Surg., 1933;27:466-88.
- [3]. Nwawka OK, Hayashi D, Diaz LE, Goud AR, Arndt WF 3rd, Roemer FW, Malguria N, Guermazi A. Sesamoids and accessory Ossicles of the foot: anatomical variability and related pathology. Insights Imaging 2013;4:581-593.
- [4]. Kassatkin S. Die Sesambeine der Hand und des Fusses beim Menschen. Z anat Entwicklungsgerch 1934;102:635-654.
- [5]. Montagne J, Chevrot A, Galmiche JM (1980) Atlas de radiologie du pied. Masson. Paris.
- [6]. Aseyo D, Nathan H. Hallux Sesamoid bones. Anatomical observations with special reference to Osteoarthritis and Hallux valgus. Int Orthop 1984;8:67-73.
- [7]. Masaki T. An anatomical study of the interphalangeal sesamoid bone of the hallux (in Japanese). Nihon Seikeigeka Gakkai Zasshi 1984;58:419-427.
- [8]. Umile Giuseppe Longo et al. Prevalence of Accessory ossicles and Sesamoid bones in Hallux valgus in Italian women. Journal of the American Pediatric Medical Association 2013/vol 103 No3 Month/ Month.
- [9]. Oloff L, Schulhofer D. Sesamoid complex disorders. Clin Podiatr Med Surg., 1996;13(3):497-513.
- [10]. Leventten EO. Sesamoid disorders and treatment. Clin Orthopedics Related Researches., 1991 Aug;13 (6) :359-63
- [11]. Dharap A.S. AL-Hashimi H. Kassab S. AND Abu-Hijleh. M.F. Incidence and Ossification of Sesamoid bones in the Hands and Feet: A Radiographic Study in an Arab Population. Clinical Anatomy., 2007;20:416-423.

- [12]. Cunningham's Manual of Practical Anatomy Vol.1.15th Edition pg:202-214.
- [13]. Sarin VK, Erickson GM, Giori NJ, Bergman AG, Carter DR. Coincident development of sesamoid bones and clues to their evolution. *Anat Rec (New Anat)*. 1999;257:174-180.
- [14]. Bizarro AH. On the traumatology of the sesamoid structures. *Ann Surg*. 1921 Dec;74(6):783-791.
- [15]. Pfitzner W. Die Sesambeine des Menschlichen Körpers. *Morphologische Arbeiten de Schwalbe* 1892;1:517-762 [cited from Dwight (1907),pix]
- [16]. Aseyo D, Nathan H. Hallux sesamoid bones. Anatomical observations with special reference to osteoarthritis and hallux valgus. *Int Orthop* 1984;8:67-73.
- [17]. Goldsberg I, Nathan H. Anatomy and pathology of the sesamoid bones. *Int Orthop* 1987;11:141-147.
- [18]. Zinman, H, Keret D, Reis M. D. Fractures of the medial sesamoid bone of the hallux. *J. Trauma* 1981;21:581.
- [19]. Scranton, E., Rutkowski, Anatomic variations in the first ray: Part II. Disorders of the sesamoids. *Clin. Orthop*. 1980;151:256.
- [20]. Jared P. Frankel, DPM, FACFS. Joan Harrington, DPM. Symptomatic Bipartite Sesamoids, *The Journal of Foot Surgery*. 1990;29(4).
- [21]. Meffert K. Über Erkrankungen der Sesambeine d.I. Metatarsophalangealgelenkes. *Brunns' Beitr klin Chir*. 1929;146:124.
- [22]. Munuera PV, Dominguez G, Reina M, Trujillo P. Bipartite hallucal sesamoid bones: Relationship with hallux valgus and metatarsal index. *Skeletal Radiol*. 2007;36:1043-1050.
- [23]. Abubaker Elsiddig Talha, .A.A.Abbas, Dr.Yasser Siddig Abdelghany, Fiez Yousif, Mohammed El Mahadi. A RADIOGRAPHIC STUDY OF THE PREVALENCE AND DISTRIBUTION OF SESAMOID BONES OF THE FOOT IN ADULT SUDANESE. *WJPMR* 2016;2(4):164-176.
- [24]. Davies MB, Dalal S. Gross anatomy of the interphalangeal joint of the great toe: implications for excision of plantar capsular accessory ossicles. *Clin Anat*. 2005;18:239-244.
- [25]. Coskun N, Yuksel M, Cevener M, Arican RY, Ozdemir H, Bircan O, et al. Incidence of accessory ossicles and sesamoid bones in the feet: a radiographic study of the Turkish subjects. *Surg Radiol Anat*. 2009;31:19-24.
- [26]. Sobel M, Hashimoto J, Arnoczky SP, Bohne WH. The microvasculature of the sesamoid complex: its clinical significance. *Foot Ankle*. 1992 Jul-Aug;13(6):359-63.
- [27]. Van Hal ME, Keene JS, Lange TA, Clancy WG. Stress fractures of the great toe sesamoids. *Am J Sports Med*. 1982 Mar-Apr;10(2):122-8.

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