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LESSER METATARSAL SESAMOIDITIS-POTENTIAL CAUSE OF FORE FOOT PAIN?? : A PROSPECTIVE MULTICENTER EPIDEMIOLOGICAL SCREENING STUDY OF THE ODISHA POPULATION

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ABSTRACT: INTRODUCTION: Sesamoiditis as a cause of fore foot pain is less often thought of, patients suffer for extended periods due to misdiagnosis and analgesic abuse resulting in dissatisfaction, depression and anxiety. **METHODS:** We performed a multicenter prospective epidemiological screening study in Bhubaneswar, Odisha from Nov' 2013 to July' 2014 in patients of foot pain for the presence of lesser sesamoids to study the incidences and causes of fore foot pain in Odisha Population. **RESULTS:** We screened 960 patients (1920 feet) in 500 male and 460 female patients. 5th Metatarsal sesamoids were present in 77 (8%) patients (M/F: 1.8:1), Bilateral in 67 (86 %) patients. (48%) patients lesser sesamoids were bipartite and (82%) were symptomatic. 52% recovered with conservative measures, 40 % patients required ultrasound guided injections and sesamoidectomy was performed in 8 % patients due to recurrence and/or failure. Other causes of fore foot pain were Rheumatoid Arthritis, Gouty Arthritis, Callosities, Hallux Valgus, Stress Fractures of the Metatarsals, Plantar Fasciitis, Infections, Morton's Metatarsalgia and Barefoot Walking (mechanical). **DISCUSSION:** High incidences of lesser sesamoids is attributed to genetics, low socioeconomic status, bare foot walking and high prevalence of Diabetes Mellitus, Smoking and Gout in our country. CT and MRI provide useful information regarding the presence and pathology involving these bones, and should be used in concert with clinical findings to guide successful patient management. An initial trial of conservative measures should follow minimally invasive ultrasound guided injections of anesthetic with steroids and lastly surgical excision.

KEYWORDS: Sesamoids, Forefoot, Pain, Sesamoiditis, Odisha, Ultrasound, Screening.

INTRODUCTION: Sesamoids are small osseous structures present partially or totally embedded in certain tendons of upper and lower extremities which develop by the process of endochondral ossification during early childhood (3-12 years). Their function is to protect the tendon from injury by reducing friction.^{1,2} They are thought to be normal variants with no definite known function. The development and evolution of sesamoid bones depends on close interaction of intrinsic genetic factors and extrinsic epigenetic stimuli like local mechanical stress and musculature.³

The lesser metatarsal sesamoids are anatomic variants that appear to be embedded in the plantar aspect of the Metatarsophalangeal joint capsule. The prevalence of sesamoids at the second through fifth metatarsals has been documented 4.3 % at the fifth metatarsal.^{2,4} Radiographic findings on these sesamoid bones suggest that race may have a strong predisposing effect on its presence.

Being usually asymptomatic, Pathology associated with these sesamoids is very rare, although it may be seen in cases of repeated cyclic loading, overuse, diabetes, infection, degenerative disease,

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osteonecrosis or trauma. However in symptomatic cases of fore foot pain, sesamoiditis as a cause is less often thought of, patients often suffer for extended periods due to misdiagnosis and analgesic abuse resulting in dissatisfaction, depression and anxiety.

For imaging evaluation, conventional radiography (i.e. lateral and dorsoplantar views of the foot and a special axial projection of the sesamoids) is initially recommended which usually present as small, well corticated, ovoid or nodular masses close to the bone surface. Cartilaginous or non-ossified accessory bones may be identified on ultrasound, scintigraphy, computed tomography (CT), or magnetic resonance (MR) imaging⁵. Indeed, misdiagnosis remains the most serious problem in cases of sesamoiditis.

We came across patients from different profession with atraumatic fore foot pain and incidental bipartite lesser sesamoids, diagnosed on routine foot x-rays which were performed as a routine orthopaedic protocol to screen fractures. The fore foot pain was attributed to pathological bipartite lesser sesamoids in these patients. Thus, we performed a multicenter prospective epidemiological and screening study on feet of patients so as to study the incidence and pathological conditions of the lesser sesamoids in the Odisha population.

MATERIAL AND METHODS: We performed a multicenter prospective epidemiological, screening study at 3 centers in Bhubaneswar, Odisha, India from Nov'2013 to July'2014 in patients complaining of foot pain for the presence of lesser sesamoids after obtaining written informed consent to study the incidence and causes of fore foot pain in Odisha Population.

INCLUSION CRITERIA: Male/Female Patient, Foot Pain, Any Etiology, Any Treatment.

EXCLUSION CRITERIA: Patient refused consent, Patient refused investigation.

VARIABLES ASSESSED: Occupation, Incidence of Lesser Sesamoids, Unipartite/Bipartite Sesamoids, Fractures, and Inflammatory Features over Sesamoids, Deep Tenderness, Associated Comorbidities (Diabetes, HIV and Immunosuppression), Causes of fore foot pain.

METHODOLOGY: Patients visiting outpatient department of 3 centers with complaints of foot pain were examined clinically after taking the detailed history and signs of inflammation noted. Routine laboratory investigations (Erythrocyte sedimentation rate, C - reactive protein, Serum Uric acid, Rheumatoid Factor, Differential WBC Count) were ordered in each patient to rule out other conditions like Gout, Rheumatoid arthritis or Septic Arthritis. Standard Dorsoplantar and Oblique digital radiographs of both feet were obtained. Presence of lesser sesamoids, fractures was noted. In case of presence of symptomatic sesamoids further investigations like Xylocaine test, Ultrasound and MRI were carried out to confirm diagnosis. Patients initially treated with rest, ice pack application, analgesics and anti-inflammatory medications, followed by ultrasound-guided injection of 1 ml of 0.125% Levobupivacaine, mixed with 10 mg of triamcinolone acetonide for 2-3 such injections at interval of 4 weeks. Lastly, Sesamoidectomy was planned if the treatment failed or recurrence occurred.

RESULTS: We screened 960 patients (1920 feet) with foot pain over 8 months at the 3 centers with 500 male and 460 female patients. 5th Metatarsal sesamoids were present in 50 male and 27 female

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patients (M/F: 1.8:1) i.e. 77 (8%) patients, Bilateral in 67 (87 %) patients and unilateral in 10 (13 %) patients with 8 (80%) being right side (see Fig.1).

Out of 77 patients, in 37 (48%) patients lesser sesamoids were bipartite located on the plantar aspect of the 5th Metatarsal of the foot. Out of the 37 bipartite sesamoids, 30 (81%) were symptomatic and associated with deep tenderness over the sesamoid just medial to the 5th metatarsal head, mostly being right sided (90%). Rest 7 (19%) sesamoids were asymptomatic and incidental findings, cause of foot pain being trauma, gout and Callosities in these cases (see Fig.2).

In 40 (52%) solitary lesser 5th metatarsal sesamoids, 37(92%) were asymptomatic and incidental findings, cause of foot pain being trauma in these cases. Only 3 patients (8 %) were symptomatic, where two patients were a military recruit and other was a diabetic lady with old thorn prick injury over the 4th web space.

Majority patients 52% recovered with conservative measures like Rest, Ice, Compression and Elevation (RICE therapy), 40 % patients required ultrasound guided injections and Sesamoidectomy was performed in the remaining 8 % patients due to recurrence and/or failure (see Fig.3).

Other causes of fore foot pain were Rheumatoid Arthritis, Gouty Arthritis, Callosities, Hallux Valgus, stress Fractures of the Metatarsals, Plantar Fasciitis, Infections, Morton's Metatarsalgia and Barefoot Walking (mechanical).

DISCUSSION: Forefoot pain is one of the commonest foot and ankle complaints in routine orthopaedics practice. Sesamoiditis as a cause of forefoot pain is less understood. Indeed, misdiagnosis remains the most serious problem in cases of sesamoiditis. These patients are often loaded with analgesics and anti-inflammatory medications for months and months together without treatment of the underlying pathology with resultant depression and dissatisfaction.

Sesamoids in the foot vary widely in their prevalence and appearance. Sesamoids are osseous structures partially or totally embedded in a tendon. Their function is to protect the tendon from injury by reducing friction. Anatomically, sesamoids at the second through fifth metatarsals appear to be embedded in the plantar aspect of the joint capsule and may also be multiple or multipartite. The prevalence of sesamoids at the second through fifth metatarsals has been documented at 0.4 % at the second metatarsal, 0.2 % at the third, 0.1 % at the fourth, and up to 4.3 % at the fifth metatarsal⁴ (see Fig. 4). However, sesamoids may be associated with pathological conditions like trauma, infection, osteonecrosis etc.

Sesamoids on imaging appear small, well-corticated, ovoid or nodular, may be bipartite or multipartite, and are found close to a bone or a joint (see Fig.5). Bipartite sesamoid fragments tend not to fit together perfectly, which aids differentiation from a fracture. The presence of these osseous structures is usually incidental. Sesamoids may be unilateral or bilateral, and are subject to significant morphological variations.

Though the world literature reports a incidence of 4.3% for the 5th metatarsal sesamoid. Interestingly, we observed a high incidence of 8% in the Odisha population which is a significant finding. These Sesamoids become symptomatic (i.e., painful) with degenerative changes resulting from barefoot walking, co morbidities, overuse, trauma or infections. Thus sesamoid related conditions should be thought of in patients with fore foot complaints in the Indian Scenario. A significant observation is that the Bipartite Lesser sesamoid variety is usually involved and are prone

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for sesamoiditis, but the exact cause is unclear. Hence presence of bipartite sesamoids should hint towards further work up for sesamoiditis.

Detecting these sesamoid bones often becomes difficult as they are small, oval, rough, convex in shape and composed mainly of bone, cartilage, and fibrous tissue, their contours on radiographs often are obscured by the opacity of the larger bones. Thus, when patients suffer from foot pain of unknown origin, the pathological sesamoid bones need to be considered as a possible differential diagnosis and help of higher investigations like Ultrasound, scintigraphy, computed tomography (CT), or magnetic resonance (MR) imaging should be sought, especially when radiographs are inconclusive.

Radiographs confirm the presence of an ossified sesamoid, and fractures are commonly evident on X-rays. Cartilaginous or non-ossified sesamoid bones may be identified on ultrasound, which can also be useful in the evaluation of adjacent soft tissue for signs of inflammation and injury⁶. Scintigraphy, used in concert with radiographic findings, may be useful in the localization of the cause of foot pain to a lesser sesamoid.^{7,8} Technetium bone scans are highly sensitive but not as specific as they show increased uptake in stress reaction, osteonecrosis, osteoarthritis, fracture and infection. CT readily demonstrates fracture, degenerative changes and can also evaluate increased sclerosis. However, MRI is most useful in the evaluation of pathology associated with lesser sesamoids. MRI findings are also relatively specific for infection, osteoarthritis and fracture, and provide superior evaluation of adjacent soft tissues.

Bipartite sesamoids may simulate a fracture, especially in cases of trauma. On radiographs, well corticated structures with smooth border, are not likely to be secondary to trauma whereas displaced irregular fragment with poorly defined irregular margins and soft tissue edema suggests fracture.

Chronic pain at the lesser sesamoids may clinically be described as sesamoiditis. Ballet dancing, running, high heel shoes, barefoot walking and marching are risk factors associated with it. MRI is particularly useful in the imaging of clinical sesamoiditis, as it evaluates intrinsic osseous as well as soft tissue abnormalities. On MRI, sesamoiditis shows bone marrow oedema isolated to the sesamoid, without changes in the metatarsal head. CT may be useful in differentiating between sesamoiditis and osteonecrosis, as subtle increases in sclerosis detected on CT would favor a diagnosis of osteonecrosis. ^{99m}Tc-MDP bone scan may help in identifying the presence of sesamoiditis as a focally increased uptake of the radioactive tracer.⁹

Osteomyelitis affecting the lesser sesamoids is most frequently secondary to direct extension⁷ from a soft tissue infection or from a septic joint¹⁰. Radiographs classically are only sensitive to late stage osteomyelitis, showing cortical destruction and adjacent soft tissue inflammation. In cases of infection especially osteomyelitis, MRI are more sensitive for evaluation, findings include T2 hyperintensity of the marrow with corresponding T1 hypo intensity, in addition to signs of inflammation in the surrounding soft tissues.

Differential diagnoses of sesamoid pain include sprain, fracture, osteonecrosis, degenerative joint disease, chronic bursitis, and neural entrapment, among others.^{11,12} Ultrasound is particularly effective in the diagnosis of a variety of musculoskeletal disorders,¹³ helps rule out other diagnosis.

Treatment of symptomatic lesser metatarsal sesamoid bones is basically conservative. The purpose of management is to eliminate inflammation and predisposing factors. Good results can be obtained in the treatment, for example, of tenosynovitis through USG-guided injections of small doses of local anesthetics mixed with steroids over and around the 4th web space just medial to the 5th

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metatarsal head. In cases where conservative therapy is ineffective, surgical excision may be the next-best option.^{14,15} Although excision undoubtedly provides the most effective relief, less invasive methods for treating symptomatic sesamoid bones need to be considered prior to surgical intervention. The ultrasound-guided injection is one such option.

CONCLUSION: Sesamoids and accessory ossicles seen in the foot vary widely in their prevalence and appearance. Sesamoiditis is a potential cause of fore foot pain. Its high incidence is attributed to genetics, low socioeconomic status, bare foot walking and high prevalence of Diabetes Mellitus, Smoking and Gout in our country. Radiological studies including radiography, ultrasound, scintigraphy, CT and MRI provide useful information regarding the presence and pathology involving these bones, and should be used in concert with clinical findings to guide successful patient management. An initial trial of conservative measures should follow minimally invasive ultrasound guided injections of anesthetic with steroids and lastly, surgical excision if the condition recurs or worsens.

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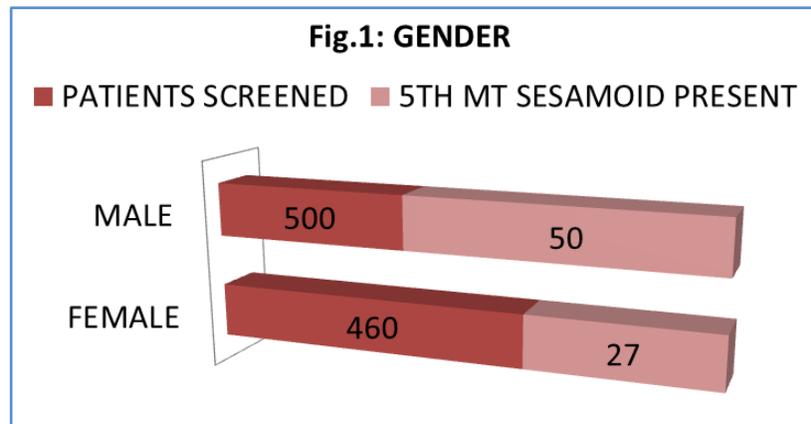


Figure 1

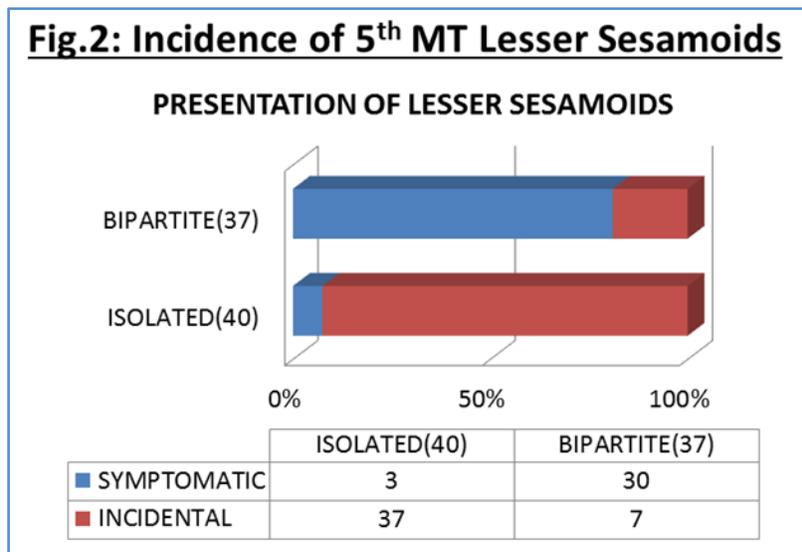


Figure 2

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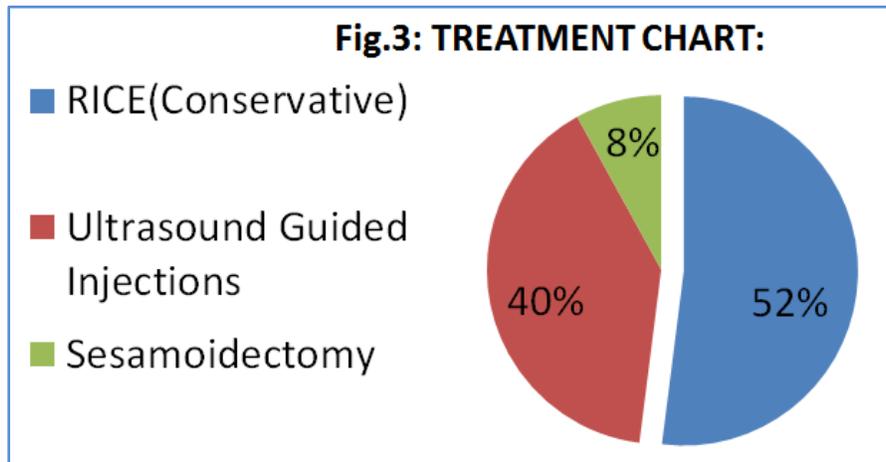


Figure 3

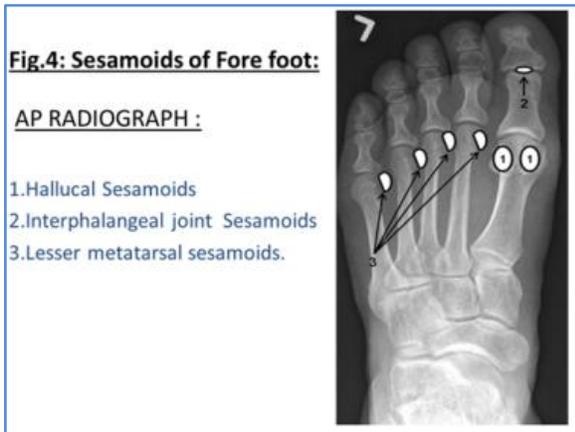


Figure 4



Figure 5

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