

A Study of Incidence of calcaneal spurs in North Indian population: A dry bone study

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ABSTRACT:-

The calcaneal spurs are the most common cause of pain in heel. The pain appears when patient stands on the foot for walking and pain disappears when patient walks some distance. The most common causes of spur formation is chronic fasciitis, wears and tears of ligaments and fascia present in the sole of foot. When the fasciitis heals, during the healing process the calcification of fascia or ligaments takes place, which results into the spur formation. The present study has been conducted on 325 dry human calcanei, irrespective of their sex, in the Department of Anatomy of M. M. Medical College and Hospital, Kumarhatti, District Solan (Himachal Pradesh). The objective of this study is to assess the rate of incidence of the presence of spurs in the calcanei and their types present in these calcanei. The photographs of all types of calcaneal spurs are taken and recorded and the study is compared with the standard literature and previous studies done by other authors. Out of 325 calcanei, 150 (35.38 %) cases are having inferior, posterior calcaneal spurs. In 28 (8.62 %) cases both types of spurs have been found. Other calcanei are having either inferior or posterior calcaneal spurs. The inferior spurs are more common on right and left side i.e out of 325 cases 75 (23.08 %) cases, and posterior spurs found in 40 (12.31 %) cases, respectively. In 2 (0.61 %) cases a scale type of spurs was present which was attached in the middle of the inferior surface of the calcanei and their anterior ends are free, sharp and pointing forwards. These observations are definitely helpful to the orthopedician, traumatologist and surgeons in their diagnosis and treatment.

Keywords:- Tarsal bones, articulation, sustentaculum tali, calcaneal tuberosity, plantar ligament, plantar aponeurosis, tendo-calcaneus, fibrosis, orthopedician and traumatologist.

INTRODUCTION:-

The calcaneus is the largest bone on which the talus bone rests. The talus give the articulation to the tibia and fibula. It has the superior or dorsal surface which is divisible into three areas, the posterior 1/3rd is rough and concavo-convex. The middle 1/3rd carries the posterior tarsal facet, the anterior 1/3rd is partly articular. On the medial surface there is an elongated area which is covered by the sustentaculum tali which gives the support to the head of talus. The plantar surface is rough, especially proximally as calcaneal tuberosity, the lateral and medial processes, separated by a notch. The medial process is longer and broader. Further distally, an anterior tubercle marks the distal limit of the attachment of the long plantar ligament. On the plantar surface of the calcaneus the abductor hallucis and superficial part of flexor retinaculum and distally the plantar aponeurosis and flexor digitorum brevis, are all attached to the medial process of the calcaneal tuberosity at its prominent medial margin. Abductor digiti minimi is attached to the lateral process, extending medially to the medial process. The long plantar ligament is attached to the rough region between the tubercular process proximally and extends to the anterior tubercle distally. The short plantar ligament is attached to the tubercle and area distal to it. The lateral tendinous head of flexor digitorum accessorius is attached distal to the lateral process near the lateral margin of the long plantar ligament. The calcaneo-fibular ligament is attached 1-2 cm proximal to the fibular trochlea, usually to low, rounded elevation. The long plantar ligament is the longest ligament in the tarsus. It extends from the plantar surface of the calcaneus and from its anterior tubercle, to the ridge and tuberosity on the plantar surface of the cuboid, to which deep fibres are attached, more superficial fibres continuing to the bases of the 2nd, 3rd, 4th sometimes to 5th metatarsal bones. The short plantar ligament is nearer to the bone than the preceding, from which it is separated by areolar tissue. It is short, wide band of great strength, stretching from the anterior calcaneal tubercle and the depression anterior to the adjoining part of the plantar surface of the cuboid; it also sustains the lateral longitudinal arch (Standring et al. 2008, Harrison, 1995).

The calcaneal spur is like a spike of bone at the anterior edge of the calcaneal tuberosity, most commonly the medial calcaneal tuberosity is affected. The posterior calcaneal spur or superior calcaneal spur also known as Achilles spur. These spurs can be due to repeated attacks of plantar fasciitis, due to repeated trauma, constant pull of the shortened plantar fascia, ill-fitting foot wears and fibromatosis of the plantar fascia. 80% of patients with plantar fasciitis have plantar heel spurs. About 10% of the general population has asymptomatic heel spurs. It is believed that it is actually not the source of pain. Many patients

with suspected painful heel spur syndrome have actually plantar fasciitis. Spur has no therapeutic or prognostic significance. Clinically patient complains of pain over ball of the heel, tenderness on plantar aspect of the heel. Radiologically, we can investigate and see the enlarged and protuded part of the calcaneal tuberosity mostly medial calcaneal tuberosity is having the spurs (Ebnerzar, 2010).

Due to stress and strains of the short plantar ligament, fasciitis takes place which gets calcified and the calcaneal spurs develop on the medial tuberosity because most of the structures like muscles, ligaments and aponeurosis attach on the medial calcaneal tuberosity. The posterior surface has a smooth middle part for the tendo-calcaneus. Its lower part is convex and is grooved longitudinally for the attachment of the fibres of the plantar aponeurosis, which sweep back from the under surface. The uppermost part is bare for a bursa that lies here deep to the tendocalcaneus (Sinnatamby, 2011).

Formation of calcaneal spurs:-

Benjamin et al. (2000) wrote that in normal development of bone, the bone grows into the Achilles tendon as the calcaneus enlarges. Ossification is preceded by vascular invasion, which occurs along rows of enthesis fibrocartilage cells. Small bony spurs develop when ossification at one point on the enthesis outstrips that on either side. Bony spurs can develop in the Achilles tendon without the need for preceding microtears or any inflammatory reaction, and they form by endochondral ossification of enthesis fibrocartilage. Kumai and Benjamin, (2002) wrote that spurs develop on the deep surface of the plantar fascia but their formation is heralded by degenerative changes that occur within it. The spurs grow by a combination of intramembranous and chondroidal ossification.

Plantar fasciitis, which occurs in individuals who do a great deal of standing or walking, cause pain and tenderness of the sole of foot. It is believed to be caused by repeated minor trauma. Repeated attacks of this condition induce ossification in the posterior attachment of the aponeurosis, forming a calcaneal spur (Snell, 2012).

The calcaneal spur is an ossification/ calcification occurring at the insertion of the plantar fascia to the periosteum, on the undersurface of the calcaneus .The spur can result due to repetitive stress in stretching of the plantar fascia and microtears, calcium gets deposited and a spur develops. Thus, spur is the result of the inflammation. Clinically there is pain on the undersurface of heel which is relieved by rest and starts on again at the initiation of activity. It is worst when patient gets up in the morning and aggravates by walking on a hard surface. We can investigate the patient by an X-ray in which we can see the spurs on plantar

surface of heel and also on the posterior surface of the calcaneus known as superior calcaneal spur or Achilles spur (Shenoy, 2014).

MATERIAL AND METHOD:-

The present study was conducted on 325 (167 of right side and 158 of left side) dry calcaneal bones from the department of anatomy, Dayanand medical college, Ludhiana (Punjab), the department of anatomy, Government medical college, Patiala and the department of anatomy of M.M. Medical College and Hospital Kumarhatti, District: Solan (Himachal Pradesh) India. All the dry calcanei were of adults and of unknown sex. The normal calcanei were selected for the study and abnormal calcanei (deformed, showing erosion, any malformation other than spurs) were rejected. All the calcanei were examined carefully and looked for the spurs present on the plantar surface and posterior surface of the calcanei. The length of spurs was measured in millimetres with the help of metallic scale. The length of the spurs were recorded and photographs of the calcanei were taken. The significance of the length of the spurs were compared with literature and also with the previous studies done by other authors.

OBSERVATIONS:-

In the present study 325 dry calcaneal bones were studied, out of which 167 were of right side and 158 were of left side. Two types of spurs were observed i.e. plantar calcaneal spurs or inferior calcaneal spurs and posterior or superior calcaneal spurs or Achilles spurs. The plantar calcaneal or inferior calcaneal spurs were present on the medial tuber calcanei and in the middle of plantar aspect of calcaneus, while the posterior or superior calcaneal or Achilles spurs were present on the posterior surface of the calcanei where the tendo-calcaneus or Achilles tendon attaches. Out of 325 calcanei inferior spurs were found in 42 in calcanei on right side and 33 calcanei on left side. 2nd site of inferior spur was found in the middle of plantar surface of the calcanei in 2 cases of right side only (**Table – V**). The posterior spurs were found to be in 20 cases on right side and 20 cases on left side. The length of spurs varied between 1.5 mm to 8.0 mm on right side and 1.5 mm to 14.0 mm on left side (**Table -VI**).

Table - I .Total number of calcanei studied and their distribution as right and left

Right calcanei	Left calcanei	Total
167	158	325

Table-II. Distribution of spurs in total calcanei according to their location, n =325

Location	Number	% age
Inferior	75	23.08
Posterior	40	12.31
Both	28	8.62

Table- III. Distribution of spurs in right calcanei according to their location, n =167

Location	Medial tubercle	% age	Middle plantar	% age
Inferior	40	23.95	2	1.98
Posterior	20	11.98	-	-
Both	15	8.98	-	-

Table-IV. Distribution of spurs in left calcanei according to their location, n =158

Location	Medial tubercle	% age	Middle plantar	%age
Inferior	33	20.87	-	-
Posterior	20	12.66	-	-
Both	13	8.23	-	-

Table – V. Table showing lengths of spurs and their numbers in the right calcanei

Length of spurs in millimetres	Number of calcanei having inferior spur	Number of calcanei having Achilles spurs	Number of calcanei having inferior middle plantar spurs
1.5	8	3	-
2.0	6	4	-
3.0	12	5	-
4.0	7	3	-
5.0	1	3	1
6.0	6	1	-
7.0	0	1	-
8.0	-	-	1
Total	40	20	2

Table – VI. Table showing lengths of spurs and their numbers in left calcanei

Length of spurs in millimetres	Number of calcanei having inferior spurs	Number of calcanei having Achilles spur	Number of calcanei having inferior middle plantar spurs
1.5	4	3	-
2.0	7	3	-
3.0	17	7	-
4.0	3	2	-
5.0	1	2	-
6.0	1	0	-
8.0	0	1	-
10.0	0	1	-
14.0	0	1	-
Total	33	20	Nil

Distribution of spurs in right and left calcanei were observed as below: -

Out of 325 calcanei studied the spurs were found in 115 (35.38%) calcanei and out of these 115 spurs the inferior spurs were found in 75 (23.08%) calcanei and posterior or superior or Achilles spurs in 40 (12.31%) calcanei. There were 28 (8.62%) calcanei in which both types of spurs were present.

Inferior calcaneal spurs: -

1. In right calcanei (167) the inferior spurs were found in 42 (25.15%) calcanei. Out of these 42 calcanei, in 40 (23.95%) calcanei the spurs were found projecting from medial tubercle, varying in length from 1.5 mm to 8 mm (**Table - V**), (**Photograph – I**), 2 (1.20%) calcanei the inferior spurs were related to the middle of plantar aspect of calcanei and their lengths were 5 mm and 8 mm (**Table - V**), (**Photograph – II**).
2. In left calcanei (158) the inferior spurs were found in 33 (20.89%) calcanei and their lengths varied from 1.5 mm to 6 mm (**Table - VI**), (**Photograph – III**).

Posterior or superior or Achilles spurs: -

In right calcanei (167) the posterior or superior or Achilles spurs were found in 20 (11.98%) calcanei and varying in lengths from 15 mm to 7 mm (**Table - V**) and in left calcanei (158) calcanei the posterior or superior or Achilles spurs were found in 20 (12.67%) calcanei and their length varied from 1.5 mm to 14 mm (**Table - VI**), (**Photograph – III**).

These spurs must be developed in the plantar fascia and long plantar ligament due to excessive wears and tears of long plantar ligament which result into plantar fasciitis. After healing process the plantar fascia gets calcified and turns into the spurs (**Photograph-II**).



Photograph-I

Showing Inferior Calcaneal Spur



Photograph-II

Showing Inferior middle Calcaneal Spur



Photograph-III

Showing Superior Calcaneal Spur

DISCUSSION:-

Stephen et al. (1999) have written that the plantar fasciitis, the most common cause of heel pain, may have several different clinical presentations. Although pain may occur along the entire course of the planter fascia, it is usually limited to the inferior medial aspect of the calcaneus, at the medial process of the calcaneal tubercle. Plantar fasciitis occurs in both men and women, but is more common in latter. Its incidence and severity correlate strongly with obesity.

Menz et al. (2008) studied 216 patients and reported that 119 (55%) had at least one plantar calcaneal spur and 103 (48%) had at least one Achilles tendon spur. Those with

plantar spurs were more likely to have Achilles tendon spur also. Prevalence of spurs did not differ according to sex. Calcaneal spurs are common in older men and women and are related to obesity, osteoarthritis and current or previous heel pain, but are unrelated to radiographic measurements of foot posture. These findings support the theory that plantar calcaneal spurs may be an adaptive response to vertical compression of rather than longitudinal traction at the calcaneal enthesis, which may have implication for the management of chronic heel pain in older people.

Aydogdu et al. (2014) reported that the origin of plantar fascia is on the calcaneus and formation of subcalcaneal spur has traditionally been attributed to repetitive longitudinally traction of the plantar fascia and also to hamstring tightness. Some histological and clinical studies suggest that vertical compressive force may play a more important role. Case-controlled studies have identified obesity or sudden weight gain, reduced ankle dorsiflexion, pes planus, and occupations that require prolonged weight-bearing as the greatest risk factors associated with calcaneal spur syndrome.

Prichansuk and Subhdrabandu, (1994) studied 82 patients with plantar heel pain and 400 normal subjects. They found the incidence of calcaneal spur in normal subjects and in patients with plantar heel pain (15.5%) (62 out of 400) and (65.9%) (54 out of 82), respectively. This highly significant difference may be due to excessive weight gain, aging and gender which may be the factors effecting the lowering of the pitch and the increasing of spur formation. These factors could lead to the development of plantar heel pain.

Riepert et al. (1995) studied 1027 patients by the radiological examination and found that in 161 patients were having plantar spurs and/ or dorsal spurs (15.7%) were diagnosed. Plantar spurs were more common than dorsal spurs (11.2% and 9.3% respectively). Dorsal spurs appear slightly earlier than plantar spurs. The spur frequencies are similar in left and right feet. The plantar spurs were significantly more common in women than in men in general, while the dorsal spurs were more frequent in men than in women up to the age of 70. The previously reported higher frequencies of plantar and dorsal calcaneal spurs in women than in men are probably a result of a disproportionately higher number of women in higher age in the group were studied. In forensic medicine, calcaneal spurs provide evidence for identity and age of unknown corpses, and certain extend their profession, physical activities and constitution during life.

Ozdemir et al. (2002) demonstrated subcalcaneal spur by radiography in 44 of the 67 heels. These were two different imaging patterns observed. Type-I and Type-II imaging patterns were described as osseous and fascial respectively. At the final examination, the

results for pattern type-I were good in 16 patients (66.7%), fair in 6 patients (25%) and poor in 2 patients (8.3%), whereas in pattern type-II results were good in 12 patients (80%) and fair in 3 patients (20%). Subcalcaneal spur was determined in 70.5% of the patients with osseous pathology and 55.5% of the patients with fascial pathology. Based on this result, it can be ascertained that calcaneal spurs develop during the pathological process causing heel pain.

Bassiouni, (1965) described that calcaneal spurs are out growths of bone into the tendons and ligamentous attachments appearing mainly at two points, one at the posterior aspect of the calcaneus near the insertion of the Achilles tendon and the other on the inferior aspect of the calcaneus at the epiphyseal line considering with the insertion of the posterior fibres of the long plantar ligament. Among 142 patients with calcaneal spurs, 58 had both inferior and posterior spurs (40-85%) 66 had inferior spurs only (46.48%) and 18 had posterior spurs only (13%). Thus 124 patients had inferior spurs (alone or with posterior ones) and 76 had posterior spurs (alone or with inferior ones). The inferior spurs were bilateral in 115 cases (92.74%), and the posterior spurs were bilateral in 71 (93.42%). Thus, these spurs are usually symmetrical and only a very few patients show unilateral spurs.

In the present study out of 325 dry calcanei 115 (35.38%) calcanei were having the spurs. These spurs were of two type i.e. inferior and superior or posterior spurs or Achilles spur. Out of 325 dry calcanei, 15 (4.62%) were found to be having both the inferior and posterior or Achilles spurs on the right side and 13 (4.0%) calcanei were having both the inferior and superior spurs on left side. 2 (0.62%) calcanei were having inferior middle plantar spurs on right side only, but no inferior spur was found in these calcanei of right side. No such spurs were found in the calcanei of left side. This shows that all the calcanei may not have all the types of spurs in every calcaneus. Our results are matching with the studies of Menz et al. (2008), Prichansuk and Subhdrabandu (1994), Riepert et al. (1995), Ozdemir et al. (2002), and Bassiouni (1965).

CONCLUSION:-

The calcaneal spurs are known for pain in the heel. These spurs cause the pain in the heel while patient starts walking and pain disappears after walking some distance. Sometimes these spurs become great problem then the patient has to undergo for surgery to relieve the problem. The knowledge of calcaneal spurs will be help the orthopedicians and surgeons in their diagnosis and treatment of pain in heel. This study may be helpful in forensic medicine, to some extent their profession, physical activities and constitution during life.

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