

CADAVERIC STUDY OF ABERRANT TENDOACHILLES TENDON IN SOUTH GUJARAT REGION AND ITS CLINICAL SIGNIFICANCE

Manju Deepak Singhal.

Associate professor, Department of Anatomy, Surat Municipal Institute of Medical Education and Research (SMIMER), Surat, Gujarat, India.

ABSTRACT

Background: The tendoachilles tendon is the strongest and thickest tendon in the body begins near the middle of the back of leg which is made up of the tendons of the soleus and two heads of the gastrocnemius muscles and is attached to the midpoint of the posterior surface of the calcaneum. An aberrant (abnormal) tendoachilles is attached to just posterior to the tendo-achilles tendon, calcaneal tuberosity and on medial aspect of calcaneum. An aberrant tendoachilles tendon is responsible for resistant equines deformity of club foot. The existence of aberrant tendoachilles tendon should be kept in mind by the orthopedic surgeons, podiatrist, sports physicians and physiotherapists. A lack of awareness such variations might complicate surgical repair.

Aim: The current study aimed at finding out the attachment of tendoachilles tendon, presence of any aberrant (abnormal) tendoachilles tendon insertion and related clinical significance i.e. resistant club foot.

Materials and Methods: 108 lower limbs, 54 right and 54 left lower limbs of 54 donated embalmed cadavers (31 males & 23 females) of age group ranging from 55 to 85 years were procured for dissection. The study was carried out for a period of 7 years in the department of Anatomy SMIMER Surat.

Results: The length of the tendoachilles tendon is 0-2cm in 3.70% of cases, 2-4 cm in 25.92% of cases, 4-6 cm in 53.70% of cases, 6-8 cm in 9.25% of cases, 8-10 cm in 5.55% of cases, >10 cm only in 1.85% of cases. In all cases, attachment of tendoachilles tendon was found on posterior aspect of calcaneum that is normal. In addition to that one of the case of left lower limb (0.92% of cases), tendoachilles tendon was found attached on medial aspect of calcaneum that is called as aberrant tendoachilles tendon.

Conclusion: Aberrant tendoachilles tendon is responsible for resistant equines deformity of club foot. Most of resistant club foot can be treated with use of an extensive posteromedial release of aberrant tendoachilles tendon with satisfactory functional results. The presence of such aberrant tendoachilles tendon should be kept in mind by the orthopaedicians. A lack of awareness such variations might complicate surgical repair.

KEY WORDS: Tendo-achilles tendon, aberrant tendoachilles tendon, Tendocalcaneus, Soleus, Gastrocnemius, club foot.

Address for Correspondence: Dr. Manju Deepak Singhal, MBBS, MD (Anatomy), Associate professor, Department of Anatomy, Surat Municipal Institute of Medical Education and Research (SMIMER), Surat-395010, Gujarat, India. Mobile: 9427544466, E-Mail: dmparam@gmail.com

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INTRODUCTION

The tendoachilles tendon is the strongest and thickest tendon in the body begins near the middle of the back of leg which is made up of the tendons of the soleus and two heads of the

gastrocnemius muscles and is attached to the midpoint of the posterior surface of the calcaneum [1]. The tendoachilles is directly related to the upright stance and bipedal locomotion of the human which is one of the characteristic

features of the human with large size of gastrocnemius and soleus [2].

The tendoachilles with its muscles soleus and two heads of the gastrocnemius and other anti-gravity muscles of lower limb are much better developed in bipeds as compared to quadrupeds because they have to lift the whole body up during attaining the erect posture and also in walking up a staircase [3].

The tendoachilles tendon has been a key player in natural selection process. The tendoachilles tendon was absent from Australopithecus and originated in homosapians since more than three million years ago [4].

During development the rotation of the limb bud occurs i.e. tendoachilles tendon is twisted and therefore the fibers from the gastrocnemius get arranged on lateral side and the fibers from the soleus get arranged on medial side and inserted accordingly on calcaneum [5, 6].

Part of the Tendo-achilles tendon which is derived from gastrocnemius can be twisted variably relative to soleus because gastrocnemius crosses the knee joint. Because of this twisting, when the tendoachilles tendon is under load, it is subject to wringing action [7].

The human has largest angle between the long axis of tibia and calcaneum as compared to any mammal. Since there is upright posture of the human, the foot is at right angle to the leg the tendoachilles tendon approaches the back of the foot tangentially and generates heavy torque [7].

The tendoachilles tendon transmits approximately seven times force of the body weight during running while during standing it transmits only half of the body weight [8].

The tendoachilles tendon is more vulnerable to injury because of its limited blood supply and combination of forces to which it is subjected [1, 9].

Normally the tendoachilles tendon is attached to the middle of the posterior aspect of the calcaneum while an aberrant (abnormal) tendoachilles is attached to –

1. Just posterior to the tendo-achilles tendon and on calcaneal tubercosity,
2. On the medial aspect of calcaneum.

It was an observation that an aberrant (abnormal) tendoachilles tendon is basically linked with a clinical condition called club foot.

Club foot deformity has four components –

1. Equinus – increased planter flexion of foot
2. Varus - inversion and adduction of calcaneum
3. Adduction – tarsal bones are directed towards the median plane
4. Cavus – increased longitudinal arch of foot

Aberrant tendoachilles tendon is one of the components causing club foot. Out of four components, equinus and varus deformities occur because of aberrant Tendo-achilles tendon.

MATERIALS AND METHODS

The current study aimed at finding out the attachment of tendoachilles tendon, presence of any aberrant (abnormal) tendoachilles tendon insertion and related clinical significance i.e. resistant club foot.

108 lower limbs, 54 right and 54 left lower limbs of 54 donated embalmed cadavers (31 males & 23 females) of age group ranging from 55 to 85 years were procured for dissection. The study was carried out for a period of 7 years in the department of Anatomy SMIMER Surat. All the lower limbs of cadavers were thoroughly and meticulously dissected. The soleus and gastrocnemius muscles dissected from their origins.

Following parameters were considered for study:

1. Length of tendoachilles tendon
2. Attachment of tendoachilles tendon

The measurements were taken with the help of measuring scale and carefully saw for attachment of Tendo-achilles tendon during dissection.

OBSERVATIONS

The following findings were observed in 108 cadaveric lower limbs during routine dissection for 1st year MBBS students.

The length of tendoachilles tendon is varies from individual to individual. In all cases, attachment of tendoachilles tendon was found on posterior aspect of calcaneum that is normal. In addition to that one of the case of left lower limb (0.92% of cases), tendoachilles tendon was found

attached on medial aspect of calcaneum that is called as aberrant tendoachilles tendon (Table – 1, Figure- 1).

Table 1: Site of attachment of tendoachilles tendon.

Attachment of tendoachilles tendon on calcaneum	Number of cases(108)			
	Right lower limbs	%	Left lower limbs	%
On posterior aspect of calcaneum	54	50	54	50
On medial aspect of calcaneum	0	0	1*	0.92

Note- * It is one case in which tendoachilles tendon was attached on posterior aspect of calcaneum as well as on medial aspect of calcaneum

Table 2: The length and attachment of tendoachilles tendon.

Attachment of tendoachilles tendon	Length of tendoachilles tendon (in cm)	Number of cases (108)	%
On posterior aspect of calcaneum	0-2	4	3.7
	2-4	28	25.92
	4-6	58	53.7
	6-8	18	9.25
	8-10	6	5.55
	>10	2	1.85
On medial aspect of calcaneum	4-6	1*	0.92

Note- * It is one case in which tendoachilles tendon was attached on posterior aspect of calcaneum as well as on medial aspect of calcaneum

Table 3: The length and attachment of tendoachilles tendon on right and left lower limbs.

Attachment of tendoachilles tendon	Length of tendoachilles tendon (in cm)	Number of cases (108)			
		Right lower limbs (54 cases)	%	Left lower limbs (54 cases)	%
On posterior aspect of calcaneum	0-2	2	1.85	2	1.85
	2-4	14	12.96	14	12.96
	4-6	29	26.85	29	26.85
	6-8	5	4.62	5	4.62
	8-10	3	2.77	3	2.77
	>10	1	0.92	1	0.92
On medial aspect of calcaneum	4-6	0	0	1*	0.92

Note- * It is one case in which tendoachilles tendon was attached on posterior aspect of calcaneum as well as on medial aspect of calcaneum

The length of the tendoachilles tendon is 0-2cm in 3.70% of cases, 2-4 cm in 25.92% of cases, 4-6 cm in 53.70% of cases, 6-8 cm in 9.25% of cases, 8-10 cm in 5.55% of cases, >10 cm only in 1.85% of cases (Table – 2).

We found same number of cases and same percentage on both right as well as left lower limbs because we procured the limbs for study from cadavers having both limbs. The length of the tendoachilles tendon is 0-2cm in 1.85% of cases,

2-4 cm in 12.96% of cases, 4-6 cm in 26.85% of cases, 6-8 cm in 4.62% of cases, 8-10 cm in 2.77% of cases, >10 cm only in 0.92% of cases in both right as well as left lower limbs and attached on posterior aspect of calcaneum (Table – 3). Only in one case (0.92%) i.e. left lower limb, the tendoachilles tendon was attached on posterior aspect of calcaneum as well as on medial aspect of calcaneum (Table – 3).

Fig. 1: Showing normal attachment of Tendoachilles tendon and aberrant Tendoachilles tendon.



DISCUSSION

Tendocalcaneus or human Achilles tendon is the most easily accessible, superficial tendon of human body that transfers the force of muscles to the bones [10, 11].

The tendoachilles tendon is made up of the tendons of the soleus and two heads of the gastrocnemius muscles and is attached to the midpoint of the posterior surface of the calcaneum. The soleus plantar flexes the ankle joint and it act as postural muscle because it contains a high proportion of slow-twitch fibers preventing the body from falling forward when standing. However the gastrocnemius also flexes the knee joint and promotes the vigorous propulsive movements because contains a greater number of fast twitch fibers.

The achilles tendon provides a learned practical well-referenced approach to the various manifestations of achilles tendinopathies, acute rupture of the achilles tendon, chronic heel ulcer. The knowledge of aberrant tendoachilles tendon opens the management options to

orthopedic surgeons, podiatrist, sports physicians and physiotherapists and is a tool for diagnosis of achilles tendon medicine.

In standard anatomical text, normal attachment of tendoachilles tendon has been given perse. unfortunately detailed information regarding the aberrant tendoachilles tendon has not been documented.

The knowledge of aberrant tendoachilles tendon is essential for orthopedic surgeon and podiatrist for treatment and surgical repair of resistant equines deformity of club foot and the aim of treatment of club foot is to cure or eliminate these deformities so that the patient becomes painless, plantigrade foot and necessary mobility.

An aberrant tendoachilles tendon is responsible for resistant equines deformity of club foot. Club foot deformity has four components – Equinus, Varus, Adduction, Cavus [12, 13].

J. Terrence Jose Jerome et al found a case of aberrant tendoachilles tendon in the right foot during the operation for lengthening the tendoachilles tendon in 3 months old male patient [14] while in present study; we found that 0.92% cases of aberrant tendoachilles tendon in the left foot during dissection.

With aberrant tendoachilles tendon, talus and calcaneum are generally deformed and navicular may be severely displaced medially [15]. These components are inter-related. The muscles, Tendo-achilles tendon, tibialis posterior and toe flexors are shortened [16].

Initial treatment of club foot should be non-operative that is serial application of plaster cast at weekly interval [17]. Most of the orthopedic surgeons have agreed that an operative procedure should be considered only after manipulation and serial application of plaster cast have failed to obtain correction in not more than 3 months. A subcutaneous tenotomy of tendoachilles tendon should be done under local anaesthesia to facilitate correction of equines [18, 19]. This tenotomy is done in about 70% of patients.

The existence of aberrant tendoachilles tendon should be kept in mind by the orthopedic surgeons, podiatrist, sports physicians and physiotherapists. A lack of awareness such variations

might complicate surgical repair.

In patients who have persistent equines deformity, release of aberrant tendoachilles tendon from its medial calcaneal attachment is required to correct it. The aberrant tendoachilles tendon is rarely described in literatures.

CONCLUSION

Aberrant tendoachilles tendon is responsible for resistant equines deformity of club foot. If equines deformity is persistent even after initial non-operative procedure including serial application of plaster cast not more than 3 months. This gives clue to us presence of aberrant tendoachilles tendon. Most of resistant equines deformity of club foot can be treated with use of an extensive posteromedial release of aberrant tendoachilles tendon with satisfactory functional results.

The presence of such aberrant tendoachilles tendon should be kept in mind by the orthopaedicians. A lack of awareness such variations might complicate surgical repair.

Conflicts of Interests: None

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