# Anatomical variances of the tibialis posterior muscle

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**Summary**

*Introduction.* Tibialis posterior muscle is one of the most important muscles supporting the longitudinal arch of foot.

*Aim of the work.* The goal of this study was to investigate the anatomical variances of distal insertion of tibialis posterior and remain its anatomy.

*Material and methods.* The study was performed on 17 male cadavers. During the autopsy course of tibialis posterior tendon, configuration of tibialis posterior tendon fibers and a place of insertion of tibialis posterior tendon were analyzed.

*Results.* Authors described normal structure of tibialis posterior tendon as well as some founded variations.

*Conclusions.* The performed study showed that anatomical variations of tibialis posterior tendon are not rare and so, knowledge of them may have clinical importance.

**Key words:** tibialis posterior muscle, anatomical variations of tibialis posterior tendon

**Streszczenie**

*Wstęp.* Mięsień piszczelowy tylny jest jednym z najważniejszych mięśni odpowiedzialnych za wysklepienie podłużne stopy.

*Celem pracy* było zbadanie zmienności anatomicznych dalszego przyczepu mięśnia piszczelowego tylnego.

*Materiał i metody*. Badanie przeprowadzono na 17 zwłokach płci męskiej. Podczas sekcji badano przebieg ścięgna mięśnia piszczelowego tylnego oraz układ jego włókien raz określano miejsce przyczepu ścięgna.

*Wyniki.* W pracy opisano prawidłową anatomię ścięgna mięśnia piszczelowego tylnego oraz znalezione odmienności anatomiczne.

*Wnioski.* Przeprowadzone badanie wskazuje, że zmienności anatomiczne ścięgna mięśnia piszczelowego tylnego nie są rzadkie, a ich znajomość może być klinicznie istotna.

**Słowa kluczowe:** mięsień piszczelowy tylny, zmienności anatomiczne ścięgna mięśnia piszczelowego tylnego

Tibialis posterior muscle (TP) is one of the most important muscles supporting the longitudinal arch of foot. It has a great meaning in pathogenesis of inherent as well as acquired foot defects.

The goal of this study was to investigate the anatomical variances of distal insertion of tibialis posterior and remain its anatomy.

## MATERIAL AND METHODS

The study was performed on 17 male cadavers. The age of investigated men in the moment of death was from 47 to 75 years, mean 64.7. Nobody presents visible defects of feet and nobody had been treated by the reason of feet defects or trauma.

During the autopsy the following features of distal tendon of tibialis posterior (TPT) were analyzed:
– a course of tibialis posterior tendon,
– a configuration of tibialis posterior tendon fibers,
– a place of insertion of tibialis posterior tendon.

## RESULTS

1. A course of tibialis posterior tendon:
   – in all investigated feet the course of TPT was typical: it ran deep to the flexor digitorum longus, back to the medial malleolus, under the flexor retinaculum and finally it lay on the deltoid ligament.
2. A configuration of tibialis posterior tendon fibers:
   – in 14 cadavers (82.4%) the rotation of TPT fibers was present in both feet,
   – in 2 cadavers (11.8%) the rotation of TPT fibers was present only in right feet,
   – in 1 cadaver (5.9%) there was no rotation of TPT fibers.
3. A place of insertion of tibialis posterior tendon:
   – in 13 cadavers (76.4%) authors found typical insertion of both TPT: to the tuberosity of navicular (the main part) and inferior surface of medial cuneiform, 2nd, 3rd and 4th metatarsals (accessory parts),

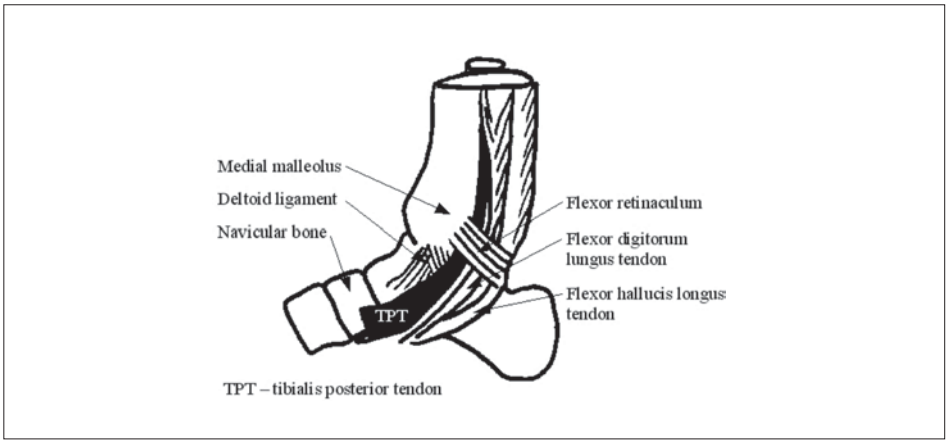


**Fig. 1.** Schema of the course of tendons on medial surface of foot

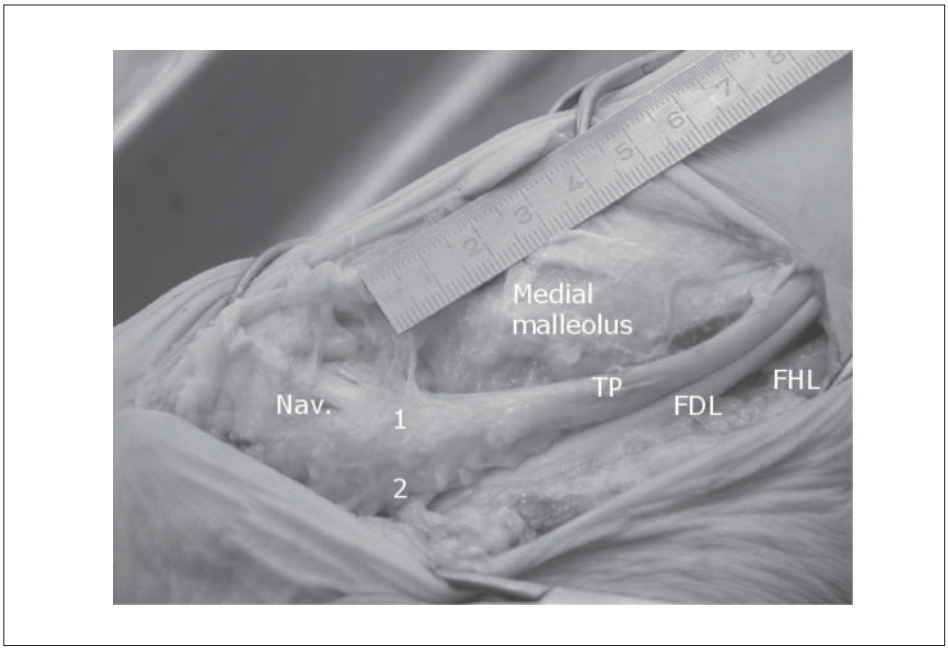


**Fig. 2.** Autopsy view of tibialis posterior tendon.
Legend: TP – tendon of tibialis posterior; FDL – tendon of flexor digitorum longus; FHL – tendon of flexor hallucis longus; Nav. - nawicular bone; 1 – main part of TPT inserted to the navicular bone; 2 – accessory part of TPT inserted to the medial cuneiform, 2nd, 3rd and 4th metatarsals

– in 2 cadavers (11.8%) TPT inserted on the left side to the tuberosity of navicular only but on the right side the insertion was typical,
– in 2 cadavers (11.8%) TPT inserted to the tuberosity of navicular only on both side.

## DISCUSSION

Tibialis posterior muscle belongs, with the popliteus, flexor digitorum longus and flexor hallucis longus to the deep-posterior group of leg muscles.

It originates on the posterior surfaces of tibia, fibula and interosseus membrane as well as on deep layer of crural fascia. The area of TP origin is divided by anterior tibialis vessels into two parts. The medial part covers proximal two thirds of the tibial shaft below the soleus line and adjacent part of interosseus membrane. The lateral part starts on superior two thirds of medial border of the shaft of fibula. Superficial fibers of TP originate also from the deep layer of crural fascia.

The belly of TP lies in deep-posterior compartment of the leg. However, some authors [1, 2, 3] suggest existence of separate compartment for tibialis posterior only. In the deep-posterior compartment TP lies between flexor digitorum longus medially and flexor hallucis longus laterally. It is also followed by three neurovascular bundles. First, lying on anterior surface of TP, includes deep fibular nerve and anterior tibial artery and vein, second – medial – is composed of tibial nerve and posterior tibial artery and vein, and the third – lateral – consists of fibular artery and vein.

On the level of distal Ľ of tibial shaft tibialis posterior forms wide pennatus tendon which narrows in course of descending and penetrates into medial malleolar canal. In the canal TPT lies on deltoid ligament, anterior and deep to the tendon of flexor digitorum longus and is covered by flexor retinaculum (figure 1). In its course in malleollar canal the TPT is enclosed with tendinous sheath which starts at superior border of flexor retinaculum and ends at the level of talonavicular joint. In the malleolar canal fibers of TPT rotates around the long axis, what, according to Roukis [4, 5] eliminates the need for any longitudinal slippage between individual tendon fibers during triplane movement of the joints of the lower extremity.

Then TPT lies superficially on the medial border of foot and inserts to the tarsal bones by two parts. The main part ends on the tuberosity of navicular and the smaller part gives fibers to inferior surfaces of medial cuneiform, $2^{nd}$, $3^{rd}$ and $4^{th}$ metatarsals (figure 2).

In literature authors found several reports about untypical distal inserts of tibialis posterior. Kiter et al. [6, 7] describe two variants of distal insertion in people with flat feet and accessory navicular bone. In first variant the TPT ends on accessory navicular exclusively and in second one the TPT connects to both navicular and accessory navicular bones. Bloom et al. [8] report five possibilities of distal end of TPT: (1) plantar calcaneonavicular ligament, (2) $5^{th}$ metatarsal base, (3) fibularis longus tendon, (4) flexor halucis brevis tendon and (5) abductor hallucis tendon. The insertion to the fibularis longus tendon is also reported by Lohrman et al. [9].

The main action of tibialis posterior is inversion and adduction of foot. It also supports plantar flexion. The passive tense of TP, commonly with plantar aponeurosis, short plantar muscles, long plantar ligament and plantar calcaneocuboid ligament, stabilized the longitudinal arch as well as the transverse arch of the foot. Malfunction of TPT is the most important reason of flat foot.

## CONCLUSIONS

The performed study as well as the literature review show that anatomical variations of tibialis posterior tendon are not rare and so, knowledge of them may have clinical importance.

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