Variation of Plantaris Muscle: 
A Case Report with Clinical Significance

Variación del músculo plantar: Reporte de un caso con Significado Clínico

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SUMMARY: The plantaris muscle is located between the soleus and gastrocnemius muscles, within the posterior calf group. Due to degeneration and its loss of plantar-flexion function, the muscle is vestigial in human beings, but it retains clinical significance. Few cases of variation in the plantaris muscle have been reported, and this, therefore, appears to be rare. Nonetheless, absence of this muscle was identified via the dissection of a left lower limb (male), which also indicated the absence of an attachment in the usual position. The present report, which addresses such variation, may provide both inspiration and reference points for the clinical treatment of so-called “tennis leg”, and for the use of plantaris muscle for the purposes of clinical, autologous graft repair.

KEY WORDS: Anatomical variation; Plantaris muscle; Absent; Clinical significance.

INTRODUCTION

The plantaris muscle found in the flexor muscle group of the leg. While it runs in an oblique manner through the space between the gastrocnemius muscle (or, more precisely, the lateral head of the latter) and the soleus muscle, it originates in the lateral condyle of the femur and the popliteal ligament. The tendon is slender, it descends alongside the medial margin of the calcaneal tendon, before joining, or terminating in, the calcaneal tendon distal. The beally, meanwhile, is fusiform and small (Standring, 2005).

Textbooks have referenced the degeneration and loss of the plantar flexion function in human plantaris muscles, and indeed, the muscle appears to be absent in around 10% of lower limbs. Nonetheless, the volume of literature pertaining to the topic is small. Some researchers, admittedly, have suggested that unilateral plantar-muscle loss is less common than the bilateral equivalent (Kwinter et al., 2010).

Generally, the muscle plantaris provides a good foundation for autologous grafts. Furthermore, in terms of clinical treatment for “tennis leg” and chronic tendinopathy, the plantaris muscle and its anatomical relationships are clinical significance.

CASE REPORT

During a routine dissection in a regional anatomy course for medical students, it was observed in an adult male cadaver that the plantaris muscle of the left lower limb was absent.

The dissection was performed in the posterior area of the leg and in the popliteal fossa. The skin and superficial fascia were dissected and the small saphenous vein and sural nerve were exposed. The popliteal fascia was then removed and the popliteal fossa was cleaned. In addition, cleaning of the lateral and medial head of the gastrocnemius muscle was performed. As indicated in Figure 1A, a cut was made in the gastrocnemius muscle about 5 cm below the lateral head. To expose the soleus muscle, the lateral margin of the gastrocnemius muscle was dissociated and rotated medially.

Near the superior margin of the tendinous arch of the soleus muscle, and deep to the lateral head of the gastrocnemius muscle, no belly of the plantaris muscle was detected. There was also no plantaris tendon present above the medial margin of the soleus muscle.

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In addition, although the soleus muscle and gastrocnemius muscle were normal, no attachment of the plantaris muscle was identified at the origin or insertion. There was no evidence of union of the gastrocnemius or soleus muscles with the plantaris muscle (Fig. 1A). On the contrary, when the right lower limb was dissected, the plantaris muscle and its tendon were observed, normal in its origin and insertion, position and shape (Fig. 1B).

DISCUSSION

Plantaris muscle variation is common, although several of the standard textbooks in China fail to reference the plantaris muscle. Absence of the plantar muscle is estimated to occur in around 10% of individuals. It has been posited by researchers that the plantaris muscle was originally attached to the plantar aponeurosis, but that its position “moved backwards” during the process of evolution.

Interest has been aroused by the plantaris tendon and its morphological characteristics, especially, in terms of its potential use, in surgery, for autologous transplantation or transposition repair. This potential is connected to its selective convenience, and its advantageous length, thinness, and shallow surface (Ma Shuangtao, et al., 2007; Janco M et al., 2002). In the treatment of lower-limb venous insufficiency, for instance, a plantaris muscle loop may be deployed. In terms of rejection risk, material selection and performance, this loop is preferable to the pedicled fascia lata loop or the semitendinosus-biceps femoris loop (Wang...
Fan et al., 1994). There is some expectation, moreover, that
the plantaris muscle may be deployed in future as an
autologous transplantation material for the repair of heart-
valve defects (Li et al., 2000).

The calcaneal tendon usually serves as the insertion
for the plantar musculature. In recent years, there has
been a noticeable increase in cases of calcaneal tendon
disease, with associated weakening and functional
impairment, and this is true not only of athletes, but
also of the wider population (van Dijk et al., 2011).
Histopathological changes were apparent in only 34 %
of asymptomatic tendons (van Sterkenburg & van Dijk, 2011).
Here, in fact, some scholars have posited that the insertion
of the plantaris muscle was closely associated with the
aetiology (Kurtys et al., 2020). The most recent literature
has noted positive results in treating chronic pain around
the middle of calcaneal tendon, with these results stemming
from the excision of the plantar muscle, its surrounding soft
tissue and its tendon, together with a reduction in tendon
tension. Follow-up, moreover, remains satisfactory after one
year (Spang et al., 2016).

From a morphological perspective, the plantaris muscle
is degenerative, as reflected in short muscle belly and tendon
elongation. Thus, the muscle has failed to adapt to rapid mus-
cular contraction. According to pertinent research, so-called
“tennis leg”, such as swelling and acute leg pain, may result
from the passive stretching of the plantaris muscle, notably
with knee-joint extension and ankle dorsiflexion below 90
degrees. Indeed, plantaris tendon rupture can arise from violent
plantar flexion not only in athletes, those who exercise heavily,
etc., but also in middle-aged individuals in poor physical shape.
In any case, the fact that the plantaris muscle can be damaged
by excessive elongation and contraction of the triceps surae
muscle is well established. Nonetheless, this may be
misdiagnosed as deep vein thrombosis or triceps surae muscle
injury, in the absence of MRI and US (Kwinter et al., 2010).
Non-surgical treatments are currently favoured for “tennis leg”.
Symptoms may ameliorate sooner, however, if the damaged
plantaris muscle is removed in the super-acute period, or if
the muscle is simply absent.

Conversely, some scholars maintain that, because of
its high-density muscle spindle, the plantar muscle is likely
to comprise the proprioceptive organ of the larger, more
powerful plantar flexors (Spina, 2007). This is because, rather
than generating power, most slender tendons regulate finer
motor functions (Kannus, 2000). Meanwhile, the major
stable knee ligaments may be more prone to injury in the
absence of the plantar muscle, via increased relaxation of
the knee during lateral and medial rotation, and weakened,
initial knee flexion (Olewnik et al., 2020).

High research value and wide prospective application
for disease treatment are associated with resection, absence
or transplantation of plantar muscle. Absence of the muscle
and its tendon obviously obstructs transplantation or removal,
but the potential graft status of the plantaris muscle can be
observed via pre-operative US or MRI. Clinical references
will also be derived from case reports.

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