

# Accessory Plantaris Muscle: Anatomy and Prevalence

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**Abstract** Accessory and anomalous muscles have been described in humans, but only a few at the level of the knee. The aim of this retrospective cohort analysis was to determine the prevalence of a new accessory muscle located at the level of the knee detected with magnetic resonance imaging (MRI). The accessory muscle is designated an accessory plantaris muscle in this study due to its intimate origin with the normal plantaris muscle. Retrospective review of 1,000 consecutive MRI exams of the knee performed on patients presenting with acute or chronic knee symptoms revealed an accessory plantaris muscle in 63 of the 1,000 patients (6.3%)—38 males (7.5%) and 25 females (5.1%). Origin of 62 of 63 of the accessory plantaris muscles merged with the origin of the normal plantaris muscle, and one of 63 merged with the origin of the lateral head of the gastrocnemius muscle. These accessory plantaris muscles inserted into the iliotibial band, the lateral patellar retinaculum, or the iliotibial tract.

**Keywords** accessory plantaris muscle · accessory knee muscle

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The author certifies that he has no commercial associations (e.g., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted article.

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The author certifies that his institution has approved the reporting of these cases and that all investigations were conducted in conformity with ethical principles of research.

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Level of evidence: Level IV Diagnostic Study

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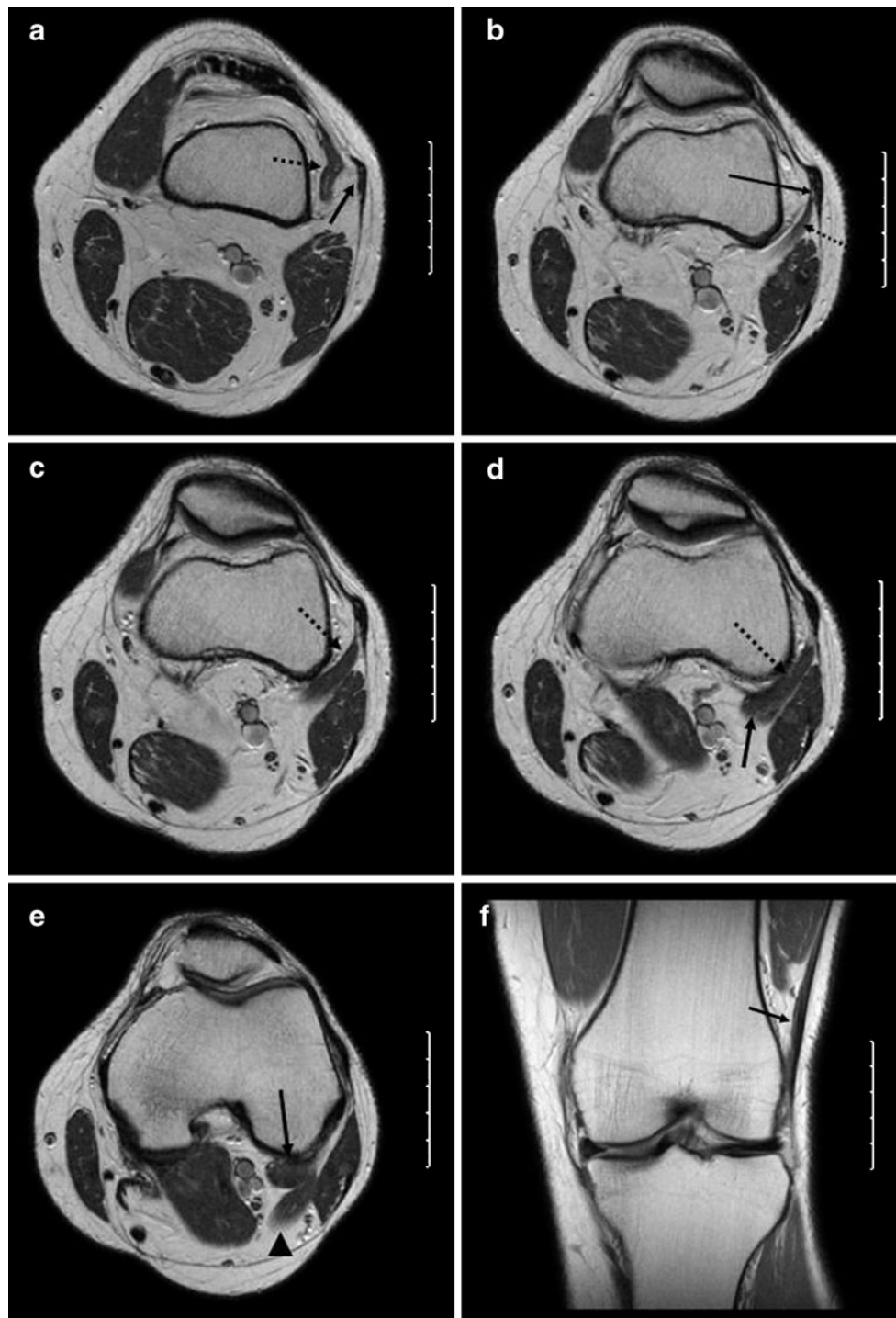
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## Introduction

While many accessory and anomalous muscles have been described in humans, only a few have been reported at the level of the knee [1–3, 6]. The clinical importance of these muscles depends upon their location and their potential affect on the adjacent anatomic structures [4]. In addition, accessory muscles may be confused for a neoplasm if they are palpated during a physical exam [5]. The aim of this retrospective cohort analysis was to determine the prevalence of a new accessory muscle located at the level of the knee detected with magnetic resonance imaging (MRI). The new accessory muscle is designated an accessory plantaris muscle due to its intimate origin with the normal plantaris muscle.

## Materials and methods

After receiving hospital institutional review board approval, a retrospective review of 1,000 consecutive MRI exams of the knee was performed to determine the prevalence of the accessory plantaris muscle and to assess its origin and insertion. The 1,000 MRI exams included 510 male and 490 female patients and were performed at outpatient imaging centers from May 2006 to February 2007, on patients presenting with acute or chronic knee symptoms. All MRI exams were performed with standard imaging protocols employing spin-echo techniques in three orthogonal imaging planes, along with a short tau inversion recovery or a fat-suppressed T2 sequence in at least one imaging plane. Imaging parameters included section thickness of 4 to 5 mm, a 14-cm field of view, and a 128 × 256 to a 256 × 256 imaging matrix. Imaging protocols were optimized for the different MRI systems which included low-field (0.3 T), mid-field (0.7 T), and high-field (1.0 and 1.5 T) MRI systems. All MRI exams were reviewed by a single musculoskeletal radiologist with 25 years of experience interpreting MRI exams.



**Fig. 1.** **a** This axial proton-density image through the knee proximal to the accessory plantaris muscle. The distal segment of the vastus lateralis muscle is identified by the *broken black arrow* and the iliotibial band by *solid black arrow*. **b** Slightly distal to **a**, the accessory plantaris muscle (*broken black arrow*) inserts into the iliotibial band (*solid black arrow*). **c** Slightly distal to **b**, the accessory plantaris muscle (*broken black arrow*) becomes larger as it courses posteromedial toward its origin. A thin insertion of the accessory plantaris muscle into the iliotibial band is still identified. The accessory plantaris muscle is located anterior and deep to the biceps femoris muscle. **d** Slightly distal to **c**, the origin of the accessory plantaris muscle (*broken black arrow*) merges with the origin of the normal plantaris muscle (*solid black arrow*). **e** Slightly distal to **d**, the origin of the normal plantaris muscle (*solid black arrow*) and the lateral head of the gastrocnemius muscle (*black arrowhead*) are present, and the accessory

plantaris muscle is no longer detected. **f** This coronal proton-density image through the knee captures the insertion of the accessory plantaris muscle into the iliotibial tract (*solid black arrow*). **g** Slightly posterior to **f**, the linear insertion of the accessory plantaris muscle (*solid black arrow*) is identified adjacent to the iliotibial tract (*black arrowheads*). **h** Slightly posterior to **g**, the accessory plantaris muscle (*solid black arrow*) becomes slightly thicker. Iliotibial tract (*black arrowheads*). **i** Slightly posterior to **h**, the accessory plantaris muscle (*solid black arrow*) becomes thicker as it courses toward its origin. **j** Slightly posterior to **i**, the accessory plantaris muscle (*solid black arrow*) is located deep to the anterior fibers of the biceps femoris muscle. **k** Slightly posterior to **j**, the origin of the accessory plantaris muscle merges with the origin of the normal plantaris muscle (*solid black arrow*). The accessory plantaris muscle is located deep to the biceps femoris muscle



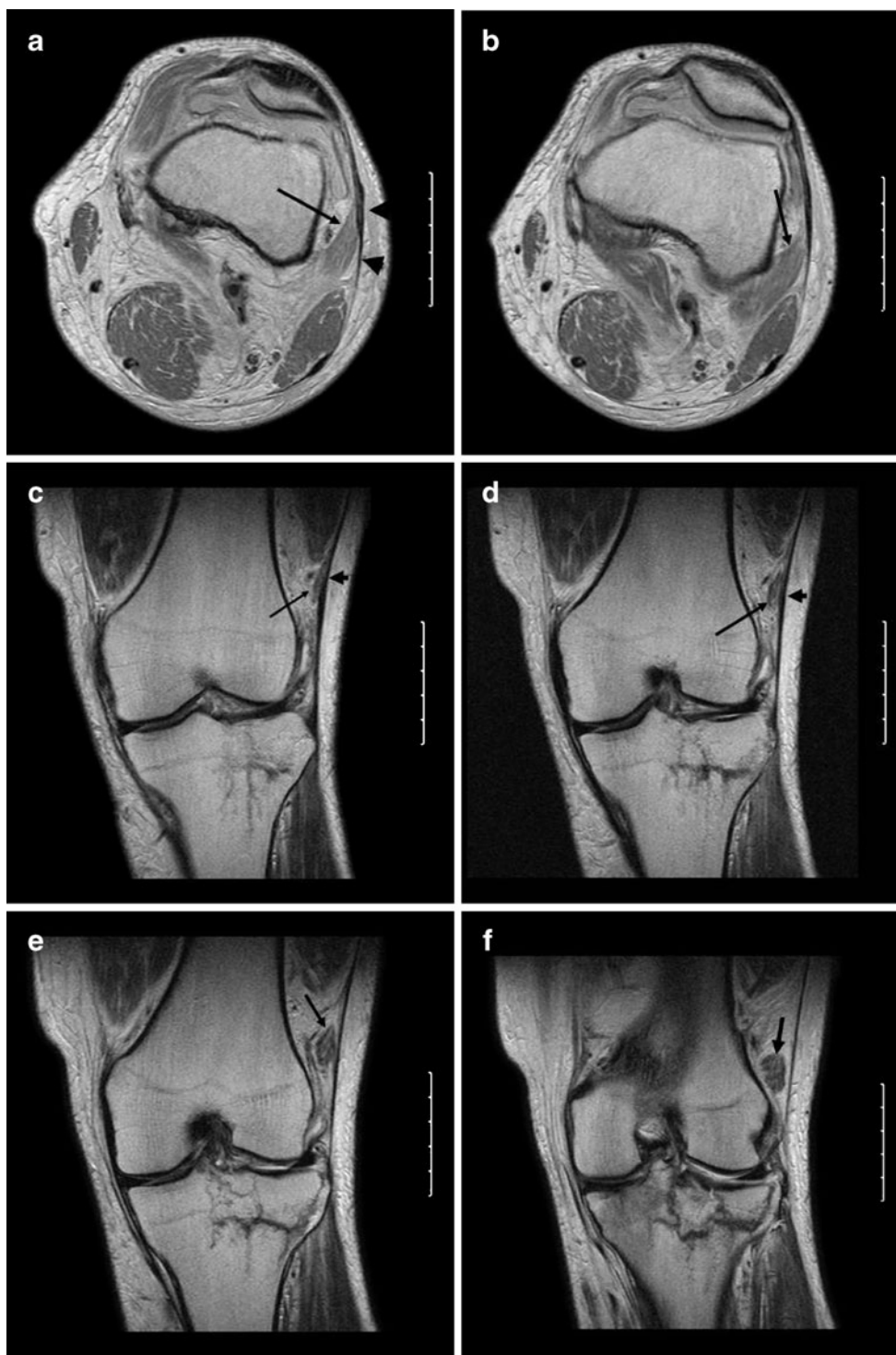
**Fig. 1.** (continued)

The accessory plantaris muscle was best delineated in the axial plane, but it was also detected in the coronal plane in all cases. To be recorded as present, the accessory plantaris muscle had to be detected in both the axial and coronal planes and contained muscle fibers that were similar in appearance to the normal muscles in the knee. If an accessory plantaris muscle was present, its origin and insertion were recorded.

For statistical analysis, the chi-square test was used to compare the incidence of the accessory plantaris in males and females.

### Results

An accessory plantaris muscle was detected in 63 of 1,000 patients (6.3%)—38 males (7.5%) and 25 females (5.1%).



**Fig. 2.** **a** This axial proton-density image depicts a prominent muscular insertion of the large accessory plantaris muscle (*solid black arrow*) into the iliotibial band and the iliotibial tract (*black arrowheads*). **b** Slightly distal to **a**, the large accessory plantaris muscle (*solid black arrow*) courses posteromedial to its origin. The accessory plantaris muscle is located anterior and deep to the biceps femoris muscle. **c** This coronal proton-density image depicts a prominent insertion of the large accessory plantaris muscle (*long black arrow*) into the iliotibial band and the iliotibial tract (*short black arrow*). **d** Slightly posterior to **c**, the large accessory plantaris muscle

(*black arrow*) still inserts into the iliotibial tract. **e** Slightly posterior to **d**, the accessory plantaris muscle (*black arrow*) becomes larger as it courses posteromedial toward its origin. **f** Slightly posterior to **e**, the accessory plantaris muscle (*black arrow*) is located adjacent to the posterolateral margin of the femoral metaphysis. **g** Slightly posterior to **f**, the accessory plantaris muscle (*black arrow*) becomes larger adjacent to its origin. The accessory plantaris muscle is located deep to the biceps femoris muscle. **h** Slightly posterior to **g**, the large accessory plantaris muscle (*black arrow*) merges with the origin of the normal plantaris muscle

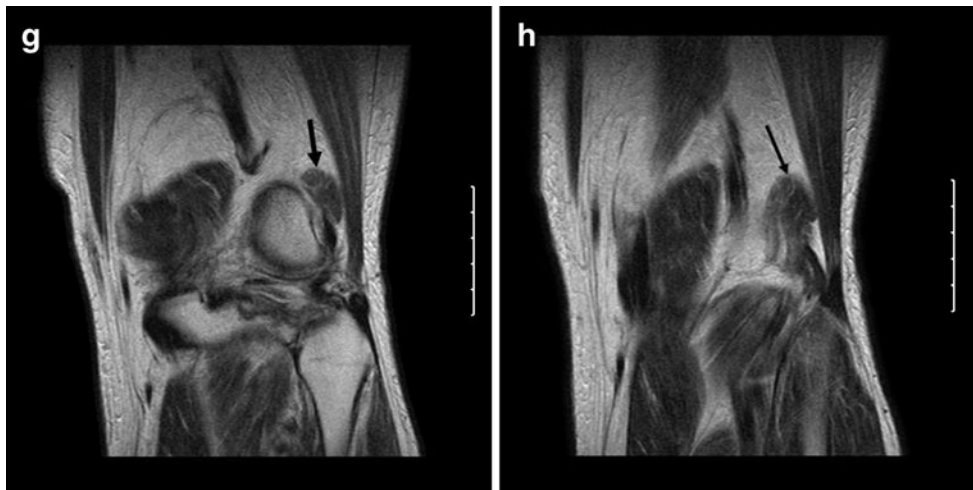


Fig. 2. (continued)

There was no statistically significant difference between the prevalence of the accessory plantaris muscle in males versus females ( $p=0.13$ ). The origin of 62 of the accessory plantaris muscles merged with the origin of the normal plantaris muscle, and the origin of one of the accessory plantaris muscles merged with the origin of the lateral head of the gastrocnemius muscle. Forty-three of the accessory plantaris muscles inserted into the iliotibial band, 15 inserted into the lateral patellar retinaculum, and five inserted into the iliotibial tract. The size of the accessory plantaris muscle ranged from a thin muscle with a linear band-like insertion (Fig. 1a–k) to a thick fusiform muscle with a wide insertion (Fig. 2a–h). Almost all the accessory plantaris muscles inserted immediately distal to the termination of the vastus lateralis muscle, and the level of the insertion of the accessory plantaris muscle was located slightly proximal to its origin.

## Discussion

The aim of this retrospective cohort analysis was to determine the prevalence of a new accessory muscle, designated an accessory plantaris muscle in this study, in routine MRI exams of the knee. The accessory plantaris muscle was detected in 63 of 1,000 patients (6.3%)—38 males (7.5%) and 25 females (5.1%). To the author's knowledge, this accessory muscle has not been previously described in the literature. MRI provides exquisite anatomic detail of the musculoskeletal system due to its excellent spatial and contrast resolution of soft tissue structures. Cross-sectional MRI imaging is the optimal noninvasive imaging modality to study normal anatomic structures of the musculoskeletal system and to detect an accessory or anomalous muscle that may be present. The origin and insertion of these muscles are best delineated with MRI

since there is no distortion of tissue planes that may occur with cadaveric dissection or at the time of surgery.

There were no limitations in this study as far as the detection of the accessory plantaris muscle or to determine its origin. The muscle was easily detected in the MRI exams which utilized low-field (0.3 T), mid-field (0.5 T), and high-field (1.0 and 1.5 T) MRI systems. Each MRI exam included spin-echo axial, coronal, and sagittal sequences, which provide excellent depiction of muscles and tendons, and employed a field of view that included the entire knee. The insertion of the accessory plantaris muscle was more difficult to determine in the low-field MRI systems due to the reduced spatial resolution.

With the new awareness of the presence of the accessory plantaris muscle, future studies may investigate if the muscle has a causative role in pathologic conditions of the knee, such as patellar tracking disorders or iliotibial band friction syndrome.

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