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Gastrocnemius tendinosis—A frequent finding on MRI knee examination☆

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ABSTRACT

Objective: Gastrocnemius tendinosis (GT) is one potential cause for posterior knee pain, commonly overlooked on clinical examinations and imaging. This study assesses the frequency of GT on MR imaging in a convenience sample based on a database search and associations with other articular pathologies and clinical findings.

Subjects and methods: With IRB approval, retrospective review was completed on 300 randomly selected MR knee exams performed from February 2009 to June 2010. Following de-identification, axial T2 and sagittal PD images, with or without fat suppression, were reviewed by 2 radiologists. The gastrocnemius tendon femoral attachments were graded as normal, mild (few cysts, thickening, intermediate signal) or severe GT (multiple cysts, marrow edema, tear). Select associated MR findings of internal derangement were documented. Clinical charts were reviewed for clinical presentation, physical exam findings, and select demographics.

Results: The inter-observer reliability for presence/grading of GT was very high (kappa statistic = 0.97). Frequency of GT was 50.33%, most frequently involving medial head of gastrocnemius (63.6%). Grades of GT were 41.7% and 17.2% for mild and severe respectively. Univariate analysis showed statistically significant relationship between grade of GT with arthrosis ($p = 0.05$) and clinical joint effusion ($p = 0.02$). Multivariate analysis showed higher odds of severe GT for individuals with medial plus lateral GT. Statistical significance was noted for presence of both GT and ACL tear (13.9%; $p = 0.02$).

Conclusion: Significant findings of our analysis included GT presented with predominant involvement of medial head of gastrocnemius tendon, mild in severity, strong association with ACL tear, presented frequently as posterior knee pain, limited joint motion and clinical joint effusion. However, there was no statistically significant association between demographic features and medical comorbidities in the patients. Increased understanding of frequency of GT allows more accurate reporting of MR knee exam and systematic search for associated abnormalities.

1. Introduction

Gastrocnemius tendinosis a.k.a tendinopathy, due to chronic repetitive microtrauma to the myotendinous junction is one of the potential causes for posterior knee pain [1,2,8,9,15,18]. However, it is commonly overlooked during clinical examinations. Further, even though magnetic resonance (MR) imaging is commonly performed to assess internal derangement of the knee, image interpretation often neglects this area. There is very little mention about this entity in literature with regard to its incidence, clinical presentation, or imaging findings [3,5,7,15,17]. Demographic or occupational categories are unexplored [3,5,7,15]. In cases in which gastrocnemius tendinosis (GT) is the primary diagnosis, management could be tailored and arthroscopy potentially avoided. Elucidation of frequency independent of pathology facilitates stratification of this finding on interpretation of MR exams. The purpose of this study was to delineate the frequency of identifying GT on MR imaging of the knee joint by retrospective review of MR imaging completed on consecutive patients at a single academic institution, and to determine if there are potentially associated articular pathologies or clinical scenarios with the presence of GT.

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2. Materials and methods

Following Institutional Review Board (IRB) approval with waiver for informed consent and creation of a protected data repository, the Radiologic Information System (RIS) was queried for all MR knee examinations performed on an outpatient population, completed between January 1, 2009 and June 30, 2010 at one academic hospital system. To assure randomization of a numerically manageable study subset, every third study was considered for review, with exclusion criteria of age less than 20 years (confinement to adult population), duplicate study from same extremity previously selected, surgical changes of arthroscopy, multi-trauma with obscuration of the region of interest, and incomplete or inadequate imaging quality.

2.1. MR imaging protocol

Imaging was completed on 4 magnet platforms including (1) 0.7T (HFO, GE Health Care, Milwaukee), (2) and (3) 1.5T (Signa HDx, GE Healthcare, Milwaukee; AERA, Siemens Healthcare, Germany), and (4) 3T (Trio, Siemens Healthcare, Germany). Dedicated knee coils were utilized. Due to variability of systems, axial T2-weighted (with or without fat saturation) and sagittal proton density images (with or without fat saturation) were used for evaluation, with the exception of one case where axial T1 and sagittal inversion recovery images were reviewed. Axial T2 images had parameters including FOV 14–16 cm, TR 2200–3500 ms, TE 68–85 ms. Matrix for non-fat saturated images was 198–256 mm while matrix for fat saturated images was 256–320 mm. Sagittal proton density images had FOV 14–16 cm, TR 2100–3500 ms, TE 23–32 ms. Matrix for non-fat saturated images was 198–256 mm and for fat saturated images, 256–320 mm.

2.2. MRI assessment

Images were reviewed independently by two radiologists (4 and 12 years of experience) blinded to previously created MR report and clinical indications/examination findings. A third dedicated musculoskeletal reader (20 years of experience) categorized discrepancies between the two readers. Tendons for medial and lateral heads of the gastrocnemius were evaluated for findings of gastrocnemius tendinopathy or tear. As there was no established literature on the imaging appearance or the grading of gastrocnemius tendinopathy, imaging findings were categorized based on MRI findings described for tendinosis at other regions of the body [10,16,18]. The tendon was characterized as normal (homogeneous signal void and consistent diameter) (Fig. 1), mild tendinopathy (one to two cystic inclusions (Fig. 2), tendon thickening, intermediate intra-substance signal changes or one or two of the mentioned characteristics (Fig. 3)), or severe tendinopathy (more than two cystic inclusions, bone marrow edema at the femoral insertion site, tendon tear (Fig. 4), presence of one, two or three of the mentioned findings or presence of all three findings of mild tendinosis (Figs. 5 and 6). In cases where both medial and lateral head tendons were abnormal, the higher grade abnormality was recorded. Care was taken to differentiate the cystic fluid collection in the posterior femoral recess or the subgastrocnemius recess from mild tendinopathy which presents as one or two cystic inclusions with the gastrocnemius tendon at its femoral attachment. The gastrocnemius tendon overlying the fluid collection were found to be normal in those patients (Fig. 7).

MR exams were reviewed for additional elements of internal derangement including complete anterior or posterior cruciate ligament tear, medial or lateral meniscal tear, medial or lateral collateral ligament tear, presence of joint effusion or popliteal cyst (present, absent, or ruptured), femoral or tibial plateau fracture.

Fig. 1. Sagittal proton density fat-saturated image showing normal medial head gastrocnemius tendon [arrow A], grade 1.

Fig. 2. Sagittal proton density fat-saturated image showing small cystic collection [arrow A] within the medial head gastrocnemius tendon at its femoral attachment, grade 2.