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Original article

Parsons' knob, the bony landmark of the tibial insertion of the anterior cruciate ligament, evaluated by three-dimensional computed tomography

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Abstract

Background: In recent years, highly detailed evaluations have been performed using three-dimensional computed tomography (3D CT). Very small bony ridges, such as Resident's ridge and the lateral bifurcate ridge can be visualised by 3D CT. The purpose of this study was to ascertain whether Parsons' knob, which was recognised as the bony landmark of the anterior cruciate ligament insertion on the tibia, can be visualised by 3D CT, and, if this is possible, to clarify its location and morphology.
Methods: One hundred knees were scanned by CT in this study and 3D models were created using the volume-rendering technique. Parsons' knob was detected on the axial 3D CT view of the tibial plateau. The location of the knob was presented on a grid aligned with the medial-to-lateral and anterior-to-posterior anatomical tibial axes. All measurements were expressed as a percentage of the corresponding maximum dimension. The width and height of Parsons' knob were also measured.
Results: Parsons' knob was detected in all 100 knees and was ordinarily found as a ridge that ran obliquely forward from the anterior edge of the medial spine. The knob was located at an average of 22 ± 3.1% of the anterior-to-posterior tibial plateau depth from the anterior edge of the tibia and extended from a mean ± s.d. of 46.9 ± 2.1% to 54 ± 3.6% of the medial-to-lateral tibial plateau width from the medial edge of the tibia. The average width of the knob was 11.5 ± 3.1 mm, and the average height was 1.2 ± 0.3 mm at the most medial portion, 0.2 ± 0.3 mm at the most lateral portion, and 1.2 ± 0.3 mm at the intermediate portion between them. The medial and intermediate portions of the knob were significantly higher than the lateral portion ($p < 0.05$).
Conclusion: The location and morphology of Parsons' knob can be well-visualised using 3D CT.
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Keywords: anterior cruciate ligament; bony landmark; reconstruction; three-dimensional computed tomography; tibial insertion

Introduction

In recent years, several anatomical studies of the anterior cruciate ligament (ACL) have been reported. In particular, several detailed reports on Resident's ridge, an osseous landmark in the ACL femoral attachment, have been published.[1–4] Resident's ridge is a thick ridge on the medial wall of the lateral femoral condyle that runs through the entire ACL footprint from proximal to distal. Moreover, a "lateral bifurcate ridge" that runs between the femoral attachment of the anteromedial (AM) and posterolateral bundles has also been reported.[5] These ridges are important and useful bony landmarks for anatomical femoral tunnel drilling in arthroscopic ACL reconstruction. Some reports on anatomical ACL reconstruction describe the use of Resident's ridge in the

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femur[6] to verify the drilling location when creating femoral tunnels. Many good to excellent postoperative clinical results of anatomical ACL reconstruction have been reported.[7–10] However, there are few reports concerning bony landmarks that help to create anatomical tibial tunnels.

In 1906, Parsons[11] reported that the tibial attachment of the ACL is indicated by a small knob on the outer margin of the internal articular facet and that this attachment run transversely outward to about the mid-sagittal line of the tibia. This small knob was subsequently named Parsons' knob and was recognised as the bony landmark of the ACL insertion on the tibia. However, only 10% of cases showed radiological evidence of Parsons' knob.[1]

In recent years, highly detailed evaluations have been performed using three-dimensional computed tomography (3D CT).[4,6,12–16] Very small bony ridges, such as Resident's ridge and the lateral bifurcate ridge can be visualised by 3D CT.[4–6,15,17] Hence, the hypothesis of the present study was that Parsons' knob can also be visualised by 3D CT. Therefore, the purpose of this study was to ascertain whether Parsons' knob can be visualised by 3D CT, and, if this was possible, to clarify its location and morphology.

Materials and methods

Approval for this study was obtained from the ethics committee of our institution, and written informed consent was obtained from each patient.

One hundred knees were scanned by CT in this study. There were 48 male and 52 female patients, and the mean patient age was 39 years (range, 15–57 years). Patients with knee injuries such as ACL rupture, periarticular fracture, and knee contusion underwent preoperative CT evaluation from April 2009 to December 2010. Patients were excluded if they had over Grade 2 degenerative arthritis by the Kellgren and Lawrence classification.

Two-dimensional CT was performed with a multislice system (Aquilion CX Edition; Toshiba Medical Systems, Tochigi, Japan). Scan parameters were as follows: 120 kVp and 200 mA, matrices of 512 × 512, gantry tilt of 0°, slice thickness of 0.5 mm, and beam pitch of 0.5 second gantry rotation. The two-dimensional images were then reconstructed for a 180 mm field of view with a 2.0 mm retrospective slice thickness to obtain to 300–350 slices. After CT, 3D CT models were created using the volume-rendering technique (ZIO software; ZIO Japan, Tokyo, Japan). The 3D shaded volume-rendering (SVR) images were reconstituted using the ZIOSTATION version 1.3.x workstation (AMIN, Inc., Tokyo, Japan).

Identification of Parsons' knob

After the reconstruction of the knee bone model, the femur and patella were selected for removal, and the tibial articular surface was viewed from straight above to obtain a true proximal-to-distal view of the tibial plateau. Next, the tibia was horizontally and uniaxially rotated to obtain a true frontal view of the tibia. The medial intercondylar ridge, medial tibial spine, and Parsons' knob were identified on these views (Fig. 1).

Location of Parsons' knob

After identifying Parsons' knob, its location was presented in a grid anatomically aligned with the medial-to-lateral and

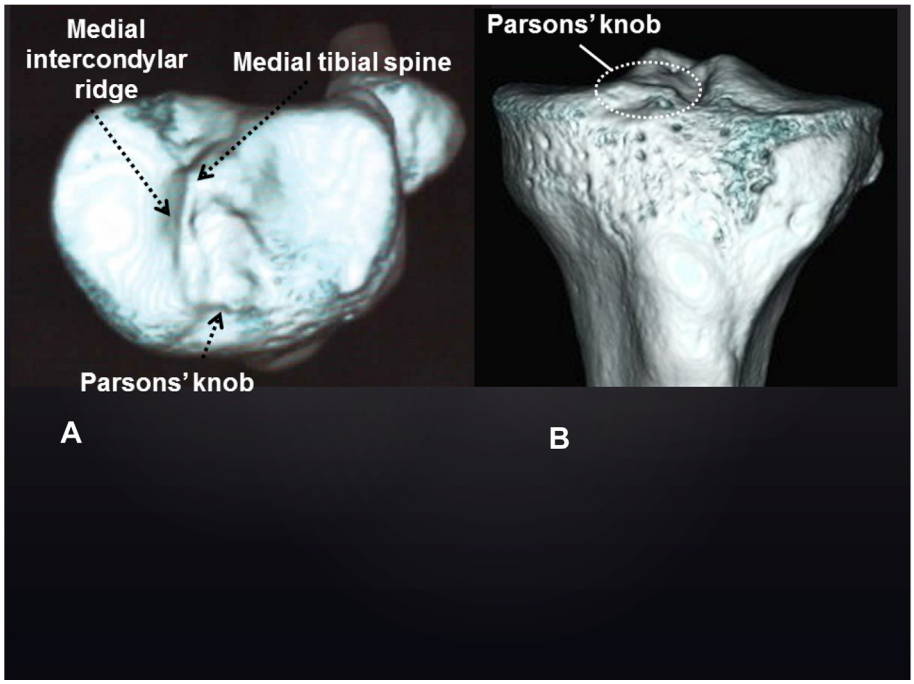

Figure 1. (A) Tibial articular surface was viewed from straight above to obtain a true proximal-to-distal view of the tibial plateau. (B) Tibia was horizontally and uniaxially rotated to obtain a true frontal view of the tibia. The medial intercondylar ridge of the tibia, medial intercondylar tubercle, and Parsons' knob were identified.

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