

An anatomical case report of the discoid lateral meniscus of the knee joint

Katsutomo KATO¹, Minoru OKITA¹, Hiroyuki TAHARA¹, Yoshitaka MANABE²,
Yoshikazu KITAGAWA², Joichi OYAMADA² and Atsushi ROKUTANDA²

Abstract The right knee, from a male cadaver aged 65, with discoid lateral meniscus was carefully dissected. The meniscus and its anatomical relationships with some associated ligaments of the knee are described. The discoid meniscus was a wide structure covering nearly the articular surface of the tibia and was almost intact macroscopically. Neither meniscal calcification nor ossification was demonstrated by radiography. There were strong transverse ligament, solid attachments from both anterior and posterior horns to the tibia, distinct posterior menisco-femoral ligament, and ligamentous slips from both anterior horns of the medial and lateral menisci to the anterior cruciate ligament. The knee anatomy was characterized by the well-development attachment system of the menisci. The medial meniscus was anatomically normal.

Bull. Sch. Allied Med. Sci., Nagasaki Univ. 14(1): 1-5, 2001

Key Words : Anatomy, Case report, Discoid meniscus, Accessory ligaments, Human knee

Introduction

The menisci are two crescentic lamellae, which deepen the surface of the upper end of the tibia in articulation with the femoral condyles¹⁾. The discoid meniscus, developmental abnormality, is the most common type of anatomic variation of the meniscus, usually occurring on the lateral side and only rarely on the medial side^{2), 3)}. The discoid meniscus has been the object of many studies, because it is a frequent source of symptoms. Most of the studies on the discoid menisci are based either on meniscectomies or on arthrographies from a clinical viewpoint. We found an interesting case of the knee with an intact discoid lateral meniscus during an anatomy practice. Therefore, this report describes the meniscal morphology of the anatomical case and its relationship with some intra-articular structures of the knee joint.

Materials and Methods

This discoid lateral meniscus was obtained from the right knee of a male cadaver aged 65, dissected during an anatomical practice at the School of Dentistry, Nagasaki University. In the left knee of the same cadaver, the author regrettably missed the opportunity to confirm the presence of the discoid

menisci. There is no clinical data regarding this case. To perform a detailed survey, the knee was removed from the formalin-reserved body by transversal cuts at the level of the upper end of the femoral condyle and the tibial tuberosity. The menisci were radiographed using a cabinet-type soft X-ray system (HB-50, Hitex Co, Osaka) in corroboration of the meniscal calcification or ossification.

Result

The discoid lateral meniscus was a wide structure that nearly covered the articular surface of the involved compartment (A and B in the Figure). The central point of the discoid lateral meniscus was approximately 1.5mm in thickness. Its free inner edge between two tibial attachments was not sharp like in normal menisci, but was rounded, and was 1.2mm in thickness.

Either the anterior or posterior horn of the lateral meniscus attached distinctly to the tibia with a strong fibrous structure shaped like a ligament. Both the anterior end of the medial and lateral menisci were stably joined by a strong transverse ligament, which was approximately 5.0mm in width at the mid-portion. The posterior menisco-femoral ligament (Wrisberg) was present, but the anterior

1 Department of Physical Therapy, The School of Allied Medical Sciences, Nagasaki University

2 Department of Oral Anatomy, Nagasaki University School of Dentistry

menisco-femoral ligament (Humphry) was absent. The posterior menisco-femoral ligament was a strong separate band that ran from the posterior horn behind the posterior cruciate ligament to the medial condyle of the femur. The width of the ligament was 3.6mm at the mid-portion, and was 8.9mm at the femoral attachment region (C and D in the Figure). Other ligamentous slips, or continuations from the anterior horn of the medial and lateral meniscus, were found (A and B in the Figure). The continuation from the medial meniscus ran in front of the anterior cruciate ligament, and that from the lateral meniscus ascended parallel to the anterior cruciate ligament. Both fused into the ligament in midcourse.

The medial meniscus was morphologically normal.

No disorders of the discoid lateral meniscus were macroscopically detected except for the appearance of a few discontinuously concentric, whitish striae in the meniscal body (A in the Figure). Also, neither meniscal calcification nor ossification was demonstrated by the radiography. The articular surface of the femoral condyle fitting to the discoid lateral meniscus during the knee extension had a pattern of slight erosion which was caused by prolonged contact.

Discussion

The frequency of the discoid lateral meniscus in man varies according to the material series, ranging between 1.0% and 15.5%⁴⁾. Goto reported that the discoid lateral meniscus was found in 6.5% of

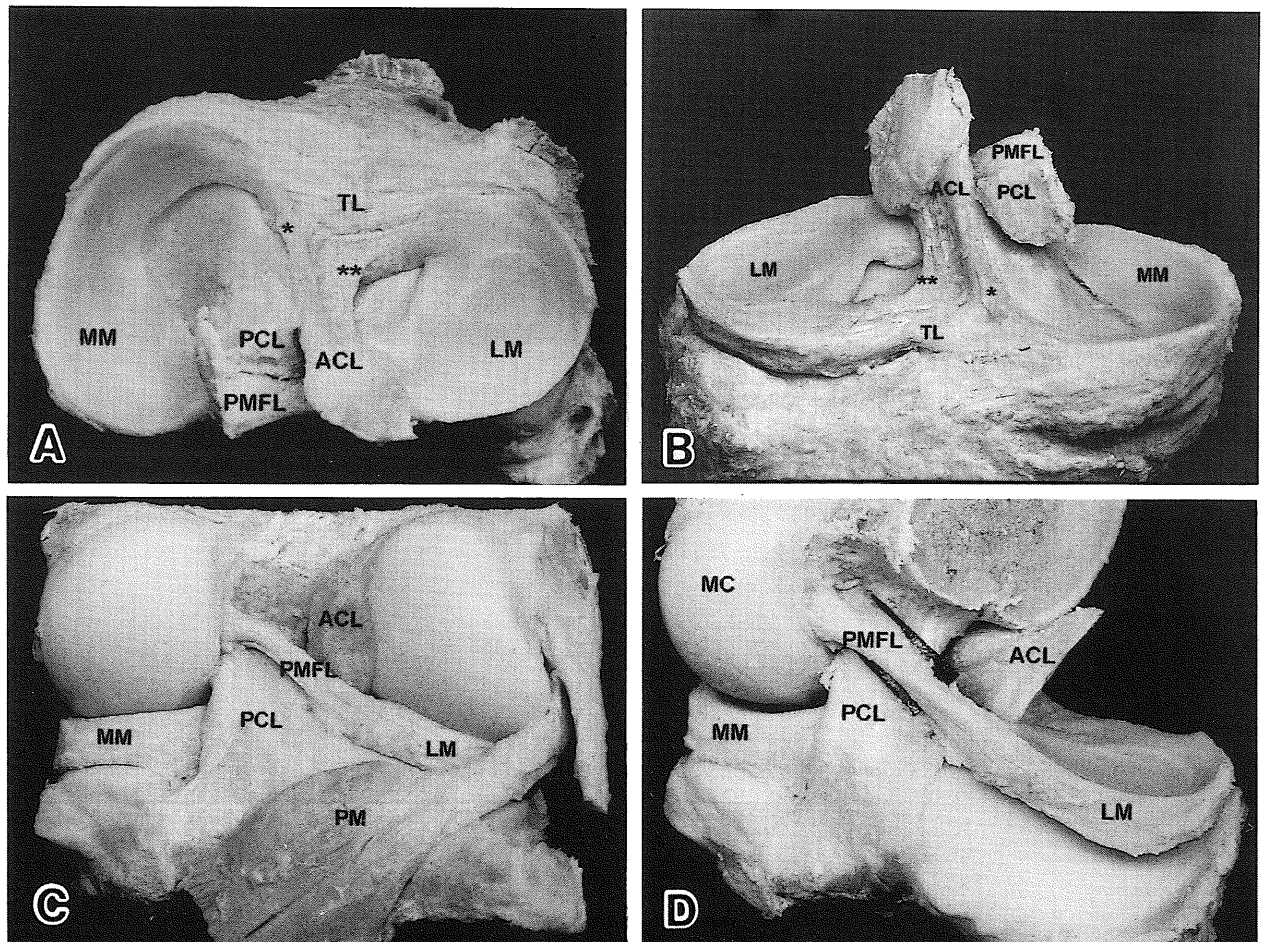


Figure. Photographs of the knee menisci and the associated structures.

- A. Superior view, after the femur was removed.
 - B. Anterior view, after the femur was removed.
 - C. Posterior view.
 - D. Posterior-lateral view, after the lateral condyle of the femur was removed. A piece of black paper was inserted between PMFL and PCL.
- LM : Lateral meniscus, MM : Medial meniscus, TL : Transverse ligament, PMFL : Posterior menisco-femoral ligament, ACL : Anterior cruciate ligament, PCL : Posterior cruciate ligament, MC : Medial condyle of the femur, PM : Popliteus muscle
 * : A slip from MM to ACL, ** : A slip from LM to ACL

Japanese adult cadavers⁵⁾. Any factors affecting the incidence of the discoid meniscus in man have never been understood. It is of interest that although the discoid menisci do not usually occur in the knee joint of mammals they are regularly found in birds and many reptiles. Certain monkeys possess discoid or circular lateral menisci. However, the discoid lateral menisci in man can hardly be considered as atavisms^{4), 6)}. Smillie presented an interesting theory that the shape of the normal adult meniscus was the result of gradual resorption of the central zone of a complete plate that is present in the early embryonic knee joint²⁾. Contradicting the above theory, Kaplan demonstrated that in human embryos, the menisci resembled their normal adult shape by 10 weeks of gestation and that a structure resembling a complete, solid disc was never present⁷⁾. Kaplan's finding have been supported by subsequent reports^{3), 8)}. Recently, the most widely accepted classification is that of Watanabe and includes the complete, incomplete, and Wrisberg-Ligament types⁹⁾. The discoid lateral meniscus in our case appears to correspond to the complete type according this classification. Also, the knee in our case is characterized by strong attachments to the tibia by both the anterior and posterior horn, well-built transverse ligament and a distinct posterior menisco-femoral ligament. These knee accessory ligaments play an important role in the fixation and positional control of the meniscus during joint movement. The incidence and development of the accessory ligaments show the variety among the individuals and the human series^{5), 10)}. Jinnaka and Amako described that the transverse ligament is absent in 44% of Japanese knees, and this fact is associated with the high incidence of meniscal tears⁹⁾.

Ligamentous slips, or continuations, of the anterior horn of the lateral and medial menisci to the anterior cruciate ligament found in our case partly resembles those of the anterior accessory ligament reported by some investigators^{11), 12)}. These ligaments may reinforce the anterior attachment of the menisci.

The discoid meniscus is an important etiological factor in meniscal disorders. One of the factors affecting the occurrence of the meniscal tears is the mobility of the meniscus, which is associated with the anatomical structures of the meniscal attachments^{9), 13)}. Kobayashi et al. concluded that the high incidence of meniscal tears relate to an imbalance

between the poor anterior attachments by the absence of the transverse ligament and the strong backward-drawing of the meniscus by the menisco-femoral ligament and/or popliteus tendon, in addition to the morphological abnormalities¹⁴⁾. The discoid lateral meniscus in the present case was almost macroscopically intact, despite the comparatively older-age cadaver. This finding may be partly due to the well-grown anterior attachment system of the meniscus, especially the strong transverse ligament and the anchors from the anterior horns to the anterior cruciate ligament.

References

1. Warwick R and William PL: Gray's Anatomy 35th ed, Longman, London, 1973, pp454-455.
2. Smillie IS: The congenital discoid meniscus. *J Bone Joint Surg* 30B:671-682, 1948.
3. DiCarlo EF: Pathology of the meniscus in Knee Meniscus, Basic and Clinical Foundations. Ed by Mow VC, Arnoczky SP, Jackson DW, Raven Press, New York, 1992, pp117-130.
4. Le Minor JM: Comparative morphology of the lateral meniscus of the knee in primates. *J Anat* 170: 161-171, 1990.
5. Goto T: Anatomical and clinical studies of Japanese knee menisci. Part 1. Anatomy of menisci and accessory ligaments in fetal and adult knees. *Kumamoto Med J* 34:917-926. (in Japanese)
6. Barnett CH, Davies DV, MacConail MA: Synovial joint, their structure and mechanics. Longman, London, 1961, pp54-73.
7. Kaplan EB: The embryology of the menisci of the knee joint. *Bull Hosp Joint Dis* 16:111-124, 1955.
8. Clarke CR, Ogden JA: Development of the menisci of the human knee joint. *J Bone Joint Surg* 65A: 538-547, 1983.
9. Watanabe M, Takeda S: Arthroscopy of the knee joint in disorder of the knee. Ed by Helfet AJ, Lippincott, Philadelphia, 1982, pp145-159.
10. Yamamoto M, Hirohata K: Anatomical study on the menisco-femoral ligaments of the knee. *Kobe J Med Sci* 37: 209-226, 1991.
11. Heller L, Langman J: The menisco-femoral ligaments of the human knee. *J Bone Joint Surg* 46B: 307-313, 1964.
12. Kim SJ, Kim DW, Min BH: Discoid lateral meniscus associated with anomalous insertion of

- the medial meniscus. Clin Orthop Related Res
315 : 234-237, 1995.
13. Jinnaka M, Amako T : Jinnaka Seikeigekagaku
(Jinnaka's Textbook of Orthopedics). Nan-
zando, Tokyo, 1983, pp1095-1107. (in Japanese)
 14. Kobayashi A, Uesaki N, Mituyasu M : On the
discoïd lateral meniscus of the knee joint.
Rinshou Seikeigeka (Clinical Orthopedics) 10 :
10-24, 1975. (in Japanese)

解剖実習体の膝関節にみられた円板状外側半月の一例について —特に関節内靱帯との関係—

加藤 克知¹・沖田 実¹・田原 弘幸¹・真鍋 義孝²
北川 賀一²・小山田常一²・六反田 篤²

- 1 長崎大学医療技術短期大学部理学療法学科
- 2 長崎大学歯学部口腔解剖学第一講座

要 旨 65歳男性遺体の右膝に見いだされた円板状外側半月を観察し、特に関節内付属靱帯との関係を記載した。円板状外側半月は比較的幅広く、脛骨の外側顆上関節面をほぼ完全に被い、肉眼的観察およびX線撮影ではその損傷や石灰化などの異常は見られなかった。本例では、全体的に半月の固定に関係する靱帯の発達が良好であった。すなわち、半月の前角と後角は靱帯を介して強固に脛骨に付着し、さらに、強い半月横靱帯が内・外側半月の前部を連結していた。後方では外側半月後角から起こる太い後半月大腿靱帯が認められた。加えて、内側・外側半月の前角から起こり前十字靱帯に合流する靱帯小束が認められたが、これらは半月の前部固定に関与すると考えられた。

長崎大医療技短大紀 14(1): 1-5, 2001