Rare disease

Symptomatic ring-shaped lateral meniscus. MRI findings.

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Correspondence to Mr Nikolaos E Koukoulas, nkoukoulas@yahoo.gr**Summary**

Ring-shaped lateral meniscus is a rare clinical entity that is usually asymptomatic. Moreover, diagnosis is always based on arthroscopic exploration of lateral meniscus. MRI has not been proven useful so far because the inner portion of the ring-shaped lateral meniscus is usually misinterpreted as a bucket-handle tear. The authors report a case of a 16-year-old girl with ring-shaped lateral meniscus in combination with a meniscal cyst. MRI demonstrated a cyst arising from lateral meniscus and meniscal tissue into the inner portion of the lateral compartment mimicking displaced meniscal fragment. Bucket-handle tears have not been reported to cause or accompany meniscal cysts. As a result the diagnosis of a ring-shaped lateral meniscus along with meniscal cyst was assumed based on MRI and confirmed during arthroscopy. The patient was treated with arthroscopic partial lateral meniscectomy and intra-articular cyst debridement.

BACKGROUND

The anatomical variation of the menisci is a well-known fact that usually occurs on the lateral side. Noble¹ was the first to describe in 1975 the ring-shaped lateral meniscus as an incidental finding during autopsy. Since then, there are some reports of asymptomatic ring-shaped lateral meniscus and only two cases of ring-shaped lateral meniscus causing clinical problems.²⁻³ Interestingly, in both cases a meniscal cyst arising from the ring-shaped lateral meniscus was the cause of the symptoms. As a result this is the third case reported in the literature with the above mentioned clinical characteristics. In all other cases reported today, the inner portion of the ring-shaped lateral meniscus, symptomatic²⁻³ and asymptomatic⁴ included, was mistaken for a displaced bucket-handle tear. What makes our case unique is the fact that this is the first case of ring-shaped lateral meniscus in which the ring-shaped lateral meniscus was suspected from the MRI.

CASE PRESENTATION

A 16-year-old girl presented to our outpatient clinic complaining for lateral, left knee pain over the last 6 months, without any history of trauma. On clinical examination, antero-lateral joint line pain was found and local swelling

could be detected with the knee flexed at 90°. The knee was stable and the limb normally aligned. Anteroposterior and lateral radiographs revealed no osseous abnormality and MRI of the left knee was programmed.

INVESTIGATIONS

Coronal images demonstrated a cyst arising from the lateral meniscus and extending laterally. Interestingly, meniscal tissue was found at the medial portion of the lateral compartment, mimicking displaced meniscal fragment. Sagittal images showed that the cyst was also extended anteriorly and that the portion of the lateral meniscus located medially, was in continuity with both the anterior and posterior horn of the lateral meniscus.

DIFFERENTIAL DIAGNOSIS

Differential diagnosis included a displaced bucket-handle tear of the lateral meniscus and an anatomical variant of the lateral meniscus (discoid or ring-shaped). The concomitant presence of the meniscal cyst made the diagnosis of the displaced bucket-handle tear unlikely because the cyst would have been drained into the joint through the tear surface. Nevertheless a more thorough evaluation of the MRI films was made. In the coronal plane, at the mid-level

Figure 1 (a) Coronal view demonstrating the meniscal cyst (black arrow, the normal C-shaped lateral meniscus (white arrow) and the inner portion of the ring-shaped meniscus (grey arrow). (b) Sagittal view demonstrating two consecutive images of bow tie sign of the medial part of the lateral compartment along with the meniscal cyst.

Figure 2 (a) Continuous meniscal tissue from the posterior horn to the anterior horn of the lateral meniscus. (b) A yellowish-brown gelatinous fluid from the cyst is released from the cyst.

of the knee (from anterior to posterior) three structures could be detected in the lateral compartment (figure 1a). The first one was the meniscal cyst (black arrow) located laterally and arising from the second structure, which was the normal in location, shape and size (compared to medial meniscus) lateral meniscus (white arrow). The third structure was the meniscal tissue located in the medial portion of the lateral compartment (grey arrow), which had almost identical shape and size compared to the second structure (normal meniscus) apart from the meniscal cyst. In the sagittal plane, at the medial portion of the lateral compartment and in two adjacent images continuous meniscal tissue from the posterior horn to the anterior horn of the lateral meniscus could be detected (figure 1b), giving the bow-tie sign seen in normal meniscus. Additionally, the meniscal cyst originating from the anterior horn of the lateral meniscus was also evident. Consequently, the diagnosis of a ring-shaped lateral meniscus along with a meniscal cyst was made and arthroscopic surgery was programmed.

TREATMENT

During arthroscopy, a ring-shaped lateral meniscus was found (figure 2a) with normal attachment of the anterior and posterior horn of the lateral meniscus. A horizontal cleavage tear of the lateral meniscus was found at the antero-central junction. Debridement of the tear with the motorised shaver released a yellowish-brown gelatinous fluid from the cyst (figure 2b). The tear was treated with partial lateral meniscectomy while the meniscal cyst was arthroscopically evacuated and debrided through the tear of the meniscus.

OUTCOME AND FOLLOW-UP

The postoperative period was uneventful and the girl remains asymptomatic 2 years after the operation.

DISCUSSION

Ring-shaped lateral meniscus is a rare anatomic variation, with only a few reports thus far. Monllau *et al*⁴ proposed that the ring-shaped lateral meniscus should be added as the fourth variant in the Watanabe's classification of lateral

meniscal abnormalities (three types of discoid meniscus).⁵ Discoid meniscus is considered to be a congenital malformation and that is in accordance with the age (16-year-old) and history (no trauma) of our case. Nevertheless, this assumption has to be confirmed in future studies.

MRI has been reported to be a valuable diagnostic tool both in displaced bucket-handle tears⁶ and in lateral meniscal variants.⁷ However, the ring-shaped lateral meniscus has not been detected on MRI so far.^{2-4 7} The inner portion of the ring-shaped lateral meniscus was interpreted either as a displaced bucket-handle tear of a normal meniscus or a central tear of a discoid lateral meniscus.^{2-4 7} In our case, the presence of the meniscal cyst excluded the possibility of the displaced bucket-handle tear. We could not find a case in the literature of concomitant bucket-handle tear and meniscal cyst. Meniscal cysts accompany meniscal tears and the most common tear pattern is the horizontal cleavage tear⁸ which is in accordance with our case. Moreover, the displaced meniscal fragment is usually located into the notch and not onto the medial portion of the lateral compartment.^{6 9} The central tear of the discoid meniscus has an irregular or degenerative circular inner margin that is not tapered and sharp.⁷ In our case, the coronal images demonstrated that the inner portion of the ring-shaped meniscus was the same as that of the normal meniscus with a sharp and tapering inner margin. Apart from the meniscal cyst, it could be said that the inner portion of the ring-shaped is the reflection of the normal C-shaped meniscus thus making the 'mirror sign'. In the sagittal plane, it is well known that normal anterior and posterior horns of the menisci are visualised at MRI as triangular areas of homogeneously low signal intensity. The two triangles with a connecting body segment produce a normal bow tie appearance which is viewed in two consecutive sagittal images, peripherally, near the capsule.¹⁰ The 'central bow tie sign' seen in our case was useful in detecting normal meniscal tissue onto the inner portion of the lateral compartment of the knee. This sign would only be expected to appear in anatomic meniscal variants such as discoid or ring-shaped meniscus and not in displaced bucket-handle tears.

Learning points

- ▶ Ring-shaped lateral meniscus is a rare anatomic variation.
- ▶ The inner portion of the ring-shaped lateral meniscus is located onto the medial portion of the lateral compartment and not into the intercondylar notch, where displaced bucket-handle tears are usually found.
- ▶ In the coronal plane of MRI, the inner portion of the ring-shaped lateral meniscus is the reflection of the normal C-shaped meniscus thus making the 'mirror sign'.
- ▶ In the sagittal plane of MRI, the 'central bow tie sign' is useful in detecting normal meniscal tissue onto the inner portion of the lateral compartment of the knee, which is in accordance with the presence of ring-shaped lateral meniscus.

Competing interests None.

Patient consent Obtained.

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