CASE REPORT

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Bilateral incomplete discoid lateral meniscus in a 14 weeks fetus: a case report and review of literature

B. V. MURLIMANJU[1)], NARGA NAIR[2)], SHAKUNTALA R. PAI[2)], MAMATHA TONSE[1)], V. VINAY KUMAR[3)]

[1)]*Department of Anatomy, Manipal University, Kasturba Medical College, Mangalore, India*
[2)]*Department of Anatomy, Manipal University, Kasturba Medical College, Manipal, India*
[3)]*Department of Anatomy, Nitte University, K. S. Hegde Medical Academy, Mangalore, India*

Abstract

Discoid lateral meniscus is a rare condition that unilateral is more common than bilateral, here we report a case of bilateral discoid lateral meniscus which was observed in the knee joints of a female fetal cadaver of 14 weeks gestation (92 mm crown-rump length). It was an incomplete type of discoid meniscus, occupying about three fourth of the tibial plateau area. The embryological basis of this anomaly is discussed with emphasize on its clinical implications. This finding support the opinion that discoid lateral meniscus as a true congenital malformation that is not found in normal development.

Keywords: bilateral, discoid, fetus, knee, lateral meniscus.

Introduction

Congenital anomalies of the menisci are very rare and seen frequently on the lateral meniscus [1].

Among them the discoid meniscus is the commonest, the other kinds of anomalies include double-layered lateral meniscus, ring shaped lateral meniscus, etc.

The incidence of discoid lateral meniscus (DLM) is estimated to be 3% to 5% in the general population and slightly higher in Asian populations [2].

In our previous original research [3], the incidence of DLM from South India was reported as 17.9%.

Le Minor JM [4] reported that these DLM are usually unilateral, however bilateral observations are found in the literature.

Rao SK and Rao SP [5] observed that 10% of the DLM are bilateral. They found the female preponderance of the DLM in their arthroscopic study.

In our previous anatomical investigation [3], we also observed the female preponderance of the DLM and in that study, 26.6% of the cases were found bilateral.

The investigation of meniscal variants is important in order to define the morphological features for clinical diagnosis and orthopedic procedures [6].

The concept of snapping knee syndrome that is caused by the DLM is widely accepted in the pediatric orthopedic literature [7].

Here we report a case of incomplete DLM, which was observed bilaterally in the knee joints of a female fetal cadaver.

Materials, Methods and Results

During the dissections of embalmed human fetuses done for the morphometric study of the knee joints, a DLM was observed on the right knee joint (Figure 1) of a female fetal cadaver.

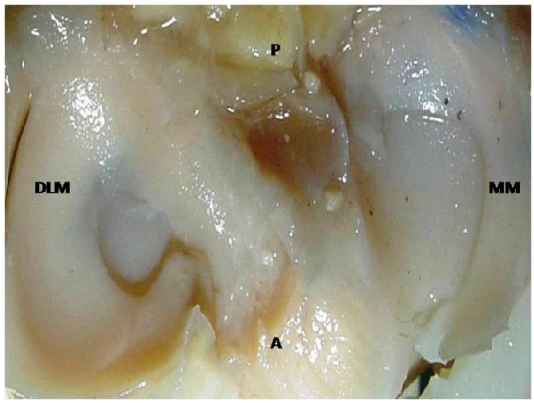

Figure 1 – ***Right knee joint of the fetus showing the incomplete discoid lateral meniscus (A – anterior, P – posterior, MM – medial meniscus, DLM – discoid lateral meniscus).***

The fetus was of an age of 14 weeks gestation (92 mm crown-rump length). After the dissection of the left knee joint, it was observed that the discoid shape (Figure 2) was present even on the left side. The menisci were wider than the usual and observed to occupy a wide area of the tibial plateau area but less than 80%. The medial menisci on both the side knee joints were found to have normal shape.

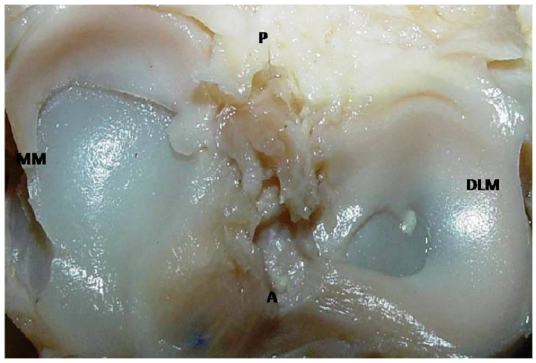

Figure 2 – ***Left knee joint of the fetus showing the incomplete discoid lateral meniscus (A – anterior, P – posterior, MM – medial meniscus, DLM – discoid lateral meniscus).***

There exists an agreement from ethics committee of the institution where the present case was observed and reported. The fetal cadaver has been donated by the Manipal University Hospital to the Anatomy Laboratory for the purpose of medical research; the obstetric history of the fetal mother was not available. The examined fetus did not show any externally visible malformations. Both the knee joints were found normal on external inspection.

Discussion

The differential diagnosis of the lateral meniscal anomalies include discoid meniscus, ring shaped meniscus, double layered meniscus, hypoplastic meniscus, accessory meniscus, partially deficient meniscus and abnormal band of meniscus [8]. In the clinical set up, making an accurate diagnosis could be difficult. For example, Pandey V *et al.* [8] had a case in which during the arthroscopic diagnosis, the ring shaped lateral meniscus was mistaken as the incomplete DLM. But, they managed to diagnose it perfectly during the second arthroscopy. Hence, the anatomical knowledge of the meniscal anomalies is essential for the clinicians involved in procedures like knee joint arthroscopy.

In the literature, there exists a debate regarding the etiology of the DLM. Few authors believe that this condition is the persistence of the normal stage during fetal development. But, most of the authors opine that this state is anomalous and arises through variant morphogenesis. Earlier, it has been described that the residual prenatal morphology of the meniscus may result in discoid meniscus after birth [9]. Smillie IS [10] believed that failure of resorption of the central area of the cartilage plate during the fetal stages of normal development, proposed the first theory on the development of the discoid meniscus. He stated that the meniscus exists as a cartilaginous disc at an early stage of development and that a congenital discoid meniscus is caused by an occasional persistence of the fetal state. Ross JA *et al.* [11] gave an opinion of Walmsley that, a failure of breakdown of the blastemal matrix that occupies the early embryological joint space results in the development of the discoid meniscus. He observed that it is only at the very earliest phase of development during the embryonic period that the plate of undifferentiated mesenchyme from which the meniscus develops, resembled a disc. This theory was refuted by Kaplan EB [12] and Clark CR and Ogden JA [13] when dissections of embryonic specimens of humans and animals failed to demonstrate the meniscus as a cartilaginous disc at any stage of normal development. Kaplan EB [12] demonstrated meniscus of adult shape in 55 mm fetus. Fukazawa I *et al.* [14] examined 41 externally normal fetuses of gestation between 14 to 30 weeks and did not find any discoid meniscus. Therefore, present case of discoid meniscus in this fetus of 14 weeks (92 mm length) support the assumption that DLM as a true congenital malformation.

Tena-Arregui J *et al.* [9], with the help of standard arthroscopic surgical equipment studied 20 frozen fetuses and their observations showed minimal differences in the fetal menisci when compared with the adult. The variation they saw the lateral meniscus was disproportionately larger than the medial meniscus in the fetuses of earlier gestational age. The variations of the shape of the menisci are explained by embryological meniscal development [4, 10]. The meniscus arises from the differentiation of mesenchymal tissue within the limb bud and becomes a clearly defined structure by the 8th week of intrauterine development [9, 12]. They arise from the eccentric portions of the articular interzone during O'Rahilly stage 22, however until the 9th week of development, they are not easily distinguishable [15]. From that point on, the menisci grow at the same rate as rest of the intra articular structures without undergoing any macroscopic structural changes [9] and assume the normal adult relationships with the rest of the knee by the 14th week [7, 16].

The accepted concept is that the DLM is an anomalous condition and arises through variant morphogenesis. Le Minor JM [4] reported that no embryological study in the human fetus had ever shown this initial discoid stage, the LM having its adult crescent shape from its inception. He added that the DLM did not originate by the persistence of a normal embryonic structure but resulted directly from abnormal morphogenesis. The support for the congenital theory also comes from the evidence of familial transmission of the DLM and reports of occurrence in twins [16].

The most widely documented classification of DLM is by Watanabe et al who described three types of DLM based on the arthroscopic appearance [2]. Discoid menisci with intact peripheral attachments and cover the entire tibial plateau are considered complete (type I), which cover less than 80% of the tibial surface are called incomplete (type II). Type III DLM, the so-called 'Wrisberg ligament type', are more normal in morphology except for a thick posterior horn and they lack posterior capsular attachments other than the posterior meniscofemoral ligament [2]. In the present study, the incomplete DLM (type II) was observed. In our previous report [17], we presented a case of complete DLM, in that case the meniscus was occupying more than 90% of the tibial plateau area. In the present case, the meniscus was occupying less than 80% of the tibial plateau area. Hence, it was considered as the incomplete type of DLM. Our previous original

study [3] has observed the incidence of this type of incomplete DLM in 14.1% of the cases. In contrast, Kato Y *et al.* [18] observed the incomplete DLM in 29.6% of their Japanese cadaver specimens.

Kocher MS *et al.* [2] reported that the DLM is an anatomical variant with a propensity for tears caused by increased mechanical stresses. Compared with the normal meniscus, the DLM has a higher frequency of meniscal tears, more so the solitary tears are more common. Seong SC and Park MJ [19], in their study to correlate the type of discoid meniscus and the tear pattern, concluded that horizontal tear patterns were the most frequent type. They also noted that simple horizontal tear was found only in the complete type of DLM and radial, degenerative and complex tears were found in the incomplete type of DLM. Kato Y *et al.* [18] reported that the incidence of meniscal tears for incomplete DLM was significantly higher than that for normal meniscus.

Conclusions

This is a case report of a discoid lateral meniscus in a fetus at the age 14 weeks. It can only support what ever available finding in the literature. We believe that the finding in this case support the opinion that DLM as a true congenital malformation.

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Corresponding author

B. V. Murlimanju, Assistant Professor, MD, Department of Anatomy, Manipal University, Kasturba Medical College, Mangalore–575004, India; Phone 91 824 2211746, Fax 91 824 2421283, e-mail: flutesnowmm@gmail.com

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