CONGENITAL DISCOID CARTILAGE

Report of a Case of Discoid Medial Cartilage, with an Embryological Note

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Discoïd cartilage was first described in 1889 by Young, and for long was found affecting only the lateral cartilage. The "snapping knee" was described as a clinical sign of this condition by Kroiss in 1910. In 1930 Watson Jones described a ring-shaped medial cartilage in a thirty-four-year-old man with clicking at the inner side of his knee; there had been no history of injury. The cartilage was circular, with a thick margin all round its circumference and a central perforation with thin margins. Watson Jones suggested that there had been an old "bucket-handle" tear, the inner segment of which had been carried in towards the centre of the joint. A similar specimen was found in class-room dissecting and was described by Basmajian (1952). In this case the other knee was found to have normal cartilages.

Apart from these two cases we have found four cases of true discoid medial cartilage in the literature. Cave and Staples described two cases in 1941, Dwyer and Taylor one in 1945, and Smillie one in 1948. From the descriptions it seems likely that three of these belong to the category which Smillie has termed "primitive." Such a cartilage is a complete plate with a thick free margin which may be convex.

Three of the discoid medial cartilages referred to had longitudinal tears and the fourth showed cystic degeneration and horizontal cleavage. Horizontal cleavage, which according to Smillie occurs characteristically in the primitive type, was also present in one of the three with longitudinal tears.

CASE REPORT

A woman aged twenty-seven came to hospital with a three years' history of pain at the medial side of her left knee. The pain was felt on rotational strains, and was of insidious onset. Eleven months before her admission she had twisted the knee, and thereafter the symptoms had become worse. Eight months later she had experienced a loud and painful "click" at the medial side of the left knee on straightening it. This was followed by swelling of the knee, inability to straighten it fully, and a slight limp. These symptoms persisted in mild degree until she was referred to hospital.

On examination there was tenderness over the joint line in front of the medial ligament. On flexion and rotation medially and laterally a click was felt inside the joint, but it was difficult to localise it precisely. There was slight elastic limitation of full extension. There was no effusion. The radiological appearances were normal.

A diagnosis of a tear of the anterior part of the left medial cartilage was made. At operation (March 1957) a longitudinal tear about half an inch (1.25 centimetres) long was found extending backwards from the anterior horn. When the anterior attachment had been freed it was seen that the cartilage was of unusual shape, extending laterally as a solid disc over the upper surface of the tibia. The cartilage was excised entire.

On examination after fixation the cartilage was seen to be an oval disc 4.5 centimetres long by 2.5 centimetres wide (Fig. 1). It was a solid plaque, 2.5 millimetres thick at the centre. The lateral border was free, convex, and 1.5 millimetres thick. The medial border was the
normal fibrous periphery of a medial cartilage. Anteriorly the longitudinal tear was seen extending backwards from the anterior horn into the cartilage as noted at the operation. No horizontal cleavage or cystic changes were seen, and no ridges on its superior surface.

The patient's daughter was also found to have symptoms referable to one of her knees. At the age of six weeks this child was noticed by Mr I. S. Kirkland to have a clicking left knee and the ligaments were so lax that the knee could easily be subluxated. This abnormality has gradually become less obvious, the child now being twenty months old.

![Photograph of discoid medial cartilage removed at operation](image)

**Fig. 1**
Photograph of discoid medial cartilage removed at operation, with centimetre scale alongside the medial border. Note the anterior split (between 1 and 2 centimetre mark) and the convex free (lateral) border. The faint horizontal grooves anteriorly are where the cartilage was gripped by forceps.

**DISCUSSION**

It has been postulated that the occurrence of discoid cartilage is due to the persistence of the foetal state, and Smillie (1948) stated that the shape of a normal cartilage is the result of gradual absorption during the latter half of foetal life of the central part of an originally complete plate. Such a view on the development of the cartilages is often taught, but it does not seem to be substantiated by a critical analysis of the development of the knee joint. Jaroschy (1935) wrote "We are not entitled to relate the disc-shaped fibrocartilage to a standstill in development, or the persistence of an earlier state. Study of the development of the knee joint is against such a theory. The lateral cartilages of new-born babies and premature babies often cover a larger area of the tibia than in adults, but do not differ greatly in shape from the adult cartilage except in rare examples which may be regarded as pathological. The theory that the fibrocartilages are to be considered as remains of complete intra-articular..."
discs is lacking in proof. In the animal kingdom disc-shaped lateral cartilages are not found in mammals, but they are constantly found in birds and many reptiles. The theory that the disc-shaped lateral cartilages in man represent a reversion to the condition in reptiles is not proved."

Kaplan also found (1955) that the fibrocartilages of the knee do not present at any phase of foetal development a disc-like appearance, either on the lateral or medial side, and he was unable to accept the thesis that the discoid cartilage is the result of arrest of development. Kaplan's study covered embryos from forty days (14 millimetres) to birth and showed that the earliest development that could be considered the precursor of the semilunar cartilage took place at the periphery of the joint.

In view of the conflicting views about the origin of discoid fibrocartilages one of us (T. A. E.) carried out some dissections of foetal limbs to throw some light on the problem.

![Cartilages from right knee joint of 37 millimetres (ten weeks) embryo. (× 60.)](image)

**Fig. 2**
Cartilages from right knee joint of 37 millimetres (ten weeks) embryo. (× 60.) The cartilages have almost the adult form.

It was found that as early as the tenth week the cartilages have a form which closely resembles that in the adult (Fig. 2), and nothing could be more distinct than the difference between the medial cartilage in the ten-weeks'-old foetus and the discoid cartilage from our patient. Further dissections confirmed that the cartilages retain this form throughout intra-uterine life. An example from a 145 millimetre foetus (eighteen weeks) is shown in Figures 3 and 4.

It is perhaps inaccurate to say that the disc shape is never present in the normal development of a fibrocartilage. In an early phase of development there is an undifferentiated mass of mesenchyme between the cartilaginous precursors of the bones. In most synovial joints this intermediate mesenchymal plate or blastemal matrix breaks down to form a space between the two bones by the end of the second month (Quain 1908). In some synovial joints parts of the mesenchyme persist to form intra-articular structures such as the fibrocartilages in the knee (Gray's Anatomy 1949). There is no embryological evidence to suggest that this undifferentiated mesenchyme normally goes on to form a complete disc of fibrocartilage whose
central portion is later absorbed to produce the adult semilunar form. All embryological evidence indicates that the central part of the plate of mesenchyme is absorbed when the joint space is developing, and from the commencement of differentiation the cartilages have

![Fig. 3](image1)

**Fig. 3**
Dissection from 145 millimetres (eighteen weeks) embryo showing the upper surface of the left tibia with the cartilages *in situ*. (*× 6.*)

![Fig. 4](image2)

**Fig. 4**
Cartilages from the left knee joint of a 145 millimetres (eighteen weeks) embryo. The semilunar shape of the cartilages is well seen. (*× 6.*)

a basic form like that of the adult. This view was also expressed by Hertwig (1892) who wrote: "Into the articular cavity are thrust from the articular capsule the metamorphosed products of the intermediate tissue which constitute the so-called semilunar fibrocartilages or the menisci." It is therefore only at the very earliest phase of development that the "plate"
of undifferentiated mesenchyme from which the cartilages develop can be said to be disc-shaped. The discoid cartilage cannot truly be said to be a persistence of a normal phase in development, because, from the time of differentiated mesenchyme, the cartilages have a semilunar form.

As to the etiology of the discoid form occurring in the lateral cartilage, Professor Walmsley (1957) expressed the following view: "I think we must always keep in mind the fact that the form of the lateral cartilage with its two horns so closely approximated does tend to have rather a discoid appearance. The semilunar form of the lateral cartilage is indeed dependent on a very minute central breakdown of the blastema matrix between the precursors of the bone, and if this fails to occur, then I can well understand how a discoid-like cartilage might result. The fact that a disc-like cartilage is more common on the lateral side than on the medial is in keeping with the greater absorption of the blastema that occurs normally during the development of the medial cartilage, and it is this greater absorption that results in the more 'open' form of this cartilage."

Discoid cartilage is found comparatively rarely, but it is possible that it often goes unrecognised (Fisher 1936). Middleton (1936) gave a chronological list of references to the previously recorded cases of discoid lateral cartilage, but made no mention of discoid medial cartilage. Smillie (1948) found twenty-nine examples of discoid cartilage in 1,300 knees subjected to operation, only one of which was on the medial side. This figure, however, represents only the incidence of discoid cartilage in patients operated upon for suspected cartilage tears. Whether discoid cartilages are more liable to suffer tears than normal cartilages is not known, for we have no knowledge of the true incidence of this anomaly; but Middleton considered that on the lateral side the disc-shaped cartilage is abnormally prone to injury. Likewise, in the absence of a knowledge of the incidence of discoid cartilage, it is useless to speculate on whether the greater rarity of the anomaly on the medial side is true or only apparent. It is of interest that other congenital anomalies are commoner on the fibular side than on the tibial side (Steindler 1950), and that, as Walmsley points out, the shape of the lateral cartilage is such that the discoid form would be much more likely to occur than on the medial side.

Middleton considered that in such a developmental abnormality as discoid cartilage, inheritance almost certainly plays a part in its transmission. He referred to a case recorded by Jones (1935) in which the mother of the affected child showed similar symptoms, and a discoid cartilage was believed to be responsible, though it was not proved by operation. This was the only case with a history of familial transmission in Middleton's series. In our case the patient's daughter had an abnormality of the knee, but so far its nature has not been proved by operation.

In some cases of lateral discoid cartilage associated defects have been noted of the fibular side of the leg. These include high fibular head, defects in the fibular musculature, peroneal luxation and changes in the shape of the lateral malleolus (Lewin 1952).

Apart from slight flattening of the medial femoral condyle which appears to be within the normal range, no such defects were found on the corresponding side of the leg in our case. No comment was made on this particular feature in the other cases of discoid medial cartilage previously described.

The cases of discoid medial cartilage have all been diagnosed clinically as torn medial cartilages, and the discoid nature of the cartilage has been found incidentally at operation. Dwyer and Taylor's (1945) patient and our patient both experienced loud and painful clicks in the knee, which, if occurring on the outer side of the knee, would have suggested a discoid lateral cartilage. Middleton (1936), discussing the cause of the snapping noise in such cases, considered that the mere presence of a disc-shaped cartilage did not cause symptoms, but symptoms necessitating removal of the structure may be brought about by injury, and by a ridge developed on the upper surface of the cartilage. When the knee is extended the femoral condyle rides over this ridge, producing the characteristic snapping noise. In our case of
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discoid medial cartilage there was no ridge on the surface, and the snapping must be ascribed to the associated tear of the anterior horn. Thus no specific diagnostic features can be said to have been found so far in discoid medial cartilage.

SUMMARY

1. A case of discoid medial cartilage is described—the fifth so far recorded—and comparison is made with the previous cases in the literature.
2. The origin of the anomaly, its incidence and clinical features are discussed.
3. The view is expressed that discoid cartilage is a congenital lesion due to abnormal development, fibrocartilage being laid down in mesenchyme which normally disappears in the formation of the joint. It is not the effect of arrest of a normal process or persistence of a normal foetal state. The only time at which a cartilage may be said to be disc-shaped is in the earliest weeks of embryonic life, when the disc or plaque of undifferentiated mesenchyme is present between the developing bones. The central part of this mass disappears early, and the fibrocartilage develops in its peripheral portion. In a ten-weeks' old embryo (37 millimetres) the cartilages were shown to have a crescentic shape like that of the adult cartilage.

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REFERENCES

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