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The menisci of the lumbar zygapophysial joints*

R. ENGEL AND N. BOGDUK

Department of Anatomy, University of New South Wales and Department of Anatomy, University of Queensland

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INTRODUCTION

Although frequently mentioned in European literature, the so-called 'menisci' of the lumbar zygapophysial joints (joints of the lumbar vertebral arches) have been described only briefly in English language journals, and not at all in anatomical textbooks. The descriptions in European literature, however, lack uniformity with respect to the incidence, form and disposition of these structures. Clinically, they are not without relevance, for entrapment of 'menisci' has been postulated as a cause of 'acute locked back'.

Because of the disparity in the literature describing the lumbar menisci, and in view of their putative clinical significance, a formal anatomical study of these structures was undertaken.

METHODS

Gross anatomy

Fifteen lumbar vertebral columns were obtained from post mortem and embalmed cadavera ranging in age from 22 to 90 years. Eighty two zygapophysial joints from all levels of the lumbar vertebral column (excluding the lumbosacral and thoracolumbar junctions) were dissected. After removing all the surrounding muscles, individual joints were dissected by either a medial or a lateral approach. The inferior or superior articular process was carefully resected, using a dental burr and leaving the articular cartilage intact. This was then gently dissected free of the joint capsule to expose the joint cavity and its contents. Observations were made of the disposition and form of any intra-articular structures which were then excised, together with their capsular connections, and processed for histological examination.

Histology

Specimens were embedded in paraffin, sectioned at 30 μm, stained with haematoxylin and eosin and examined under the light microscope.

Embryology

Studies were performed on the lumbar vertebral columns of three human embryos of 43, 125 and 240 mm (crown–rump length). The lumbar region of each specimen was embedded in paraffin, and sectioned along transverse or sagittal planes at 7 μm, stained with haematoxylin and eosin, and examined under the light microscope. Four joints from each of the 43 and 240 mm (crown–rump) specimens and three from the 125 mm (crown–rump) specimen were studied.

* Reprint requests to Dr N. Bogduk, Department of Anatomy, University of Queensland, St Lucia 4067, Australia.

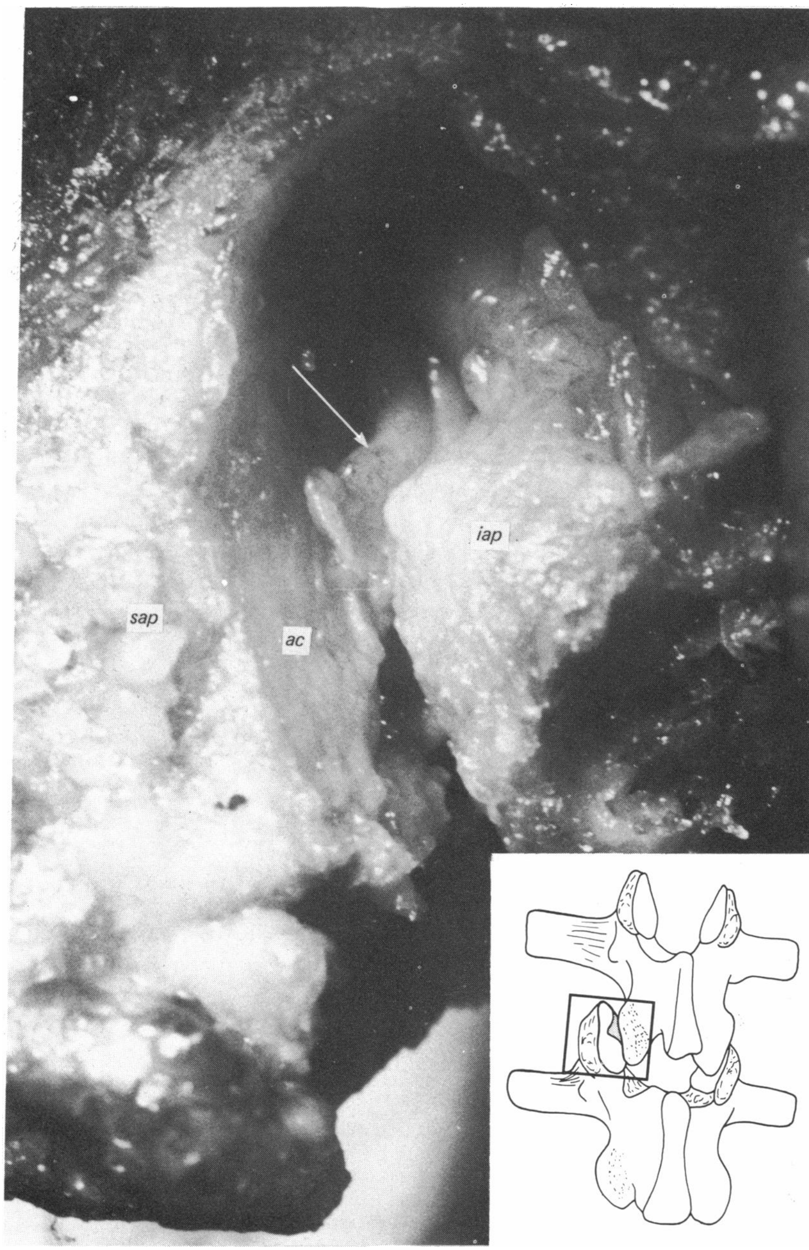

Fig. 1. An adipose tissue pad (arrowed), situated, as shown in the inset, at the superoventral pole of a left L2–3 zygapophysial joint, viewed from behind. *sap*, superior articular process; *iap*, inferior articular process; *ac*, articular cartilage.

RESULTS

On the basis of histological composition and disposition within the joint, three types of intra-articular structure were identified in the adult material of the present study. At least one type of structure was represented in every one of the 82 joints studied. Forty seven joints contained more than one type. The three types of structure were an adipose tissue pad, a fibro-adipose meniscoid, and a connective tissue rim.

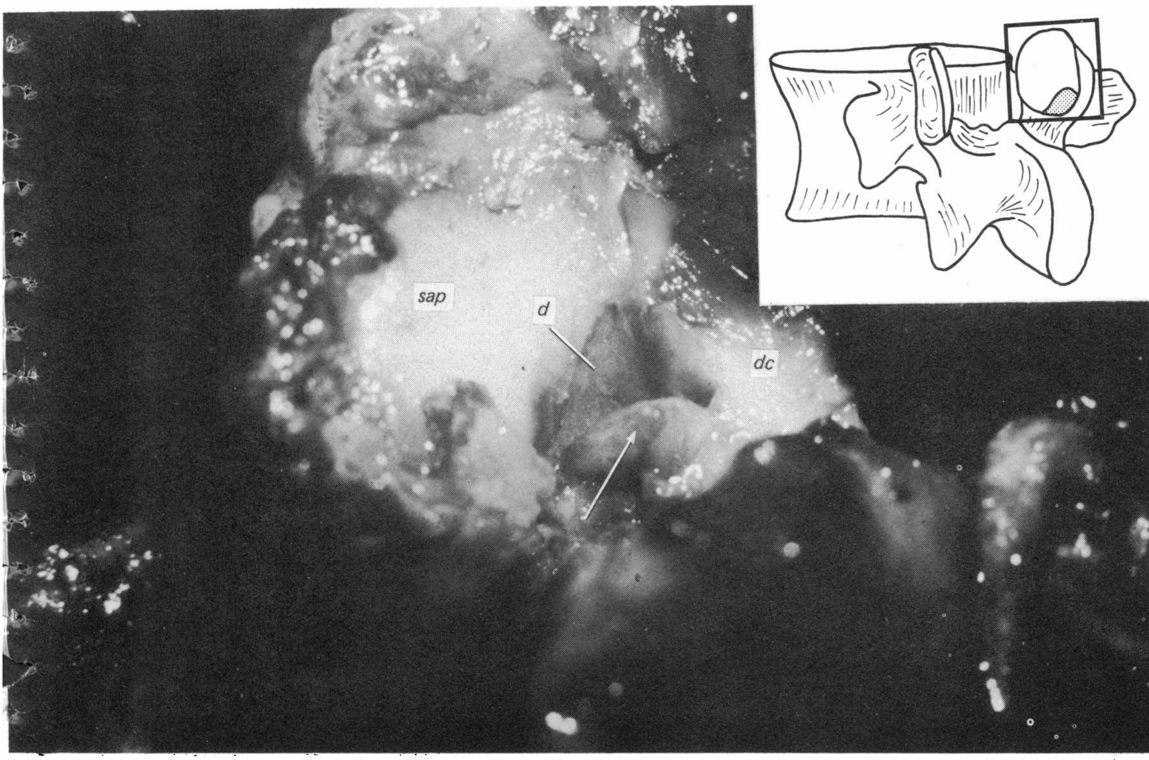

Fig. 2. An adipose tissue pad (arrowed) viewed from its medial aspect and situated, as shown in the inset, at the inferodorsal pole of a right L3–4 zygapophysial joint. The L3 inferior articular process has been resected entirely to reveal the pad which has been retracted from the L4 superior articular process (*sap*), leaving a shallow depression (*d*) in the articular cartilage, formed by the pad. *dc*, dorsal capsule.

Adipose tissue pads

Adipose tissue pads occurred in 72 (88%) of the joints, and were located at either the superoventral or inferodorsal pole. A single superoventral pad occurred in 13 (18%), and an inferodorsal pad in 18 (25%) of the 72 joints, while in 41 (57%) joints, both superoventral and inferodorsal pads were present.

The adipose tissue pads were papilliform in shape with a wide base attached to the joint capsule peripherally. Each tapered to a rounded free border centrally within the joint cavity (Figs. 1, 2). They varied in size. Some occupied only the space bounded by the joint capsule and the perimeter of the articular cartilages, while others projected up to 2·5 mm into the joint cavity, between the articular cartilages. Each was soft in consistency and yellow in colour, when obtained post mortem.

Microscopically, these adipose tissue pads were composed of adipose tissue (which formed the bulk of the structure), loose connective tissue and blood vessels. At the periphery of the pad its adipose core was surrounded by layers of collagen lamellae which supported blood vessels and provided attachment to the joint capsule. Internally, connective tissue septa subdivided the adipose tissue into lobules, but, towards the free border, the septa diminished to leave a single mass of adipose tissue, still surrounded by the outer connective tissue and its associated blood vessels.

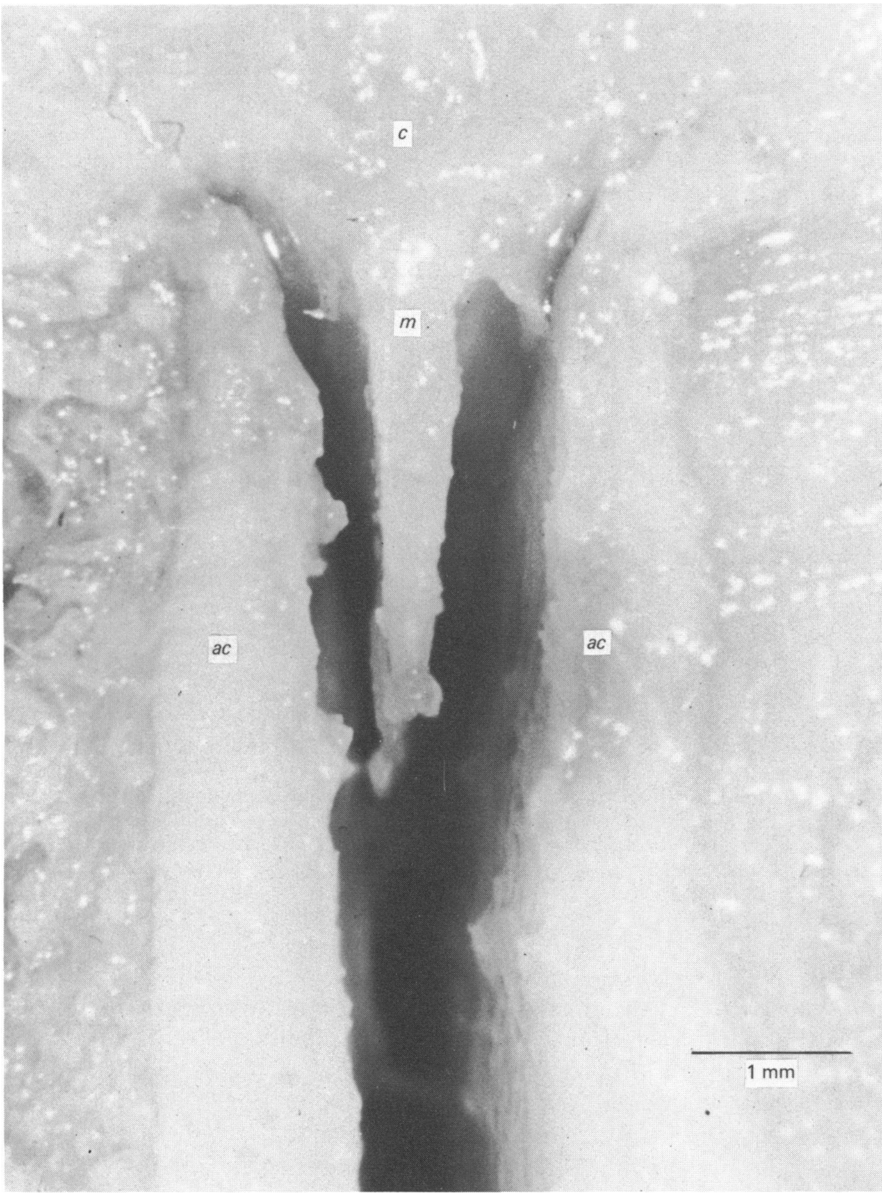

Fig. 3. Close-up view of a microscopic coronal section through a lumbar zygapophysial joint revealing a linguiform fibro-adipose meniscoid (*m*) projecting into the joint cavity from the rostral joint capsule (*C*). *ac*, articular cartilage.

The entire surface of each pad was lined by synovial membrane of the adipose (cell-rich) type.

Fibro-adipose meniscoids

Fibro-adipose meniscoids occurred in 44 (54%) joints. They were located at the superior pole in 23 (52%), at the inferior pole in 10 (23%) and at both poles in 11 (25%).

They varied in outline. Some were linguiform while others were more crescentic

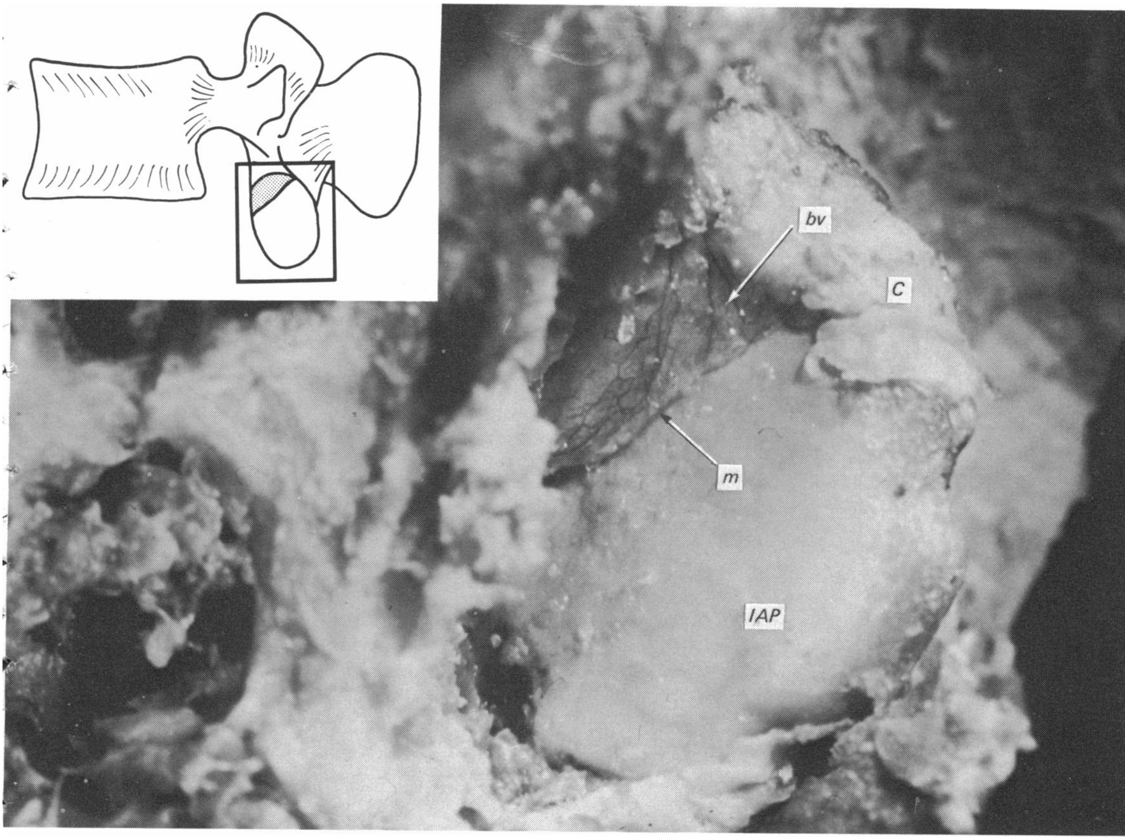

Fig. 4. A lateral view of a crescentic fibro-adipose meniscoid (*m*), situated as shown in the inset, at the superoventral pole of a left L3–4 zygopophysial joint. The superior articular process has been resected to reveal the meniscoid. Blood vessels (*bv*) were apparent on its surface. *IAP*, inferior articular process; *C*, joint capsule.

(Figs. 3, 4). Each had a thick base which attached to the joint capsule peripherally, and tapered to a thinner free border centrally, within the joint. They extended between the articular surfaces for variable distances, ranging from 3 to 4 mm. They were firm in consistency and blood vessels were frequently visible on their surface (Fig. 4).

Microscopically, fibro-adipose meniscoids were composed of adipose tissue, loose tissue and dense connective tissue and blood vessels. The base consisted of an adipose tissue core which was covered and interspersed with bundles of collagen fibres which radiated out of the joint capsule. Blood vessels running parallel to the capsule were abundant in the base. In the middle portion of the meniscoid, adipose tissue persisted but blood vessels and the internal connective tissue diminished, while the connective tissue covering the structure increased in thickness. Adipose tissue was lacking in the apical portion of the meniscoid, which was made up entirely of connective tissue. The superficial connective tissue of the apex was orientated perpendicular to its surface while the deeper connective tissue was unorientated. Overall, each fibro-adipose meniscoid had the appearance of being a flattened conical fibrous cap mounted on an adipose tissue base (Fig. 5). Each meniscoid was covered throughout by synovial membrane which varied in type. The basal region was covered by either an adipose

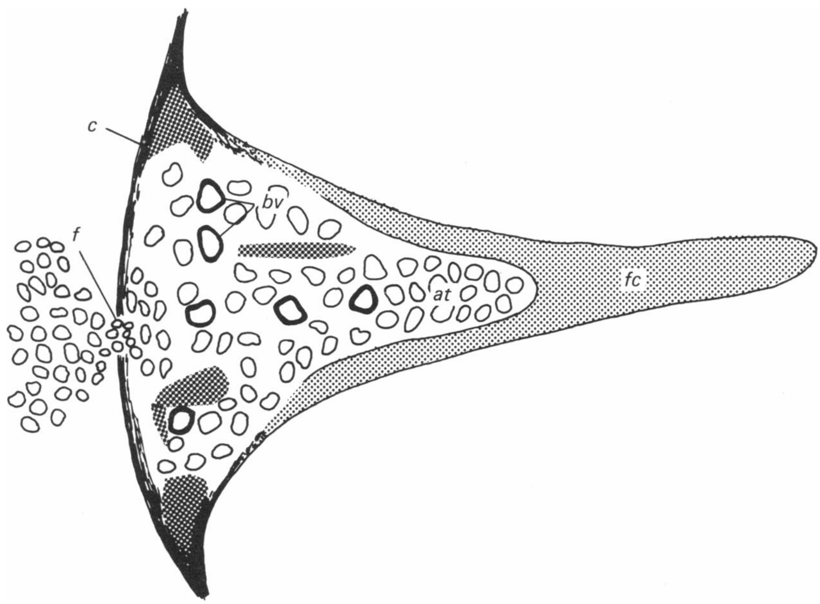

Fig. 5. Diagrammatic summary of the structure of fibro-adipose meniscoids. Each consisted of an adipose tissue (*at*) base, crowned with a flattened fibrous cap (*fc*). Both the cap and base were continuous with the joint capsule (*c*), and blood vessels (*bv*) were abundant in the base. In 27% of specimens a penduncculated extension of the basal adipose tissue was observed to pass out of the joint through a foramen (*f*) in the joint capsule.

(cell-rich) or a fibrous (cell-poor) synovium while the apical region was covered by fibrous synovium.

Twenty seven per cent of the fibro-adipose meniscoids examined demonstrated extracapsular extensions. The basal adipose tissue formed a peduncle which communicated with the pericapsular fat by way of a foramen in the joint capsule (Fig. 5). Such foramina are normal features of the lumbar zygapophysial joints, being found at both the rostral and caudal poles of the joint.

Connective tissue rims

Connective tissue rims occurred in 16 (20%) joints. They were located at the dorsal border in 3 (19%), at the ventral border in 3 (19%) and occurred at both borders in 10 (62%) of these joints.

Connective tissue rims extended along the entire dorsal or ventral border, assuming the curved contour of the margin of the joint. They were thick (2 mm) at their base which blended with the joint capsule, but tapered rapidly, within 0·5–1·0 mm, to a thinner border centrally, within the joint. They did not enter between the articular cartilages but rather filled the wedge shaped space between the capsule and the margin of the joint.

Microscopically, each consisted of connective tissue, blood vessels and synovial membrane. The connective tissue was a continuation of the capsular fibrous tissue, and it appeared to be little more than an invagination or internal thickening of the joint capsule. Blood vessels were randomly dispersed within the structure.

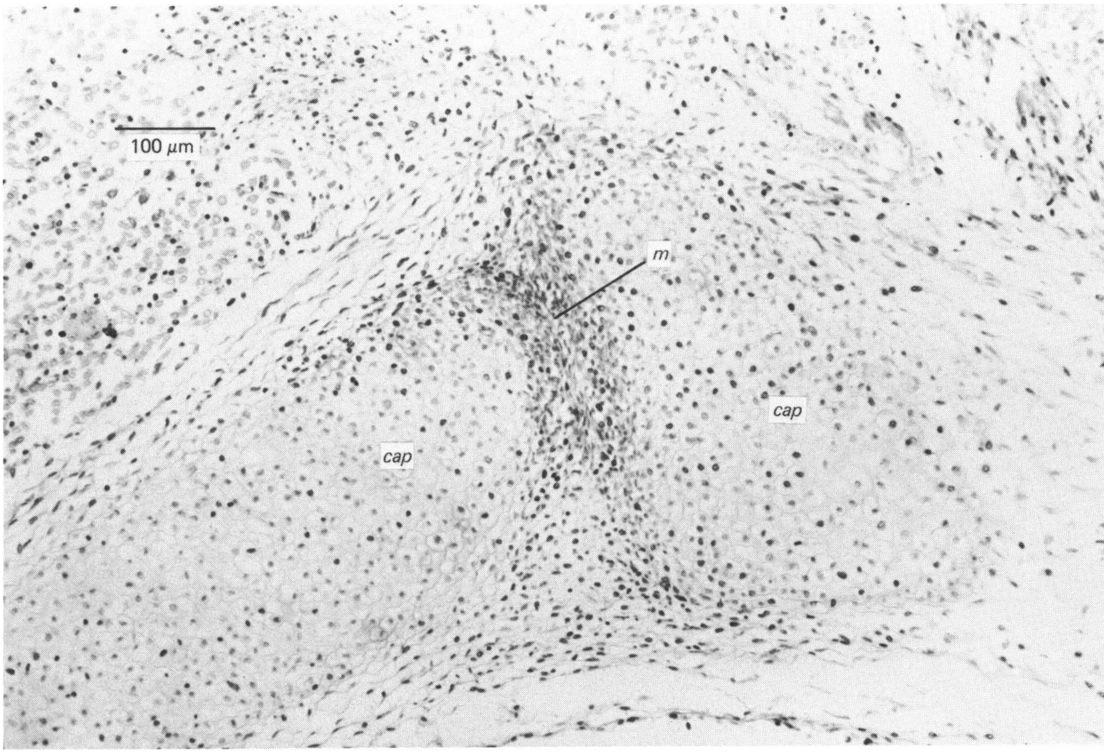

Fig. 6. The appearance of a lumbar zygapophysial joint in a 43 mm crown–rump embryo. Primitive chondral articular processes (*cap*) are separated by undifferentiated mesenchyme (*m*) which fills the future joint cavity.

Simultaneous occurrence of intra-articular structures

Intra-articular structures of the three types described above occurred simultaneously in various combinations in 47 of the joints studied. Within the joint they were spatially arranged in the following way: connective tissue rims ran along the dorsal or ventral perimeter of the joint and their ends extended up to the base of any polar structures and blended with them. When an adipose tissue pad and a fibro-adipose meniscoid occurred simultaneously at the superior pole, the adipose tissue was situated slightly more ventrally than the fibro-adipose meniscoid. Conversely, at the inferior pole it was situated more dorsally. At either pole adipose tissue pads and fibro-adipose meniscoids were substantially separate but their bases were connected by a short bridge similar in thickness to the connective tissue rim (see Fig. 9D).

Intra-articular plate

Two of the joints studied demonstrated an unusual feature. One joint from a 22 years old male and another from a 33 years old female possessed a complete plate separating their articular surfaces. The plate was thick, peripherally, where it attached to the joint capsule, but was thinner centrally. Its consistency was similar to that of the fibro-adipose meniscoid.

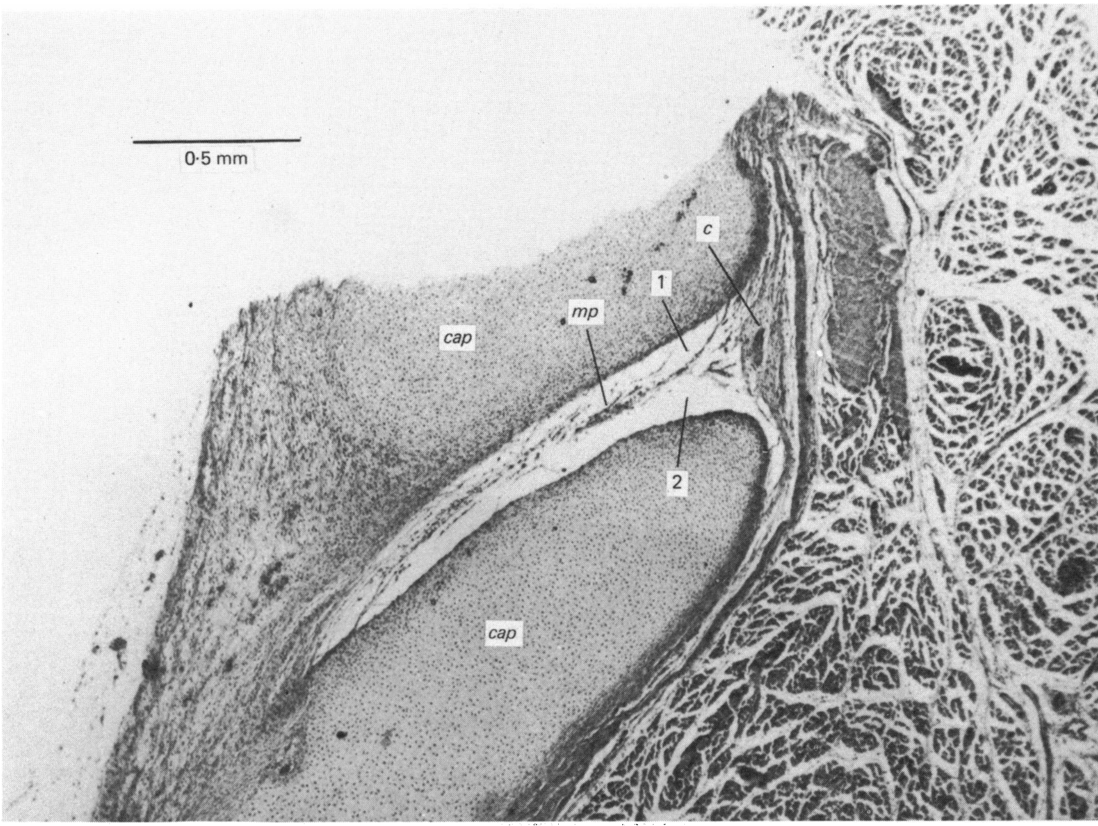

Fig. 7. A lumbar zygapophysial joint from a 125 mm crown–rump embryo in which a joint cavity separates the chondral articular processes (*cap*) but is subdivided into two spaces (1,2) by a mesenchymal plate (*mp*) extending across the joint from the primitive joint capsule (*c*). The mesenchymal plate was complete in all sections through the joint and therefore formed a complete intra-articular plate.

Correlations

The incidence of intra-articular structures was the same in all age groups studied (22–90 years) and it was not related to the presence of gross osteoarthrotic changes. Similarly, there was no higher incidence at any particular vertebral level or side. There was no difference in the relative incidence of any particular sub-type of structure in relation to age, level or side.

Embryology

In the embryonic joints observations were made of what appeared to be the precursors of the intra-articular structures found in the adult.

In the 43 mm crown–rump embryo, each zygapophysial joint appeared as a condensation of undifferentiated mesenchyme completely filling the space between the primitive chondral articular processes (Fig. 6). In the 125 mm crown–rump specimen, this mesenchyme formed a plate which stretched across the entire primitive joint cavity, dividing it into two halves. Peripherally the plate was continuous with the mesenchyme forming the joint capsule (Fig. 7). The joints of the 240 mm crown–rump embryo also contained mesenchymal plates but these did not span the entire joint. Each was composed of undifferentiated mesenchyme about three to four cells

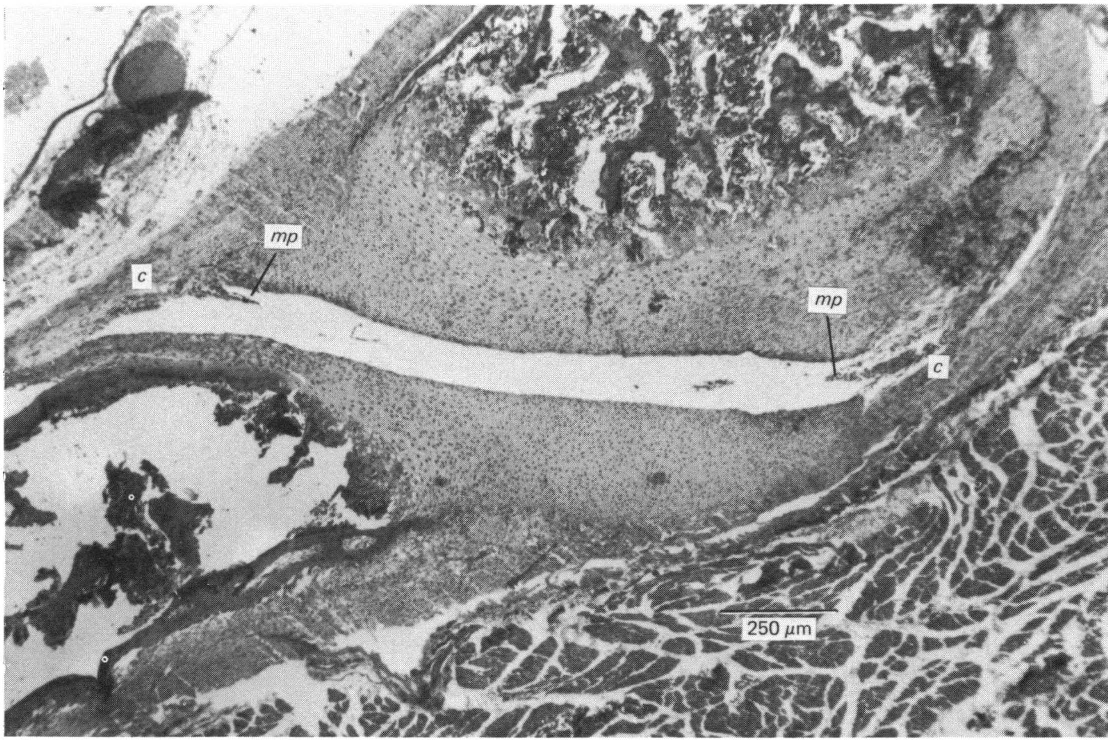

Fig. 8. A transverse section through the centre of a lumbar zygapophysial joint from a 240 mm crown–rump embryo. Peripherally, elements of a mesenchymal plate (*mp*) are seen projecting from the joint capsule (*c*), but the plate is deficient centrally.

in thickness, interspersed with blood vessels. Rather than a plate, each was like a washer in shape, with its peripheral edge blending with the capsular mesenchyme, but its central edge becoming attenuated to leave no mesenchyme in the central region of the joint cavity (Fig. 8). These incomplete plates resembled the complete plates of the 125 mm crown–rump embryo but had the appearance of having undergone attrition in their central portions. The remaining peripheral wedges occupied positions within the joint analogous to the location of the intra-articular structures seen in the adult.

DISCUSSION

The occurrence of intra-articular structures in the lumbar zygapophysial joints is not surprising. Similar structures occur in several other synovial joints in the body. Adipose tissue pads have been noted in the knee (Ham & Cormack, 1979), ankle joints (Grant, 1930) and other joints in the lower limb (Barnett, Davies & MacConaill, 1961). Meniscoid structures are known in the metacarpophalangeal joints and interphalangeal joints of the hands and feet (Santo, 1935), and true menisci occur in the temporomandibular, acromioclavicular, sternoclavicular, knee and radiocarpal joints. The fibro-adipose meniscoids found in the present study were referred to as meniscoids rather than menisci because histologically they more closely resemble a fibrous fat pad rather than the familar, fibrocartilaginous menisci of the temporomandibular joint or knee.

Intra-articular structures in adult lumbar zygapophysial joints have been described

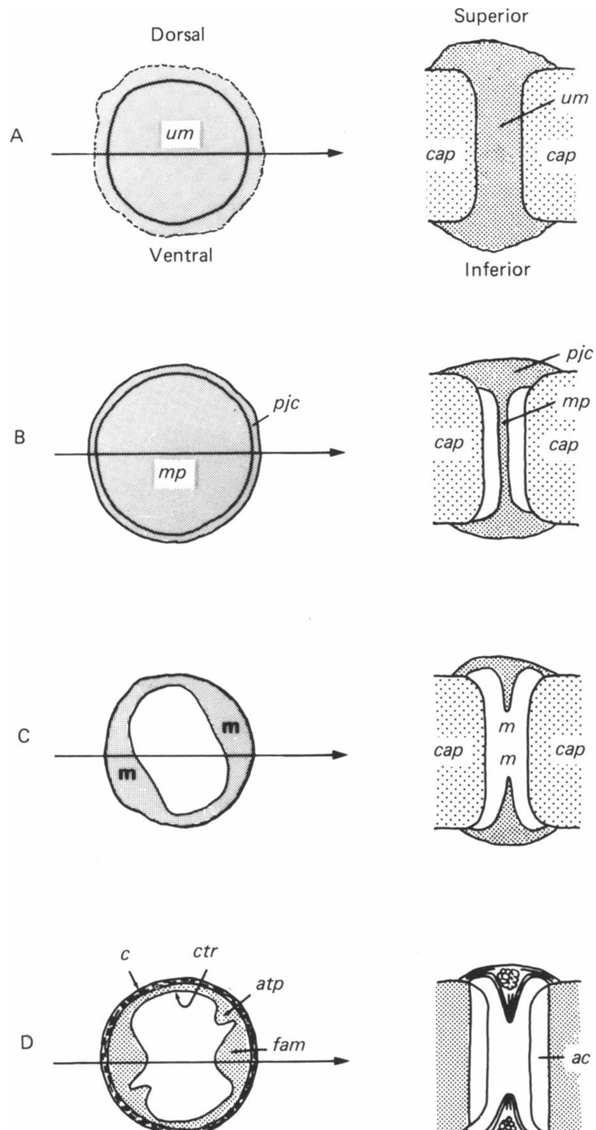

Fig. 9 (A–D). Schematic summary of the development of intra-articular structures in the lumbar zygapophysial joints. The left hand figures represent mediolateral views of the contents of the joint cavity. The right hand figures represent coronal sections of the joint along the plane shown by the arrow. (A) Primitive stage of development. Undifferentiated mesenchyme (*um*) fills the future joint cavity and separates the chondral articular processes (*cap*). (B) Early embryonic stage. A complete mesenchymal plate (*mp*) continuous with the primitive capsule (*pjc*), subdivides the joint cavity into two spaces. (C) Late embryonic stage. The central portion of the mesenchymal plate undergoes attrition, leaving primitive meniscoids (*m*) projecting into the joint cavity. The remaining mesenchyme forms the substrate for any future intra-articular structures and the extent of peripheral regression of the mesenchyme predicates the size of any future structure. Regression is maximal at the dorsal and ventral aspects of the joint, and least at the superior and inferior poles. (D). The adult state. The mesenchyme has differentiated to form the joint capsule (*c*) and connective tissue rims (*ctr*), adipose tissue pads (*atp*) and fibro-adipose meniscoids (*fcm*). All three forms of intra-articular structure may be present in the one joint and duplicated at the opposite pole, but one or more of the structures may be lacking. Presence or absence is predicated by the amount of mesenchymal precursor which has remained at particular locations in the joint. The histological composition of a given structure depends on the extent of differentiation of the mesenchymal precursor.

by several authors in the past. Töndury (1940, 1972) described synovio-adipose 'meniscoids' at the rostral and caudal poles of each joint. Similar structures were described by Penning & Töndury (1963). Zaccheo & Reale (1956) described three types of meniscus in each joint: a synovio-adipose 'foliform' meniscus, a 'linguiform' fibrous meniscus and an 'annular' fibrocartilaginous meniscus. Dörr (1958, 1962) also described three types of structures similar to those of Zaccheo & Reale (1956). De Marchi (1963) described structures in the cranial and caudal recesses of the joints which consisted of bodies of fat tapering into a connective tissue meniscus. Kos (1969) considered that the various types of menisci described in the literature were variants of an ideal tripartite meniscus which was composed of a peripheral base consisting of adipose tissue; a middle portion, formed by synovium, and a free border formed by dense fibrous tissue. A given meniscus could be composed of any combinations of these three basic parts.

Amongst the English language descriptions, Hadley (1961, 1964) stated that 'menisci' could be found in the upper and lower joint margins. They varied in form and were composed of adipose tissue, synovium, fibrous tissue, blood vessels and sometimes cartilage. Lewin, Moffett & Viidik (1962) felt that the synovio-adipose and fibrous menisci described by others were more strictly synovial reflections, while the 'annular' fibrocartilaginous menisci of Zaccheo & Reale (1956) represented the only true menisci in the lumbar zygapophysial joints.

There are several limitations to the interpretations given in this literature. The descriptions were often based on examination of the entire vertebral column and the various sub-types of meniscus described were frequently better developed in the cervical or thoracic zygapophysial joints. The specific incidence of various sub-types, and to what extent they were better or less well developed in the lumbar region, was not stated explicitly. Furthermore, whereas three sub-types of meniscus were described throughout the literature and even within certain single studies, the disposition of the multiple sub-types within a given joint was never described.

Notwithstanding these limitations, it is possible to correlate the three types of intra-articular structures found in the present study with various sub-types described by previous authors. Because of their distinctive position at the dorsal and ventral margins of the joint, the connective tissue rims of the present study clearly correspond to the annular fibrocartilaginous menisci of Zaccheo & Reale (1956). In the present study, however, these structures consisted predominantly of fibrous tissue. The cartilaginous core reported by Zaccheo & Reale was not observed. The reason for this difference probably lies in the fact that the cartilaginous menisci of Zaccheo & Reale were described as inconstant, and best developed in the thoracic region. They are therefore not usual features of lumbar zygapophysial joints. Because of their small size and intimate connection with the joint capsule, connective tissue rims probably do not represent true menisci, but are simply central projections of the joint capsule.

Connective tissue rims or fibrous menisci at the dorsal and ventral margins of the zygapophysial joints were not described by any other previous authors who referred only to structures at the cranial or caudal poles of the joint. Considering the literature as a whole, the various types of polar menisci which have been described range from synovial reflections, synovium covered fat pads, foliform synovio-adipose menisci, fibro-adipose meniscoids to purely fibrous menisci. The issue which arises is whether truly distinctive types of menisci occur at the poles or whether previous authors have simply described variants of a single fundamental type of structure. Although descriptions of polar menisci have varied between individual past studies with respect to microstructure and configuration, conspicuously, the same histological components are represented in each sub-type. Each previously described meniscus contained variable proportions of connective tissue, adipose tissue, blood vessels and synovium. That these tissues consistently occur in every type of polar meniscus suggests that what have been described are in fact variants of a single fundamental type of structure. Support for this contention lies in the embryological development of the lumbar zygapophysial joints.

In peripheral synovial joints, early in the chondral stage of their development, a mesenchymal condensation called the 'interzone' (Haines, 1947) or 'joint disc' (Whillis, 1940), fills the future joint cavity. This interzone later undergoes attrition (Barnett *et al.* 1961). A thin mesenchymal bridge may persist, dividing the joint space into two cavities, or the persisting mesenchyme may rupture at its middle, leaving incomplete plates at the periphery of the joint (Santo, 1935). This sequence of events was reflected in the present study of the embryological development of the lumbar zygapophysial joints even though only a small number of specimens was available for study. Nevertheless, an intra-articular plate of mesenchyme or interzone was observed and its apparent attrition noted. Similar observations have been made previously by Töndury (1972), Kos (1969), and Emminger (1972). The embryological development of the lumbar zygapophysial joints and their intra-articular components thus appears to be like that of peripheral synovial joints, particularly those of the hand (Santo, 1935).

The one feature common to all studies of the embryological development of the lumbar zygapophysial joints is that only one type of putative precursor has ever been observed for the three types of adult 'meniscus'. The lack of three types of embryonic meniscus indicates that all the adult forms are derived from the single embryonic intra-articular plate. In view of the common embryonic origin, it is suggested that the disparity in the literature describing the various polar menisci found in the adult can be resolved by adopting the following interpretation (Fig. 9).

Early in the chondral stage of development of the lumbar zygapophysial joints the joint cavity is filled by mesenchyme. As the joint cavity develops the mesenchyme persists to form an intra-articular plate which divides the future joint cavity into two halves. Rarely, the complete plate may persist into adult life, but most commonly the central portion of the plate disappears leaving a circumferential lip of mesenchyme projecting from the internal aspect of the future joint capsule. The peripheral mesenchyme then regresses to varying extents. The regression is maximal at the dorsal and ventral margins but is less complete at the rostral and caudal poles. The extent of the regression determines the size of any intra-articular structure which will develop from the remaining mesenchyme. The mesenchyme undergoes differentiation into fat, fibrous tissue and synovium and, depending on the extent of differentiation, intra-articular structures of varying histological composition may arise. The simplest are synovium-covered fat pads, or purely fibrous rims. The more elaborate are the fibro-adipose, synovium-covered structures. Whether more than one structure develops in a given joint depends on how much primitive mesenchyme persists as a substrate at particular locations within the joint, and the variations in the form and composition of intra-articular structures seen in the adult occur as a result of differing degrees of differentiation of this mesenchyme. What controls the extent of differentiation, however, is open for speculation. It may be an intrinsic property of the mesenchyme itself, or the differentiation may be secondary to mechanical factors.

Töndury (1940) argued that fatty meniscoids were degenerative forms of initially fibrous structures, but Lewin *et al*, (1962) negated this view with their observation that intra-articular fat pads occur in normal neonatal lumbar zygapophysial joints so that these fatty structures could not be due to degenerative changes. What appears more likely is that fibrous tissue arises in initially adipose structures as a result of mechanical stress.

Fibro-adipose meniscoids project well into the joint cavity and are located at the superior and inferior poles, i.e. along the principal line of movement of the joint. They are therefore exposed to compression between the articular surface and it is conceivable that they would undergo fibrous metaplasia secondary to this mechanical stress. This contention is supported by the occurrence of fibrous synovium over the apex as opposed to adipose type synovium at the base.

Adipose tissue pads, in contrast, are substantially located off the axis of movement and do not project as much between the articular surfaces. Hence, they would be less exposed to mechanical compression and be, therefore, less likely to undergo fibrosis.

Accordingly, one can hypothesise that, at the poles of the lumbar zygapophysial joints, primitive mesenchymal menisci undergo primary differentiation into fatty structures, as seen by Lewin *et al.* (1962) in neonates, and that fibrosis occurs subsequently, if particular structures are subject to mechanical stress. Otherwise they remain purely synovio-adipose structures.

The structure of adult fibro-adipose meniscoids is consistent with this view, because the basal region of these structures, which is not compressed by the articular surfaces, has a structure most similar to that of the simple adipose tissue pads. Only the compressed apex of fibro-adipose meniscoids appears to have undergone fibrosis, producing a fibrous cap on the adipose base.

In summary, the interpretation submitted is that the polar intra-articular structures which occur in the adult are derived from a single mesenchymal precursor. This differentiates into synovio-adipose structures which, if exposed to mechanical stress, subsequently undergo fibrosis. The various types of structures seen in the adult, and described in the literature can thus be accounted for by variations, in the amount of mesenchymal substrate present at various locations in the joint, in the extent of its differentiation, and in the extent to which it undergoes secondary fibrosis.

Regardless of their origin, the presence of intra-articular structures in the lumbar zygapophysial joints has attracted speculation as to their functional significance. Töndury (1972) suggested that they reduced the incongruity of the articular surfaces. Zaccheo & Reale (1956) suggested that they permitted stability of the joint and harmony of movement. Lewin *et al.* (1962) felt that the polar fat pads acted as an "easily displaceable space filler which facilitates rather than restricts movement of the joint processes". With regard to the dorsal and ventral menisci, they felt that their primary function was to provide greater stability and to help distribute the load over a greater articular area. Töndury (1940) and Dörr (1958) suggested that intra-articular fat pads may moderate the load of the joint processes.

The present data did not permit any further elaboration of the functional significance of any intra-articular structures in the lumbar zygapophysial joints. However, the fact that they are regularly present in joints of all ages suggests that they must play some form of normal functional role. One feature of the joints, not referred to by previous authors, is that during normal movement they undergo a substantial degree of subluxation. The role of the polar intra-articular structures may perhaps be correlated to this subluxation. It may be that they are involved in protecting or lubricating the exposed, subluxated articular process during flexion or extension.

The clinical significance of the 'menisci' of the lumbar zygapophysial joints relates to the meniscus entrapment theory which was elaborated by Kos & Wolf (1972*a*, *b*, *c*). These authors submitted that menisci with fibrous apices, when interposed between articular processes, could deform the articular cartilage, thereby creating a recess in which the apex could become trapped. Entrapment of the apex would then cause traction on the capsule and this capsular strain in turn would be a cause of pain and muscle spasm which restricted any attempted movement.

This entrapment theory requires a meniscus of a particular form, namely a base which is firmly attached to the capsule, a fibrous apex sufficiently firm to be capable of deforming articular cartilage and being entrapped, and a middle portion capable of transmitting traction from the apex to the capsule. None of the 'menisci' observed in the present study conformed to this ideal. Connective tissue rims were far too short and stunted to be capable of being trapped inside the joint. Moreover, the tautness of the dorsal and ventral capsules and the protective functions of the multifidus muscle and ligamentum flavum would prevent entrapment of any dorsal and ventral menisci. The adipose tissue pads were too soft and pliable to be capable of deforming articular cartilage, and thus would not be liable to entrapment. The fibro-adipose meniscoids had a firm fibrous apex which certainly could be expected to deform articular cartilage and to be trapped in any so formed recess. However, the central portion of these structures was predominantly adipose tissue with little connective tissue connecting the apex to the base. Therefore, if the apex became trapped, rather than transmit any traction to the base and capsule, it would appear more likely that this middle portion would cleave or rupture. This would result in a loose body formed by the detached apex rather than any sustained capsular traction.

If meniscus entrapment does occur clinically, then it would do so only in the presence of a meniscus with a substantially fibrous middle portion, capable of transmitting traction to the capsule. The present data indicate that such menisci occur uncommonly, if at all. This contrasts with the high incidence of 'acute locked back' which suggests that some other mechanism must be responsible for this syndrome. The inconsistency between the present morphological data and the proposed mechanics of the meniscus entrapment theory suggest that to date this theory may have been overstated.

SUMMARY

In a study of 82 lumbar zygapophysial joints three types of intra-articular structures were identified. They were adipose tissue pads and fibro-adipose meniscoids, both located at the superior and inferior poles of the joint, and connective tissue rims, located along the dorsal and ventral margins.

Every lumbar zygapophysial joint contained at least one of these structures and 47 contained more than one type.

Connective tissue rims are short, central projections of the joint capsule and do not enter between the articular surfaces.

Adipose tissue pads are covered by synovium and fill the subcapsular space at the superoventral and inferodorsal poles of the joint.

Fibro-adipose meniscoids, also covered by synovium, project from the joint capsule at the superior and inferior poles and enter between the articular surfaces.

Adipose tissue pads and fibro-adipose meniscoids are probably derived from a

common primitive mesenchymal meniscus which primarily differentiates into a fatty structure. The fibrous component of fibro-adipose meniscoids then secondarily develops as a result of compression of the tip of the fatty structure between the articular surfaces.

The function of these intra-articular structures is not evident but may be related to protection of the articular processes as they subluxate during flexion and extension.

Meniscus entrapment in the lumbar zygapophysial joints has been proposed as a cause of acute locked back, but the present morphological data are inconsistent with this view.

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