FROM THE DEPARTMENT OF ORTHOPAEDICS AND SURGICAL TUBERCULOSIS, ST. GÖRAN'S HOSPITAL, STOCKHOLM.
(HEAD, DOCENT S. ORELL, M.D.)

SOME CASES OF PARADISCAL DEFECTS IN THE ANTERIOR PORTION OF THE VERTEBRAL BODY, WITH REMARKS ON THE PATHOGENESIS OF THE LESIONS IN QUESTION

BY

ARVID HELLSTADIUS

Especially of late, my attention has been focussed upon a number of homologous cases where the skiagrams show defects situated in the anterior portion of the vertebral body adjacent to the intervertebral disc. Since comparatively little attention seems to have been given to lesions of this type, and since there is a difference of opinion regarding their origination, I have collected some cases of this kind, mainly with the object of discussing the aetiology and pathogenesis of the changes on the basis of observations made in these patients.

CASE 1.—Boy aged 16. Fell down while skiing in March, 1946, and struck the lower part of his back against a stone. Afterwards felt pain in the back, which gradually extended to the right thigh. Examination on 7/6/46: Small gibbus in the upper part of the lumbar spine. Considerable rigidity of the entire dorsum. Lasègue's sign positive at 15 degrees right and at 30 degrees, left. X-ray findings on 9/8/46: In the anterior lower portion of the first lumbar vertebra a paradiscal area of rarefaction in the vertebral body immediately behind the anterior lower angle. The lesion is separated from the surrounding substance of the vertebral body by a fairly broad sclerotic zone. The adjacent intervertebral disc is not flattened (Fig. 1).

CASE 2.—Man aged 22. Since the autumn of 1936 had felt pain in the posterior part of the right thigh. Examination on 17/3/37: Back soft and flexible. X-ray findings on 18/3/37: In the upper portion of the third lumbar vertebra, a short distance behind the anterior angle, a circular

defect situated paradiscally in the vertebral body and extending back almost to the centre of the latter. This area is separated from the surrounding substance of the vertebral body by a fairly broad sclerotic zone. The intervertebral disc is somewhat flattened. The extreme eminence of

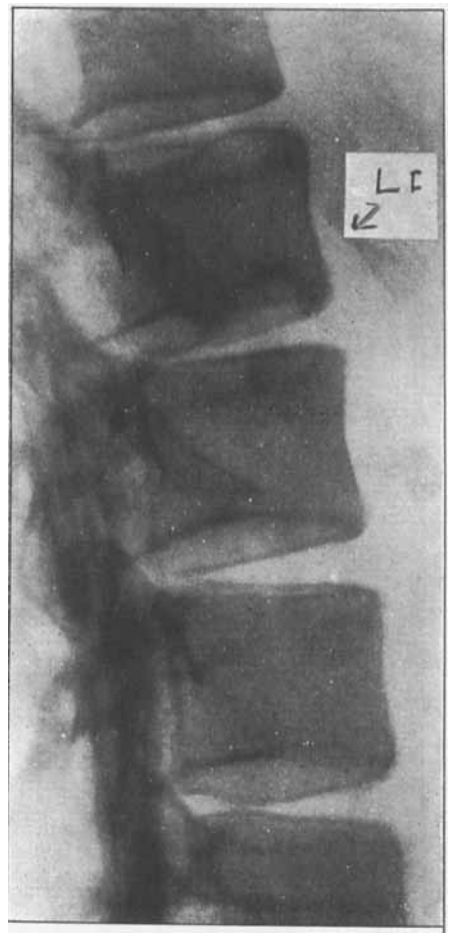

Fig. 1.

the anterior lower angle is lacking in the second lumbar vertebra. Slight gibbus formation between the two vertebrae. X-ray examination on 23/4/38 discloses the same changes as on 18/3/37(Fig. 2).

CASE 3.—Woman aged 31. Had since 1938 suffered periodically from symptoms of dorsal insufficiency in the lumbar region. Examination on

12/8/43: Lumbar spine rather rigid to movements. X-ray findings on 12/8/43: In the upper portion of the twelfth thoracic vertebra a defect in the paradiscal part of the vertebral body immediately behind the anterior angle. The defect is broadest in front, tapering off towards the

Fig. 2.

back. It is delineated by a sclerotic zone. The adjacent intervertebral disc is not flattened.

CASE 4.—Boy aged 13. Had for a year experienced pain in the back when stooping. Examination on 30/4/45: In the lumbar region, slight rigidity to movements. Mantoux test, negative to 1 mg. X-ray findings

on 5/5/45: In the anterior lower paradiscal portion of the first lumbar vertebra a defect, broadest towards the front and tapering off behind. In the adjacent anterior angle an apophysial nucleus in the normal position. The delineation of the defect is somewhat indistinct. The upper outline of the second lumbar vertebra is blurred and rough within an area directly opposite the defect. The intervertebral space between the

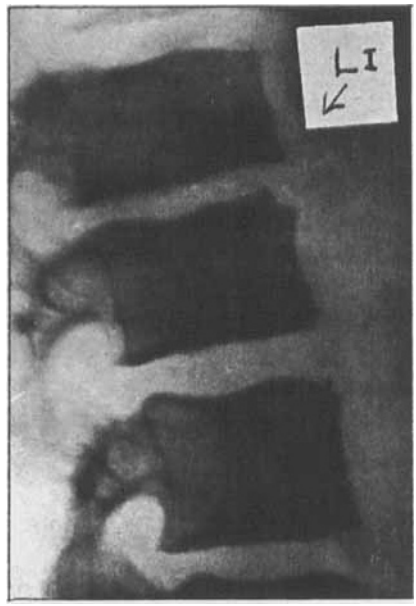

Fig. 3.

first and second lumbar vertebrae is depressed, particularly towards the front, a slight gibbus having developed in consequence. Radiographs taken on 11/6, 10/8 and 18/12/45 reveral the same changes as on 5/5/45, except for the apophysial nucleus being somewhat larger in size (Fig. 3). X-ray findings on 4/6/46: The apophysis has now united with the vertebral body, the definite anterior angle thus being formed. Immediately behind this the paradiscal defect with moderate marginal sclerotization is visible. The changes extend forward on to the anterior outline of the vertebral body above its lower anterior angle. The intervertebral disc between the first and second lumbar vertebrae is flattened.

CASE 5.—Boy aged 9. Early in June, 1945, a playmate jumped up on the patient's back. The patient felt as if "something gave way" in the

back, afterwards complaining of dorsal pain. Examination on 15/10/45: In the upper part of the lumbar region a very small gibbus. Lumbar spine rigid to movements. Mantoux test, positive (has been inoculated with BCG). X-ray findings on 15/10/45: In the lumbar and lower thoracic

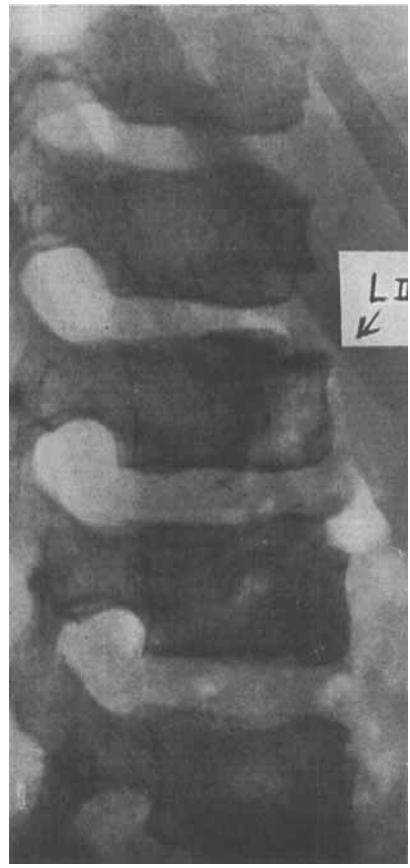

Fig. 4.

spine, in several of the vertebrae stair-like indentations, typical for the patient's age, in the anterior angles of the vertebral bodies. In the upper anterior angle of the second lumbar vertebra the defect in the vertebral body is more extensive than in other vertebrae, viz. extending farther back into the vertebral body. The defect is separated from the surrounding substance of the vertebral body by a distinct, fairly broad sclerotic zone.

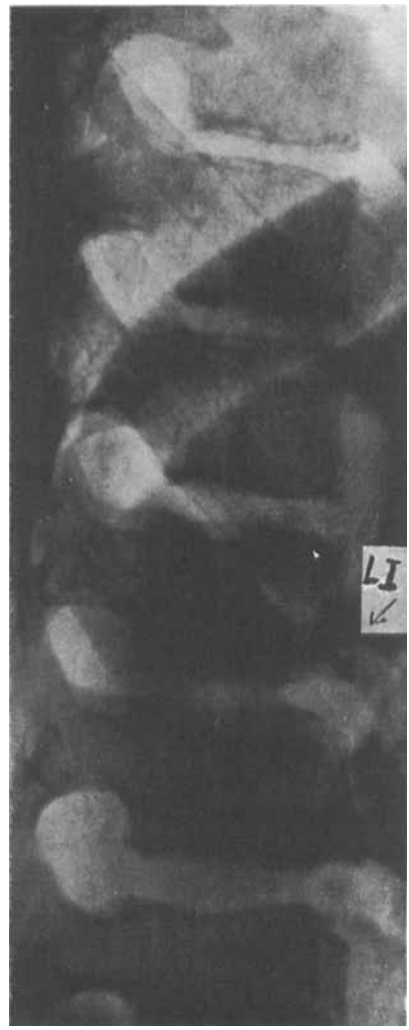

Fig. 5.

The intervertebral disc between the first and second lumbar vertebrae is flattened in the anterior and middle portion, so that slight gibbus formation has occurred (Fig. 4). A radiograph taken on 30/1/47 shows the same changes as on 15/10/45.

CASE 6.—Girl aged 11. Fell from a sledge in February, 1946, and has subsequently complained periodically of pain in the lumbar region.

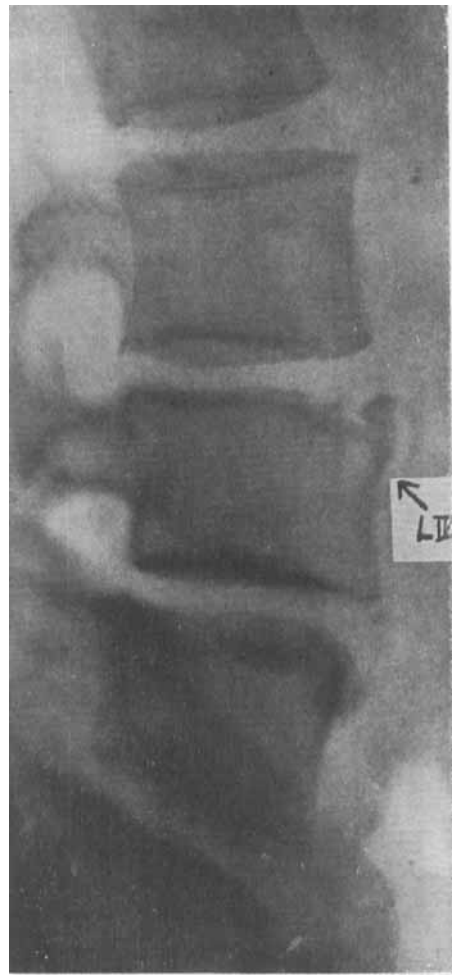

Fig. 6.

Examination on 20/6/46: Lumbar lordosis reduced, with slight scoliosis with convexity to the left. Lumbar area soft and flexible. X-ray findings on 20/6/46: In several of the lumbar and lower thoracic vertebrae, stair-like or slanting indentations in the anterior angles of the vertebral bodies, typical for the patient's age, with apophyses still unconnected with the vertebral body. In the lower anterior angle of the first lumbar vertebra an oblique indentation larger than those in the remaining vertebrae, i.e. extending farther back into the vertebral body. This indentation contains

an apophysial nucleus, which is not situated where the anterior angle normally develops, being instead somewhat deflected towards the vertebral body. The intervertebral disc between the first and second lumbar vertebrae is slightly flattened, especially within its anterior portion. In the lower anterior angle of the second lumbar vertebra the apophysis has united with the vertebral body, and immediately behind the anterior

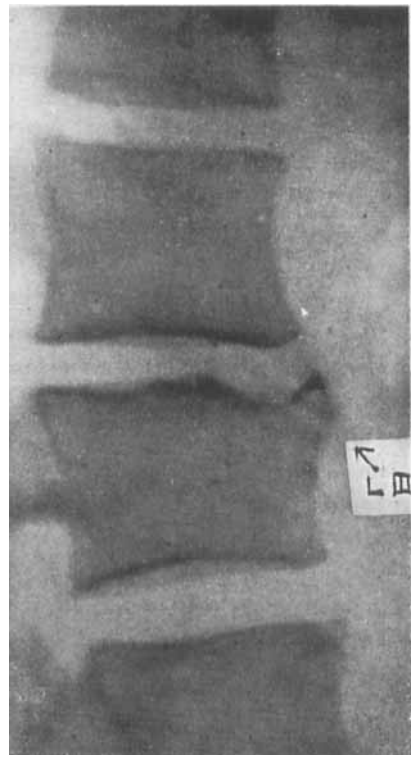

Fig. 7.

angle of the vertebral body thus formed, there is a minor anterior paradiscal defect. X-ray findings on 22/11/46: Changes nearly identical with those in the preceding skiagram, yet the apophysial nucleus in the lower anterior angle of the first lumbar vertebra has increased in size, thus being considerably larger than the other apophysial nuclei (Fig. 5).

CASE 7.—Man aged 57. Dorsal distress for several years. Examination on 21/8/46: Lumbar musculature rigid. X-ray findings on 2/9/46: In the upper anterior portion of the fourth lumbar vertebra a paradiscal

defect, bordering in front on a so-called persisting apophysis. The paradiscal defect merges into the narrow, cleft-like fissure between the so-called persisting apophysis and the actual vertebral body. It is enclosed in a fairly broad sclerotic zone. The adjacent intervertebral disc is not flattened (Fig. 6).

CASE 8.—Man aged 41. Reporting for symptoms of dorsal insufficiency. X-ray findings on 23/10/40: In the paradiscal upper anterior portion of the third lumbar vertebra a defect, enclosed in a fairly broad sclerotic zone and bordering in front on a so-called persisting apophysis. The paradiscal defect merges into the narrow, cleft-like passage separating the so-called persisting apophysis from the actual vertebral body (Fig. 7).

In the cases recorded above, the paradiscal defects in the anterior portion of the vertebral body were rather uniform in radiographic appearance. There was a broad open communication between the defect and the adjacent intervertebral space. The defects were discrete and often separated from the substance of the vertebral body by a fairly broad sclerotic zone. As a rule they were broadest in front, tapering off towards the back. In children, showing the characteristic stair-like or slanting indentations in the anterior angles of the vertebral bodies in which apophysial nuclei have developed or are about to develop, the anterior paradiscal defects manifested themselves largely as dorsal extensions of those indentations (Figs. 4 and 5). The apophysial nucleus subsequently uniting with the angle of the vertebral body, a normal anterior angle may be formed, with an anterior paradiscal defect situated immediately behind the angle. In several of the instances the adjacent intervertebral space was appreciably depressed, sometimes most markedly towards the front, so that slight gibbus formation had occurred. In other cases, however, such a depression was absent. Wherever a depression of the intervertebral space was noted, it was of moderate degree.

Two of the instances (Cases 7 and 8) differed from the remaining in simultaneously showing a so-called persisting apophysis in the adjacent angle of the body of the affected vertebra. In these cases the anterior paradiscal defect merged into the narrow, cleft-like passage separating the so-called persisting

apophysis from the actual vertebral body (Figs. 6 and 7). The former constitutes the frontal border of the anterior paradiscal defect. The fact that the anterior paradiscal defect is connected with the narrow, linear space separating the so-called persisting apophysis from the vertebral body plainly manifests the aetiologic and pathogenetic interrelation between the persisting apophysis and the anterior paradiscal defect in these cases. For this reason, in my discussion of the aetiology and pathogenesis, I propose to consider first the other type of paradiscal defects, i.e. those not associated with so-called persisting apophyses.

Several of the patients examined had been referred to the department with a diagnosis of suspect tuberculous spondylitis. In none of the cases could any evidence be obtained to support this conception. The fact *inter alia* that never any advance of the changes was demonstrable is adverse to a diagnosis of tuberculosis. Several of the cases were followed up with repeated radiographs for considerable periods of time (ranging from a couple of months to more than a year), without in any case an extension of the process being noted. A paradiscal focus of tuberculous caseation at this site and with a broad open communication entering the intervertebral disc is usually expected to advance in such a way that at least the intervertebral disc is completely or for the most part destroyed. In the above cases, there was either none at all or only a moderate depression of the intervertebral space. In addition, one of the patients was tuberculin-negative.

The paper by Puig Gury, "Pyogenetic osteomyelitis of the spine", contains *inter alia* two skiagraphs showing changes resembling those observed in my cases. In his opinion, the lesions are due to septic spondylitis. However, since no details are given of the cases, it is impossible to form an idea as to how definitely the diagnosis had been established. The radiographic appearance of the paradiscal defects here under discussion is admittedly often more similar to lesions of septic spondylitis than to those of tuberculosis. In cases of septic foci in the vertebral body adjacent to the vertebral disc, the latter is as a rule relatively uninjured as compared with the changes entailed

by tuberculous spondylitis. Yet in my cases there were no histories of any infective conditions whatever prior to the dorsal distress. Hence, septic and infectious spondylitis can be ruled out.

R. Hanson in his treatise, "Diseased conditions of the vertebrae", *inter alia* describes a case with, according to the X-ray films reproduced (Figs. XVI and XVII), changes similar to those in my own cases. He regards a local disturbance of the ossification as the causal factor. The longitudinal growth of the vertebral bodies takes place at the site, where the cartilaginous terminal plate touches the vertebral body. Here an enchondral ossification occurs in the same way as between the epiphysial cartilage and the metaphysis of the long bones. Thus, a local inhibition of the process of ossification in a spot within the anterior portion of the vertebral body would result in anterior paradiscal defects in the X-ray shadow of the vertebral body. This explanation fails, however, to account for the flattening of the adjacent disc, which is noted in some of the cases. It is difficult to conceive that local inhibition of the ossification within the vertebral body should simultaneously produce flattening of the intervertebral disc.

Further, the question should possibly be considered whether congenital malformation might play a part in the origination of anterior paradiscal defects. The deformity in question might arise during the differentiation of the cartilaginous spine into vertebrae and intervertebral discs, by the tissue forming the disc then being partly displaced into the anterior paradiscal portion of a vertebral body. This assumption would also serve to explain the flattening of the adjacent part of the intervertebral disc accompanying the somewhat larger paradiscal defects. *Inter alia,* developmental anomalies of this type are described in Schmorl's text-book, "*Die gesunde und kranke Wirbelsäule im Röntgenbild*", but these involve only the middle and posterior portions of the vertebral body. They are interpreted as persisting remnants of the notochord, a residue of which in the intervertebral disc is the nucleus pulposus. As far as I was able to ascertain from the literature, no developmental anomalies

of this type have been found on autopsy to affect the anterior portion of the vertebral body.

In publications both by Overgaard and Brocker, there are *inter alia* some figures illustrating anterior paradiscal defects without other changes in the vertebral bodies, i.e. corresponding with my observations. Both authors interpret the lesions as Schmorl's "*Knorpelknötchen*". The anterior paradiscal defects obviously have certain features in common with Schmorl's "*Knorpelknötchen*". Like these they are situated within the portion of the vertebral body adjacent to the intervertebral disc, and their often sclerotic, fairly broad marginal zone closely resembles that to be found in "*Knorpelknötchen*". The latter, however, are derived from the nucleus pulposus and are confined to the middle or posterior portions of the vertebral body, even though they may spread somewhat excentrically from the site of the nucleus pulposus. The lesions observed in my cases involved the anterior part of the vertebral body and, while sometimes extending as far back as into the median portion, yet were broadest in front and narrower towards the back. Hence, they could hardly have been due to a protrusion of the nucleus pulposus into the vertebral body.

At least in some of the cases, the anterior paradiscal defects resemble changes sometimes resulting from fractures of the vertebral body, i.e. changes caused by traumatic displacement of disc tissue (not only of the nucleus pulposus but also of the annulus fibrosus) into the vertebral body. The volume of the tissue thus displaced in cases of fracture of the vertebral body is often considerable. On the other hand, it may be comparatively small, and then the lesions can be closely similar to the anterior paradiscal defects here under discussion.

Consequently, the conception readily suggests itself that quite a slight compression fracture might be the causal factor, with exclusively local compression within the paradiscal anterior portion of the vertebral body, and not injuring the anterior angle and the remaining part of the vertebra. 3 of my patients (Cases 1, 5 and 6) gave a history of trauma, admittedly not of a particularly severe one, but still introducing the development of the

dorsal distress. The other patients did not blame their symptoms on to injuries, and there is thus no evidence in the latter cases as to the lesions being due to a sudden impaction of disc tissue into the vertebral body. Very probably in a proportion of the anterior paradiscal defects the cause is an isolated trauma, and in cases of this type the defect is the result of the sudden impaction of disc tissue into the vertebral body by this injury. From the medico-legal point of view it is naturally a highly important question whether a given trauma is or is not to blame for the development of these changes.

On the other hand, it is also conceivable that disc tissue is slowly and gradually depressed into the vertebral body, without a distinct trauma, as was shown by Schmorl in the case of the "*Knorpelknötchen*". According to Schmorl, a rupture of the cartilaginous terminal plate is conditional for the formation of "*Knorpelknötchen*". He states that the strain placed upon the spine in everyday life can be equally responsible as a trauma for producing ruptures of this type. The nucleus pulposus will protrude through those fissures in the cartilage plate, and the powerful resilient pressure exerted by the nucleus pulposus will be applied directly to the rather delicate, perforated osseous lamina. By the action of this pressure the osseous tissue is absorbed, the nucleus pulposus thus entering more and more deeply into the vertebral body. Around the nucleus pulposus invading the vertebral body new cell formation takes place, and a broad zone of cartilaginous tissue develops in consequence. In many instances, a markedly sclerotic marginal zone will subsequently be formed. Böhmig is of the opinion that "*Knorpelknötchen*" may also arise in another way. He has studied the vascularization of the intervertebral discs. During the earlier stages of life the disc receives blood vessels, which enter it in several places, from the vertebral body. These vessels consequently pervade the cartilage plate on their way from the vertebral body to the intervertebral disc. Later the vessels become atrophic, and beyond the age of 25 there are no vessels in the intervertebral disc. The gap in the cartilaginous plate, through which the vessels pass or have passed, constitutes a *locus minoris*

resistentiae. Owing to the pressure of the nucleus pulposus this nutrient foramen can be dilated, and a gradual protrusion of the nucleus pulposus into the vertebral body can thus be brought about.

A gradually proceeding impaction of disc tissue into the vertebral body, as in the case of "*Knorpelknötchen*", can also be conceived to result in the formation of anterior paradiscal defects, although here the protruding disc tissue is not derived from the nucleus pulposus but from the annulus fibrosus. W. Müller in his paper. "*Die Bedeutung der sogenannten Knorpelknötchen*", gives X-ray films of a case with paradiscal defects in the anterior portions of two vertebral bodies (Figs. 6 and 7). There was no history of trauma. Müller attributes the lesions to a gradually proceeding impaction of disc tissue ventrad to the nucleus pulposus into the vertebral body, viz. similar to as with "*Knorpelknötchen*".

The assumption of the anterior paradiscal defects being due to an impaction of disc tissue into the vertebral body affords at the same time a natural explanation of the frequently present depression of adjacent intervertebral spaces.

In two of my cases recorded above (Cases 7 and 8) the anterior paradiscal defect in the vertebral body was associated with a so-called persisting apophysis, situated in the contiguous angle of the body of the affected vertebra. In publications on the subject of so-called persisting apophyses, this combination is also to be found in certain reproduced radiographs, e.g. in Hellmer's paper, "*Röntgenologische Beobachtungen über Ossifikationsstörungen im Limbus vertebrae*" (Fig. 27). As already mentioned, especially the fact that the anterior paradiscal defect merges into the narrow, cleft-like passage separating the so-called persisting apophysis from the actual vertebral body, points to the same aetiologic and pathogenetic factors being responsible in those cases for the origination both of the so-called persisting apophyses and of the anterior paradiscal defects. Opinions differ, however, as to the mode of development of the so-called persisting apophyses.

Some of the authors (e.g. R. Hanson, Janker, Hellmer) consider a developmental anomaly preventing the osseous union between the apophysis and the vertebral body to be the cause of the so-called persisting apophysis. Hence the denomination, persisting apophysis.

Schmorl is of another opinion. In his systematic investigation, comprising examinations of several thousands of spines, he did not meet with a single case yielding, on autopsy, any evidence of a developmental anomaly. Schmorl and Junghanns hold the view that at least a considerable proportion of the so-called persisting apophyses quite simply result from fractures severing the marginal portion from the remainder of the vertebral body, there being no subsequent osseous union. They point out that many of the so-called persisting apophyses are far too big to be in actual fact derived from the apophysis. Thus, they cannot consist only of a portion of the limbus vertebrae separated from the vertebral body, but must include, in addition, a larger or smaller piece of the contiguous part of the vertebral body. However, in the view of these authors, not all the so-called persisting apophyses are fragments. They state that according to their macroscopical and microscopical findings there can scarcely be any doubt as to changes of this type possibly also being produced by a gradually proceeding impaction of disc tissue into the cancellous bone of the vertebral body, i.e. in the same way as with "*Knorpelknötchen*", a demarcation of the anterior angle of the vertebral body being thus brought about.

Having regard to these opinions maintained by Schmorl and Junghanns, Hellmer has reported on, *inter alia,* two cases in which the antero-posterior pictures had been taken with oblique direction of the central ray, so that the surface of the vertebral body turned towards the limbic nucleus was projected on the X-ray films. This surface presented an undulating appearance, showing a certain likeness to the corresponding surface of the vertebral body prior to the union with the limbic nucleus. According to Hellmer, this observation supports the conception that in these cases the so-called persisting apophysis actually

is the apophysis, and that consequently a developmental anomaly must have prevented the apophysis from uniting with the vertebral body.

On the other hand, the anterior paradiscal defects in some cases associated with so-called persisting apophyses, and obviously being causally interrelated with the latter, are not connected in any way with the actual limbus, since they are situated behind the angle of the vertebral body within the adjacent spongy bone.

All the facts become attuned if the supposition is made that an impaction of disc tissue is responsible both for the anterior paradiscal defects and the so-called persisting apophyses. In that case "*Knorpelknötchen*" as well as anterior paradiscal defects and so-called persisting apophyses would be taken to arise in the same way, being due either to an isolated trauma or to a gradually proceeding impaction of disc tissue into the cancellous bone of the vertebral body. There is, however, the difference that in the case of "*Knorpelknötchen*" the disc tissue is derived from the nucleus pulposus, whereas with the anterior paradiscal defects and the so-called persisting apophyses it originates from the portion of the annulus fibrosus situated in front of the nucleus pulposus.

The nucleus pulposus exerts an elastic pressure more powerful than that produced by the remaining portion of the intervertebral disc. It will therefore be easily understood, especially as the part of the cartilaginous terminal plate adjacent to the nucleus pulposus is particularly delicate (Schmorl), that "*Knorpelknötchen*" occur very frequently as compared with anterior paradiscal defects. The position of the latter ventrad in the vertebral body suggests that the strain placed on the vertebra, which is maximal within this area, plays a certain part in their origination. A proportion of the cases observed related to children, and the relatively soft and pliable osseous tissue in the infantile vertebral body has presumably been conducive to the development of the lesions.

Further, it can be mentioned that in Scheuermann's kyphosis (kyphosis dorsalis juvenilis) the irregularity of the upper and

lower outlines of the vertebral body usually apparent in the radiograms may also involve deeper indentations, especially in the anterior portion, and that paradiscal defects may thus develop resembling those described above, though as a rule comparatively shallow. Schmorl's patho-anatomical study concerning kyphoses of this type has shown an extensive destruction of the cartilage plates to be present, with herniation into the spongy bone of the vertebral body not only of the nucleus pulposus but also of the surrounding disc tissue. In addition, his patho-anatomical examinations have disclosed that the protrusion of disc tissue from the annuals fibrosus is often especially pronounced ventrad, where the pressure resulting from strain is particularly increased during the development of the kyphosis.

In both Overgaard's and Borcher's publications mentioned above, where some cases of anterior paradiscal defects are illustrated, the lesions come under the heading of Scheuermann's disease. Admittedly, the latter condition as well as anterior paradiscal defects seem to be associated with herniation of disc tissue into the vertebral body, but in Scheuermann's disease the changes are extensive and resulted in the cases which Scheuermann has described, in wedge-shaped vertebrae arising, which does not apply to the anterior paradiscal defects here under discussion. For this reason, the latter can hardly be classified as manifestations of Scheuermann's disease.

As regards the clinical symptoms in cases of anterior paradiscal defects of this type, it can be stated that these ranged as a rule from more pronounced dorsal distress with slight kyphosis and more or less marked rigidity of the lumbar spine to a merely mild inconvenience from dorsal insufficiency without spinal deformation, and with soft and flexible dorsum. In certain instances there was some doubt as to the actual connection between the clinical symptoms and the anterior paradiscal defect. Thus, e.g. in Case 1, it can hardly be very likely that the severe sciatic symptoms were due to the anterior paradiscal defect in the first lumbar vertebra. Undoubtedly, some of the anterior paradiscal defects fail to give rise to clinical symptoms.

Probably the dorsal distress experienced by patients suffering from anterior paradiscal defects results from changes in the intervertebral disc, brought about by a portion of the disc tissue invading the vertebral body. Knutsson has studied the stability of the disc connections between the vertebral bodies by taking radiograms (in lateral projection) with the subject in the vertical position, partly with maximal stooping and partly with maximal hyperextension. He thereby found, in cases of disc degeneration, a parallel displacement of contiguous vertebral bodies, which is not so with normal intervertebral discs. According to Knutsson, this is an early sign of disc degeneration and may precede the radiographic evidence of flattening of the intervertebral disc. Presumably such an instability of the disc connections is responsible for the dorsal distress accompanying anterior paradiscal defects.

The treatment should be modified having regard to the severity of the subjective and objective symptoms. In the gravest cases a period of rest in bed with a plaster mould can be advisable, followed by the use of a plaster corset; in the intermediate cases, an orthopaedic cloth corset reinforced with busks or plates; whereas in mild cases a period of rest and possibly physical therapy will suffice to make the symptoms subside. In addition, there are perhaps cases in which artificial ankylosis of the affected vertebrae, produced by osteosynthesis of the arcus portions, may prove beneficial.

SUMMARY

Some homologous cases are described, with skiagrams showing defects within the anterior portion of the vertebral body adjacent to the intervertebral disc, and the cause of these lesions is discussed. The changes are probably due to a—traumatic or gradually-developing—impaction of disc tissue situated in front of the nucleus pulposus into the cancellous bone of the vertebral body. In a couple of cases the defects were adjacent to a so-called persisting apophysis, merging into the narrow passage separating the latter from the vertebral body. Hence, even the

so-called persisting apophyses may be considered to be due to a similar mechanism as the anterior paradiscal defects.

ZUSAMMENFASSUNG

Einige gleichartige Fälle mit im Röntgenbilde zum Vorschein kommenden Defekten in den vorderen Teilen des Corpus vertebrae bis zur Zwischenscheibe werden beschrieben und deren Ursache besprochen. Diese könnte ein Trauma oder ein sich allmählich entwickelnden Druck des vor dem Nucleus pulposus liegenden Zwischenscheibengewebes auf die Spongiosa des Corpus vertebrae sein. In einigen Fällen lagen diese an einer sogenannten persistierenden Apophyse und setzten sich direkt in den schmalen Zwischenraum fort, der letztere vom Corpus trennt. Selbst die sogenannten persistierenden Apophysen mögen in ähnlicher Weise entstehen wie die vorderen paradiscalen Defekte.

RÉSUMÉ

Description d'une série de cas semblables de déformations, constatées par radiographie, de la partie antérieure du corps de la vertèbre située près du disque intervertébral et recherche de leurs causes.

Ces altérations sont très vraisemblablement causées par un trauma ou par une pression exercée petit à petit sur le tissu spongieux du corps de la vertèbre par la partie du disque qui se trouve devant le nucleus pulposus.

Dans quelques cas ces déformations se trouvaient situées près d'une apophyse dite persistante et se prolongeaient directement dans l'étroite fente séparant l'apophyse du corps de la vertèbre.

Par conséquent, les apophyses dites persistantes peuvent aussi être provoquées de la même manière que les déformations paradiscales antérieures.

REFERENCES

J. E. W. Brocher: Die Scheuermannsche Krankheit. Basel 1946. Benno Schwalbe & Co.

R. Hanson: Acta chir. scand. Vol. 60, p. 309, 1926.

H. Hellmer: Acta radiologica. Vol. 13, p. 483, 1932.

R. Janker: Fortschr. Röntgenstr. Vol. 44, p. 519, 1931.

F. Knutsson: Nordisk Medicin. Vol. 31, p. 1875, 1946.

W. Müller: Bruns Beiträge z. klin. Chir. Vol. 145, p. 199, 1928/1929.

K. Overgaard: Nordisk Medicin. Vol. 5, p. 593, 1940.

J. Puig Guri: Journ. of Bone and Joint Surg. Vol. 28, p. 29, 1946.

H. Scheuermann: Acta ortop. scand. Vol. 5, p. 161, 1934.

G. Schmorl: Fortschr. a. d. Gebiete der Röntgenstr. Vol. 38, p. 265, 1928.

Schmorl und *Junghanns:* Die gesunde und kranke Wirbelsäule im Röntgenbild. Georg Thieme. Leipzig 1932.