SCHEUERMANN'S DISEASE

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Scheuermann's disease, a condition that occurs commonly but at the outpatient department presents infrequently, consists of a wedging of the lower thoracic vertebra resulting in a fixed kyphosis, which may later lead to degenerative stages in this or the neighbouring regions of the spine.

In this paper it is intended to present 4 cases seen at the Princess Alice Orthopaedic Hospital; to describe the clinical features and discuss briefly the pathology and aetiology of Scheuermann's disease; and finally to suggest various methods of treatment.

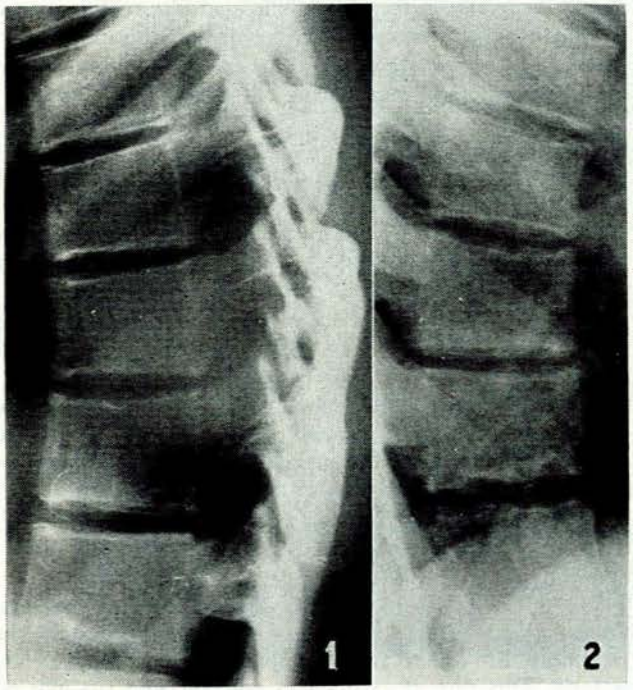

Fig. 1. Case 1. Thoracic spine showing signs of Scheuermann's disease—May 1961.
Fig. 2. Case 1. Thoracic spine in March 1963. Note closure of epiphyses and persistence of Schmorl's nodes.

CASE REPORTS

Case 1. European female aged 22

Seen on 30 May 1961 complaining of thoracic backache for 4 years, aggravated by working in flexed position. No history of trauma. *On examination:* General condition satisfactory. Tender over mid-thoracic spine, with slight kyphosis. Movements full. Straight-leg-raising test negative on both sides. Reflexes present and equal. *X-ray:* Thoracic spine shows signs of Scheuermann's disease (Fig. 1). *Treatment:* Postural exercises and brace (worn for only a short period).

Seen again on 26 March 1963 still complaining of backache, worsened by extra housework since recent marriage. *On examination:* General condition satisfactory. Some prominence of lower thoracic spine. All spinal movements full and pain-free. *X-ray:* Changes similar to those shown in previous radiograph (Fig. 2): note closure of epiphyses and persistence of Schmorl's nodes.

Case 2. European male aged 19

Seen on 28 February 1961 with history of mid-dorsal backache following a fall from a tree 3 years previously. Pain aggravated by flexion strains. *On examination:* General condition satisfactory. Slight lower thoracic kyphosis, but no tenderness. Full range of painless movements elicited. *X-ray* showed early Scheuermann's disease. *Treatment:* Jourdain brace.

Case 3. Non-European male aged 22

Seen on 1 June 1961 for correction of polio deformities. At follow-up clinic on 7 September 1961 he complained of backache following a kick in right lumbar region. *On examination:* General condition satisfactory. Some tenderness in right lum-

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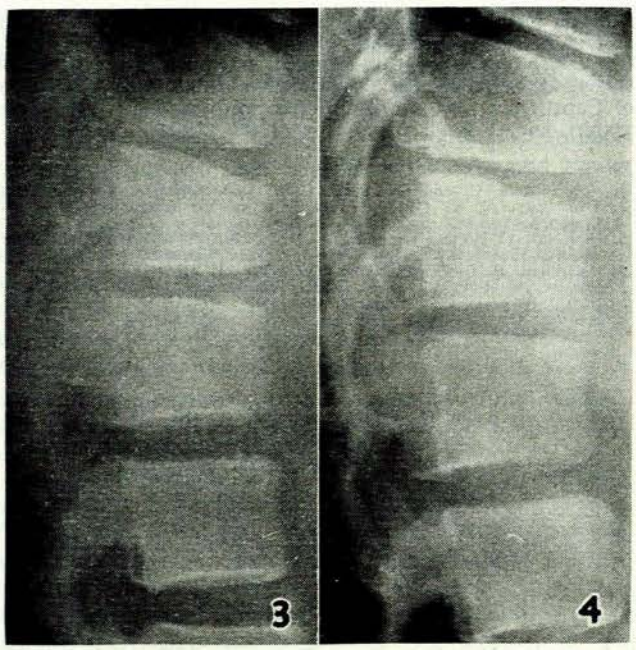

Fig. 3. Case 3. Dorso-lumbar spine showing signs of Scheuermann's disease—September 1961.
Fig. 4. Case 3. Dorso-lumbar spine—April 1963. Note persistence of wedging.

bar region with spasm of the erector spinae and painful limitation of all movement. *X-ray* showed presence of Scheuermann's disease (Fig. 3). *Treatment:* Rest and analgesics.

Seen again on 4 April 1963. No complaints. *On examination:* General condition satisfactory. Normal spinal curvature with full pain-free movements. X-ray showed persistence of wedging (Fig. 4).

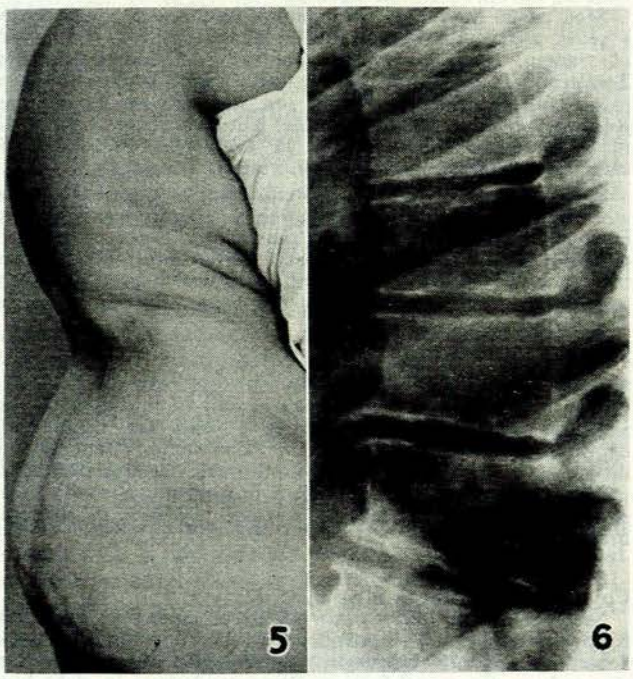

Fig. 5. Case 4. Old Scheuermann's disease—severe thoracic kyphosis.
Fig. 6. Case 4. Dorsal spine showing old Scheuermann's disease, with severe secondary degenerative changes.

Case 4. Non-European female aged 34

Seen 14 February 1963 complaining of low thoracic backache for 2 years following the birth of a baby—intermittent in nature, with one severe attack confining her to bed for 2 days. No history of trauma; no adolescent backache. *On examination:* General condition satisfactory. Severe thoracic kyphosis (Fig. 5). Movements full and pain-free; straight-leg-raising test negative. X-ray showed old Scheuermann's disease with severe secondary degenerative changes (Fig. 6). *Treatment:* Intermittent traction and manipulation under anaesthetic.

CLINICAL FEATURES AND DIAGNOSIS

Scheuermann's disease more frequently affects males between the ages of 10 and 18 years. The patient may present with low-grade backache or with deformity; as a rule he is not seen until months or years later, when he complains of pain over the thoracic spine. Occasionally a history of trauma may be obtained.

The patient is usually well built and robust. On local examination a non-tender kyphosis of the lower thoracic spine is found, with a compensatory lumbar lordosis. The other sections of the spine are usually not affected. At all stages of the disease the spine is balanced and, viewed from the side, the ear, shoulder and hip joint are in the same vertical line. The deformity is fixed and the contour of the spine remains unchanged when the patient sits. An interesting feature sometimes seen is a tightness of the hamstrings that prevents the patient, even with the aid of his kyphosis, from being able to reach the ground when he bends.

Radiographs reveal an abnormality of the lower thoracic vertebral bodies. These become wedge-shaped anteriorly with irregular superior and inferior surfaces. Scalloping of these surfaces may also be present—the so-called Schmorl's nodes. Difficulty in the interpretation of the radiographs may arise from the fact that the appearance of the normal apophyses in children may not be dissimilar (see below).

Biochemical tests reveal no abnormality in the levels of the serum calcium, phosphorus or phosphatase.

Differential Diagnosis

Scheuermann's disease is to be distinguished from the following conditions:

Postural kyphosis, a condition frequently found in the same age group. It is a correctable deformity, producing normal radiographs.

Tuberculosis, which produces the typical picture of bony destruction and collapse, and usually affects a more localized region of the spine.

Ankylosing spondylitis, which is more widespread in distribution, affecting all regions of the spine. The patient with this condition will complain of general symptoms of ill-health.

DISCUSSION

Anatomy of the Intervertebral Region

The young vertebral body has covering its superior and inferior surface a cartilaginous end-plate, around the periphery of which is an epiphyseal ring, thicker anteriorly. This ring of cartilage is notched, and fits into reciprocal notches on the surface of the body of the vertebra. Into the epiphysis are inserted fibres of the annulus

fibrosus and anterior longitudinal ligament, thus forming an apophyseal ring.

The cartilaginous end-plates, which persist in the adult, are perforated by minute vessels passing from the vertebral body into the intervertebral disc. This latter structure consists of a central core, the nucleus pulposus, which is surrounded by the annulus fibrosus.

The apophyseal ring commences to ossify anteriorly at about 10 years and fuses with the body of the vertebra at about 18 years to form the slightly elevated rim of the plane surface of the vertebral body.

Aetiology and Pathology

Although evidence of Scheuermann's disease has been noted in vertebrae discovered during archaeological excavations[1] (Fig. 7), no agreement on its aetiology and pathology has been reached. In 1921 Von Scheuermann[2] described this condition, which he called kyphosis dorsalis juvenalis. While working in an institute for crippled children in Copenhagen he noted a number of male adolescents all of whom were suffering from marked spinal curvature. He found that most of them had been farm labourers and, on questioning, was informed that most ascribed their deformity to the hard work they had previously had to do. A few ascribed their deformity to a particular traumatic incident. He further noticed that the group as a whole were very well developed and had strong spinal musculature. In radiographs taken of these patients he observed the characteristic wedging of the vertebra, localized to the lower thoracic spine.

In 1927 Schmorl[3] noted that in 10% of over three thousand spinal dissections herniation of the nucleus pulposus into the body of the vertebra was present. In a high percentage of cases of Scheuermann's disease there is radiological evidence of nuclear herniation, although the cause is unknown. Schmorl supposed that the herniation was due to congenital weaknesses in the epiphyseal end-plate complex.

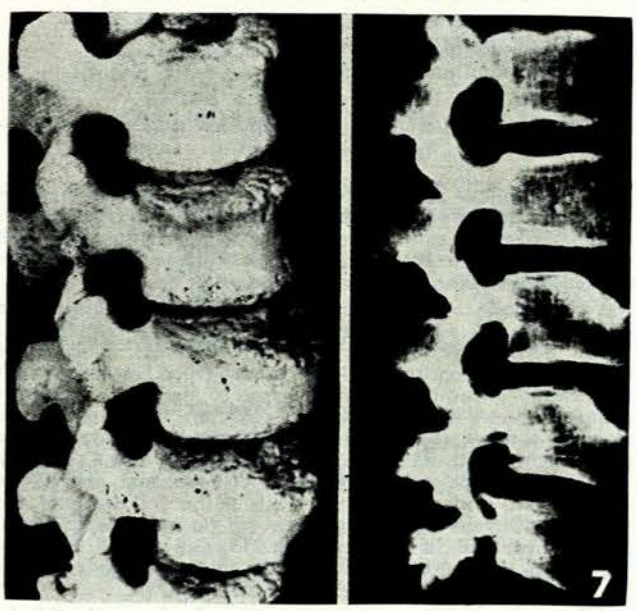

Fig. 7. Lateral photograph and radiograph of remains of a girl aged 16 from the excavation of a Bronze Age barrow of about 1600 B.C. (Calvin Wells,[1] *Journal of Bone and Joint Surgery*, August 1961, **43B**, 575. By kind permission.)

Michele[4,5] maintained that the thoracic kyphosis was secondary to an increased lumbar lordosis due to a tight ilio-psoas. This muscle stretched like a bowstring from pelvis to dorso-lumbar region, owing to a lag in the growth of the muscle during the spurt of rapid vertical growth in late childhood. Increased flexion strains on the anterior aspect of the lower thoracic epiphyseal plates would result in growth disturbances in this region.

Lambrinudi suggested that the herniations occurred as a result of minute cracks or fractures in the end-plate complex. His theory was that the basis of the thoracic kyphosis was the presence of tight hamstrings. This would result in backward tilting of the pelvis, with an exaggerated lumbar lordosis and compensatory flexion of the lower thoracic spine. As the line of gravity of the body passes anterior to the vertebral bodies, maximal pressure falls on the anterior aspects of the epiphyseal plates The greater the kyphosis therefore the greater the pressure.[6]

Junghans, quoted by Hanraets[7] and Creyssel and Schnepp,[8] expressed the opinion that the herniation of nuclear substance was due to growth disturbances with the development of fine cracks or fractures in the epiphyseal end-plate complex through which herniation could occur. I think the minute vascular perforations in the end-plates may in themselves constitute an inherent weakness through which herniation could occur if flexion strains were severe. An as yet unidentified metabolic toxin may in some way damage the epiphyseal plates with the production of areas of weakness or even actual fractures. Perkins[9] suggested that the nuclear herniations were the primary event, but did not explain why.

A vascular basis for the vertebral deformity was propounded by Cloward and Bucy.[10] They described cases of kyphosis dorsalis juvenalis associated with extradural cysts, and expressed the opinion that these cysts compressed and occluded venous channels draining the vertebra. Defective bony growth would result. They suggested that kyphosis unassociated with such cysts might be due to venous stasis of unknown aetiology.

By whatever reason, loss of nuclear substance into the body of the vertebra may result in various degrees of separation of the epiphyseal end-plate complex as the nucleus pulposus insinuates itself between the centrum of the vertebral body and the plate. As flexion strains are maximal anteriorly, nuclear protrusion would occur here. Defective bony growth would be the inevitable sequela. In addition, as Perkins[9] states, 'The nucleus pulposus is a highly elastic spherical body which transforms the spine into an elastic rod which then obeys the laws for the transmission of stress through an elastic curved body, namely that the stress on the concave side is the same as the stress on the convex side. In consequence of this there is no tendency for any wedging to occur, albeit that some flexion of the thoracic spine is continually present in the ordinary orthograde stance. Loss of nuclear substance into a vertebral body results in the disc losing its power of acting as a rubber buffer. Excessive flexion strains now act directly on the bone, which becomes wedged.'

Treatment

This depends upon the age of the patient. If the condition is recognized in the early stages when the apophyses are still open, correction is possible. A period of 3 months on a plaster-of-paris bed, with hinge to correct the deformity, is a logical order of treatment. In practice such a drastic curtailment of school activities is rarely necessary. If the patient concentrates on hyperextension exercises and avoids hyperflexion strains, and follows a daily regime that includes a number of hours flat on his back on a hard bed, this is as much as is usually necessary to control the condition. A well-fitting brace is permissible providing it does not take the place of the exercises, although Gervis[11] states that this discourages full extension. The most elaborate and time-consuming mechanical treatment of the deformity, even in its early stages, may sometimes fail to produce a perfectly normal spine, and because of this the development of a good carriage is in the end the most important part of the treatment. Postural exercises—bracing back the shoulders and holding the head erect—masks the deformity to a very large extent.

An adult should be told that he has a back that may not stand up to severe strains.[9] A majority realize this themselves and alter their occupation so that they do not experience any further discomfort. Some physiotherapy may be ordered to span the time during recovery from a recent strain.

In later life backache may develop and this may be treated conservatively with medication and physiotherapy. A corset or manipulation may eventually be required to alleviate the condition.

SUMMARY

1. Four cases of Scheuermann's disease are presented.

2. Radiographs demonstrate characteristic changes, namely wedging, Schmorl's nodes and, later, osteo-arthritis.

3. The clinical features of Scheuermann's disease are discussed.

4. The intervertebral anatomy is briefly alluded to and theories on the aetiology of Scheuermann's disease are reviewed.

5. A suggestion is made that the condition may be due to epiphyseal separation.

6. The treatment of the condition is briefly dealt with.

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REFERENCES

1. Wells, C. (1961): J. Bone Jt Surg., **43B**, 575.
2. Von Scheuermann, H. (1921): Z. orthop. Chir., **41**, 305.
3. Schmorl, G. (1927): Verh. dtsh. path. Ges., **22**, 250.
4. Michele, A. A. (1961): N. Y. St. J. Med., **61**, 98.
5. *Idem* (1960): Milit. Med., **125**, 324.
6. Roaf, R. (1960): J. Bone Jt Surg., **42B**, 49.
7. Hanraets, A. (1959): *The Weak Back*. Amsterdam: Elsevier Publishing Co.
8. Creyssel, J. and Schnepp, J. (1954): Lyon chir., **49**, 433.
9. Perkins, G. (1961): *Orthopaedics*. London: University of London Press.
10. Cloward, R. B. and Bucy, P. C. (1937): Amer. J. Roetgenol., **38**, 681.
11. Gervis, W. (1960): Practitioner, **240**, 185.