The vulnerable, rapidly growing thoracic spine of the adolescent

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Summary

The upper and lower surface of the vertebral bodies are covered with a thick cartilaginous plate in which the secondary ossification centres develop at puberty and continue to grow throughout adolescence. Congenital indentations in the cartilaginous plates are not uncommon and they constitute regions of diminished resistance, which yield under physical stress. Prolapse of disc tissue occurs into the vertebral body, causing a disturbance of growth but little if any pain. The vertebrae in the mid-thoracic region become wedge-shaped, and a kyphotic deformity results, the so-called Scheuermann's disease, or adolescent kyphosis. A plea is made for the screening of children exposed to risk.

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Alarm bells are ringing loud and clear after a spate of broken necks among schoolboys on the rugby fields, which have led to quadriplegia and, in some cases, death. Recently, the South African Rugby Board has been compelled to institute yet another investigation into the problem of collapsing scrums and over-robust play.[1,2]

Not unnaturally, the drama attached to injuries of such severity overshadows, almost to exclusion, the relatively minor and oft-repeated injuries involving the lower thoracic and upper lumbar vertebrae, both at sport and at play (especially during vacation periods), which cause little discomfort or pain at the time. Any complaints are liable to be dismissed merely as 'growing pains' — a syndrome which simply does not exist. Fathers of boys who show promise on the rugby field are often at fault, refusing to allow a 'trivial complaint' to stand in the way of the success of the team in which their sons play a key role.

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The cumulative effect of these injuries can be severe, either in the short term while the boy is still at school, or in the long term after adulthood is reached. Boys are not the only victims of this insidious process during the vulnerable period of rapid growth. Figures extracted from the records of the Spinal Deformities Clinic at the H. F. Verwoerd Hospital, Pretoria, over the 3-year period 1975 - 1978 are both significant and revealing: out of a total of 1 400 cases in the series, there were 290 cases (21%) of thoracic kyphosis. A breakdown of this number indicated that 210 cases (72% of the patients with kyphosis and 15% of the series) displayed the features of Scheuermann's disease, with structural changes demonstrated on radiography. Boys outnumbered girls by 5:3 in the series. There were 30 patients (10%), whose ages exceeded 20 years, the oldest still complaining at 57 years and 64 years.

Schmorl and Junghanns,[3] whose masterly treatise on the human spine was based on the examination of no less than 10 000 cadavers, stated unequivocally: 'Juvenile kyphosis appears predominantly in those who already have a congenital indentation of the discs in the region of the nucleus pulposus.... The cartilaginous plates within the region of the indentations, and in adjacent areas, are thinner than normal, which creates a region of decreased resistance.... If these regions are exposed during their second growth (that is, after the 12th year of life) to heavy physical labour, or if the youth participates in sports where the spine is exposed to stress or to considerable shock (motorcycle riding, etc.), then the thin cartilaginous plates become fissured and disc tissue prolapses into the spongiosa of the adjacent vertebral bodies (Fig. 1).[3]

The same authors continue: 'The growth zone of the disc at this age still consists of hyaline cartilage... [which] undergoes extensive destruction... and causes an inhibition of growth... [with the result that] . . . anteriorly pointed, wedge-shaped vertebrae are formed.'[3]

The most heavily involved region extends, not unexpectedly, from T6 to T11 vertebral levels, since this is the most rigid and therefore the most vulnerable segment of the entire spinal column. The clinical appearance of a thoracic kyphotic deformity is most readily demonstrated when the patient bends forward in an effort to touch the toes (Figs 2 and 3). The normal 'gentle' arc of a circle is replaced by an interrupted

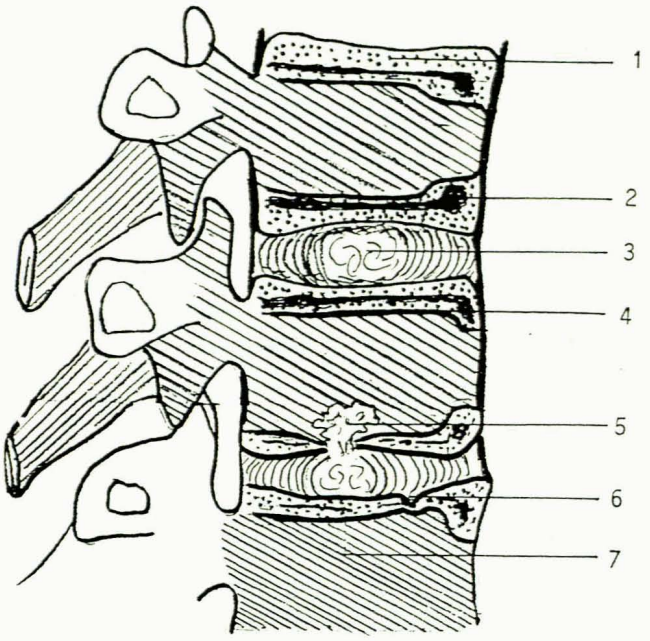

Fig. 1. Diagrammatic representation of normal and abnormal growth centres of the vertebrae: (1) cartilaginous plate; (2) secondary ossification centre, the annular epiphyseal rings of the superior and inferior surfaces of the vertebral bodies; (3) the intervertebral disc; (4) the vertebral end-plate; (5) prolapsed disc tissue through a defect in the indented cartilaginous disc, giving rise to a Schmorl's node; (6) an indentation in the cartilaginous plate; and (7) the primary ossification centre of the vertebral body. (Adapted from Schmorl and Junghanns.[3])

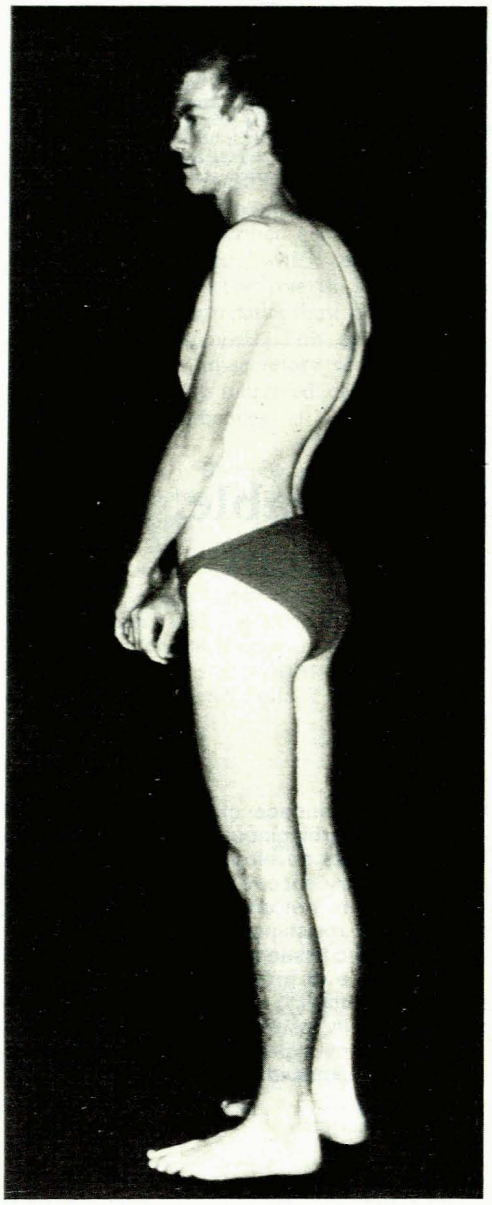

Fig. 2. Clinical appearance of an adolescent boy with the typical round back deformity of Scheuermann's disease. (Reproduced from Dommisse[4] with permission.)

Fig. 4. Radiograph of a normal thoracic spine of an adolescent, showing well-developed, healthy epiphyseal rings of the antero-superior and antero-inferior angles of the vertebral bodies.

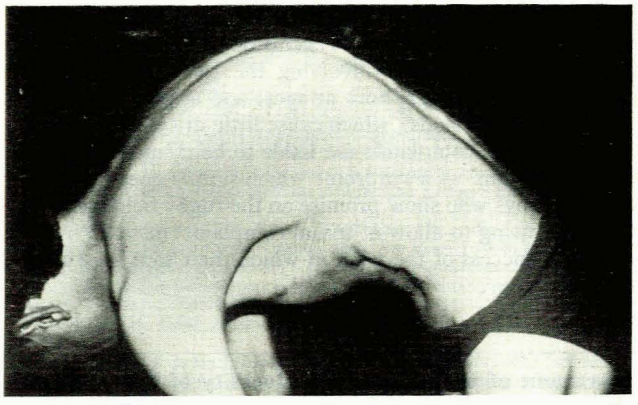

Fig. 3. The short angular arc of the thoracic deformity is clearly demonstrated when the patient bends forward to touch toes. (Reproduced from Dommisse,[4] with permission.)

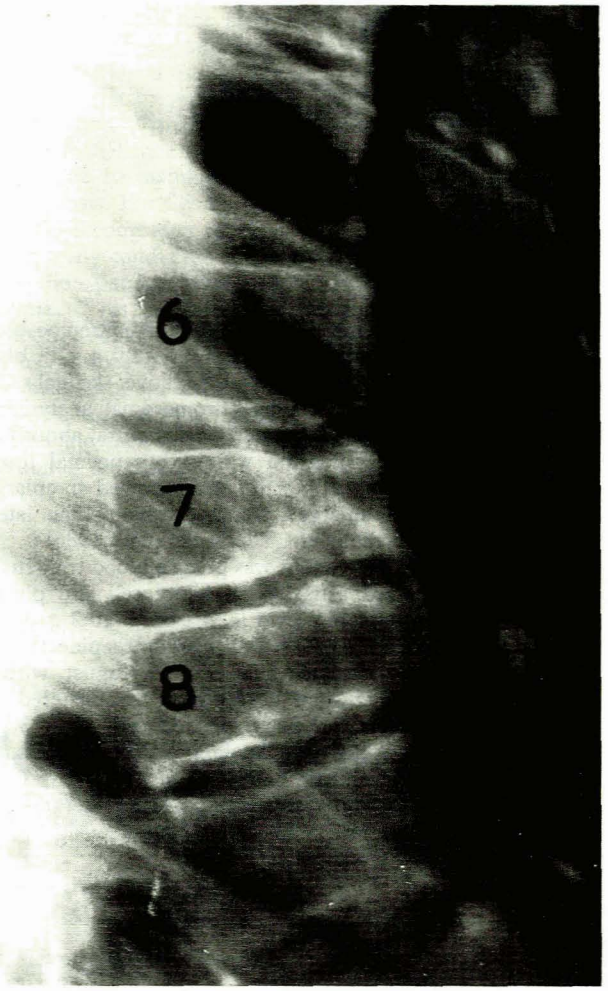

Fig. 5. Radiograph of advanced Scheuermann's disease, with characteristic structural changes, and anterior wedging at T7 and T8 levels.

broken arc or by a short sharp arc that, with a little experience on the part of the examiner, is readily recognised.

Attention must also be directed to another type of thoracic kyphosis, namely postural kyphosis, which is common in the adolescent age group, and is more often seen in girls than in boys. In this instance, the kyphotic curve, as measured on radiographs taken with the child standing erect, exceeds the normal 30 - 40° and may even reach 70°. The difference, however, is clearly defined, inasmuch as radiography of the spine reveals no structural changes in the growing vertebrae, hence the diagnosis of 'postural, non-structural, thoracic kyphosis'. In a small percentage of these cases, structural changes have been seen later, but with timely diagnosis and appropriate orthopaedic management during and through the growing period, structural changes (Scheuermann's disease) can be prevented.

The normal growth and development of the vertebrae are illustrated in Figs 1 and 4, together with the congenital indentations present in an undetermined percentage of otherwise normal children. Diagrammatic representations of the pathological lesions and the radiological appearances of the normal and the wedge-shaped vertebrae of Scheuermann's disease are shown in Figs 1, 4 and 5.

In summary, there is a period of vulnerability of the spine in all growing children, and this occurs during the adolescent years when the physical potential of the child surpasses the mental facilities for understanding and judgement.

Excessive forms of exertion and physical stress demand appropriate screening of schoolchildren during the adolescent period of rapid growth, and counselling of over-zealous parents.

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