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THE PATHOLOGY OF ADOLESCENT SCOLIOSIS

BY

R. G. ABERCROMBIE, M.D.

Physician for Orthopaedic Diseases, Royal Hospital, Sheffield; Medical Director, Edgar Allen Institute, Sheffield

Adolescent scoliosis is distinguished from other forms of scoliotic curvature by its incidence among young girls, by the special tendency to rotation of vertebrae which accompanies the lateral curves, and by the obscurity which surrounds its causation and pathology. This last feature has given rise to the synonym of "idiopathic scoliosis," in contrast to curvatures associated with recognized pathological conditions, such as congenital malformation of vertebrae, paralysis of spinal muscle-groups, or contractures following intrathoracic disease. Adolescent kyphosis is also of obscure origin; it differs from adolescent scoliosis in that it shows itself at a somewhat later age, it is far more frequent in boys than in girls, and it gives rise to little or no lateral curvature or rotation. Further, in adolescent kyphosis the x-ray examination shows early and striking changes in the vertebrae, fully described by Calvé and Galland (1930); whereas in adolescent scoliosis the x-ray appearances during the early stages are quite normal, the wedging of vertebrae being a late manifestation. Ambiguity has sometimes arisen in the literature owing to the fact that in true adolescent scoliosis there may be a backward or kyphotic element in the dorsal lateral curve; and also that in true adolescent kyphosis there may be a slight and unimportant lateral deviation. There is, however, no clinical difficulty in distinguishing between the two conditions, and there is little doubt that they are pathologically quite distinct. In this paper I confine myself entirely to the question of the causation and pathology of adolescent scoliosis.

Many theories have been put forward to account for a malady so enigmatic in origin and so severe in its results. Perhaps that most widely held is to the effect that the curvatures are a consequence of some form of weakness of the muscles or other structures of the spine. This view has recently been restated by Hauser (1937), who suggests the term "decompensation" for the hypothetical muscular insufficiency. It is difficult to accept weakness as the sole or principal cause, since the condition may show itself in girls who are muscularly vigorous and strong, leading apparently normal and healthy lives, and may advance to severe and permanent deformity without sign of any malady other than that of the curvatures themselves. It is true that the condition is sometimes seen in girls of the "slender maiden" type, who have "shot up" beyond their strength. Such cases are usually mild and postural in type, since the majority of severe cases show themselves prior to the period of rapid growth. In the "slender maiden" type it seems probable that the bodily weakness may be a subsidiary though not the sole

cause of the abnormal posture. Inequality in the length of the legs, unilateral occupations, and defective respiratory movements of one side of the chest have been put forward as causes. Such factors may give rise to an adaptive curvature, but I have not been able to find clinical evidence of their capacity to cause the characteristic symptoms of true adolescent scoliosis, with its secondary curvatures and rotation and its occasional progressive tendency. Analysis of the aetiological factors and of the symptoms has led me to the belief that the posture and deformities are not due to any form of weakness, but, on the contrary, are the result of long-continued abnormal muscular contraction.

Aetiology

Adolescent scoliosis affects girls far more frequently than boys. It shows itself in late childhood and early youth, and is thus associated with the approach or establishment of puberty.

Social Incidence.—Taking my personal experience over a number of years, I believe that adolescent scoliosis is relatively more frequent among the children of the comfortably-off than it is among the hospital class. I have been impressed by its incidence in the sedulously reared only daughters of well-to-do parents. In the hospital class it is the more carefully tended children that are usually affected; among the neglected children of the very poor it is rare. It is thus certainly not a deprivation disease; on the contrary, it appears to be associated with too anxious and solicitous an upbringing.

Recent Incidence.—There has been a massive reduction in the number of cases during recent years. This applies to all social classes and to all institutions in Sheffield and, so far as my inquiries go, to the country generally.

Characters of Curvatures

So gradual is the development of the faulty posture that it is usually impossible to fix the time of its origin; indeed, it is often discovered by chance. At this stage the girl does not complain of pain, fatigue, or any other symptom, and seems unaware of the defect in her attitude. The curvature is known as "postural" or "functional" if the form of the vertebrae is unaffected, so that it is possible to redress the attitude; when deformation of the vertebrae has occurred the attitude cannot be fully redressed, and the curvature is known as "structural" or "organic." In structural curvatures the attitude is often accentuated by a superadded functional element, indi-

cating an influence at work which tends to increase the deformity. Functional cases usually recover with treatment, but occasionally they pass into the structural phase while under observation. If the case is structural when first observed, evidence is lacking as to whether an earlier functional phase has been present. The disputed question as to whether certain cases are structural from the beginning is therefore at present undecided. The various anatomical types of curvature need not here be described.

Explanation of Symptoms

The posture and deformity of adolescent scoliosis are an exaggeration of a physiological attitude, that of bashfulness. On more than one occasion I have known an access of bashfulness during medical examination to be mistaken for a postural scoliosis. At the approach of puberty the girl loses the care-free movements of childhood and becomes modest, self-conscious, and sometimes bashful. Modesty is an instinctive safeguard for immaturity. The bashful attitude is also a defensive one; it depends upon the activity of an ancestral postural reflex, and has the effect of a modest self-effacement which conceals the lineaments of the figure by the sidelong posture and the torsion of the trunk. It is thus in complete contrast to the erect attractive poise of fully developed womanhood.

Natural modesty is physiological, but it may deepen into a morbid self-consciousness, and the associated attitude of bashfulness may then become habitual. In such instances the ancestral postural reflex may assume control, the attitude passing by insensible gradations into the pathological posture of adolescent scoliosis. In unfavourable cases the long-continued muscular contraction may induce structural changes in the young and plastic tissues, and the spinal deformity becomes organic.

In the form of curvature most usually seen the predominant curve and rotation are to the right in the dorsal region, with a subsidiary curve to the left in the lumbar region. The abnormal posture is thus most noticeable in the neighbourhood of the right shoulder. The explanation of the frequency of this particular curve may be that the posture is essentially expressive, and that in expressive gestures it is the right upper limb that is usually called into play. It is the right hand that is waved, the right fist that is clenched, and the instinctive posture of adolescent scoliosis is also to the right. In a left-handed girl suffering from scoliosis the curve was to the left in the dorsal and to the right in the lumbar region.

Rotation is thus to be regarded as part of the attitude brought about by muscular contraction, and not as a mere concomitant of the lateral curves, to which it is often quite disproportionate in grade. Rotation is a far more noticeable feature in adolescent scoliosis than in other types of lateral curvature, in which it is a concomitant. A very different pathological condition serves to illustrate the origin of spinal curvatures in long-continued postural muscular contractions. The morbid changes of encephalitis lethargica sometimes lead to the release of ancestral postural reflexes in a perverted form. The bizarre attitudes which result may give rise in young subjects to structural spinal deformities (Abercrombie, 1928).

Significance of the Aetiological Factors

The import of the incidence among young girls has been discussed. Typical adolescent scoliosis is also occasionally seen in boys. At a stage in their development boys sometimes show well-marked feminine characteristics and become as modest and as bashful as a girl, and are thus

also open to the train of pathological events which have been described. The disproportionate incidence among more carefully nurtured children suggests that too anxious a solicitude in upbringing may impair self-reliance and induce a morbid self-consciousness. Several writers have noticed an abnormal psychological state associated with scoliosis. It is not easy to define. The girls are not hysterics; the disturbance is at the level of instinctive behaviour, and the defect is not so much in the personality as in its environment.

The diminished incidence in recent years corresponds to a more rational system of education, with its games and open-air sports. The results are to be seen in an upright carriage and a demeanour at once modest and self-reliant. In former days false modesty seems sometimes to have been taught as part of the curriculum. A manual of conduct published in 1871 recommends "a pleasing modest reserve and retiring delicacy that blushing withdraws from the gaze of admiration." It is interesting to recall that this was the period of the routine use of the back-board.

Instances occur, although they are rare, in which the symptoms of adolescent scoliosis show themselves after an acute infection. The interpretation appears to be that during a critical stage of a girl's development the debility of convalescence may affect her mentality, rendering her timid and self-conscious. This mental change in association with the bodily weakness may induce scoliosis. In one case severe adolescent scoliosis followed directly upon an attack of acute chorea.

Treatment

Although it is difficult to estimate the results I believe that the recognition of the psychological element in adolescent scoliosis increases the efficiency of treatment, and it certainly adds greatly to its interest. The relatives should be instructed that the anxiety which they so often show is unwholesome for the patient, and they should be forbidden to worry her about her attitude. Treatment should be directed to both mind and body. Psychological treatment should be indirect. The girl should be placed in a healthy and cheerful moral atmosphere. The less said about the curvature the better. In the treatment of postural curvatures in my judgment it is best to disregard the individual curves altogether and to rely on free-standing exercises under a judicious and trained instructress. The object of the exercises is to give confidence and to improve the bodily poise, and it is essential that they should be enjoyable.

Structural curvatures are a more difficult problem. Much ingenuity has been employed in the design of exercises to correct special curves and to strengthen special muscle-groups. However skilfully carried out, the results are disappointing. I incline to the view that in place of this highly specialized treatment equally good results are obtained by general exercises of an invigorating and enjoyable character designed to improve the bodily poise. With some diffidence I record the impression that the condition may be sometimes actually aggravated by too intense an attention directed to particular curves. In overgrown girls it is reasonable to order a daily period of dorsal recumbency. It is outside the scope of this paper to discuss the treatment of severe structural curvatures by means of forcible reduction, fixed apparatus, or surgical operation.

A few words may be added with regard to prevention. Parental solicitude should not be allowed to interfere with the development of self-reliance. A free and con-

fidet bearing should be encouraged by games and sports, and there should be friendly comradeship with the opposite sex.

Summary

The posture and deformity of adolescent scoliosis have an affinity with the attitude of bashfulness. This attitude is the expression of the modesty of puberty; it is defensive in origin, and is dependent on an ancestral postural reflex. In certain cases the modesty of puberty deepens into a morbid self-consciousness associated with an exaggeration of the postural reflex of bashfulness; and the consequent long-continued muscular contraction induces the scoliotic posture and deformity. Recognition of the psychological element increases the scope and effect of treatment.

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AN OUTBREAK OF PARATYPHOID AND DYSENTERY IN A TRAINING-SHIP

BY

**EDWARD R. PEIRCE, M.R.C.S., L.R.C.P.,
D.P.H., D.T.M.**

*Senior Assistant Medical Officer of Health, Port of
Liverpool*

An outbreak of paratyphoid fever occurred in a Mersey training-ship during September, October, and November, 1937; this was of particular interest in that it happened in a closed community and ran concurrently with a smaller outbreak of Sonne dysentery. The vessel is a third-class cruiser, about fifty years old, used in training boys for the lower deck of the Royal Navy or Merchant Service. The ship's complement consisted of the commander, thirteen officers, and 112 boys; in addition the commander's wife and a maid live in the vessel. A local practitioner is responsible for the medical care of the boys.

On October 5, 1937, the following facts were ascertained by the senior assistant port medical officer:

1. That on September 18 two boys, suffering from pyrexia and malaise, were sent to Birkenhead General Hospital for observation, and were subsequently diagnosed as cases of Sonne dysentery; one of them returned to the vessel on September 29, but was again taken ill, and was readmitted to hospital on October 3 with paratyphoid fever.
2. That on September 19 twelve boys complained of diarrhoea. All recovered in twenty-four hours.
3. That on October 1 one boy, and on October 3 two boys, were removed to Birkenhead General Hospital for observation.
4. That on October 4 the visiting medical practitioner was informed by the bacteriological department of the Birkenhead General Hospital that the patients admitted on October 1 and October 3 were suffering from paratyphoid fever.

On October 5 the medical officer of health for the City and Port of Liverpool received notification of a case of ? paratyphoid fever in the training-ship; the boy was examined by the senior assistant port medical officer and removed to Fazakerley Hospital. Bedding and effects of the patient were collected for disinfection and the ship's hospital washed down and sprayed by an inspector of the Port Health Authority.

General Investigations

The boys returned from summer leave on August 26, 1937, and a number of new boys joined between that date and September 30. The latter group included one (G. R. N.) who will be referred to again later in the report; he joined on September 9, reported sick on September 17 with indefinite symptoms, and remained in the ship's hospital until September 24. The following day he went home on week-end leave and did not return to the vessel, his parents withdrawing him for health reasons. (This boy was subsequently visited at home, and his parents persuaded to allow him to enter hospital.) Except for the aforementioned cases no other sickness was reported.

Water and Food Supplies

Drinking-water is obtained from a hydrant on Rock Ferry Pier four times daily, conveyed to the vessel by water-boat, and pumped into storage tanks on the upper deck. The tanks are used exclusively for drinking-water. River water is utilized for flushing latrines, urinals, and lavatories; there is no possible contamination of the drinking-water from this source. Food supplies are kept in store-rooms used especially for that purpose, and are the direct responsibility of the cook, who has the assistance of four boys in the galley. Milk in bulk is used only for cooking; for drinking purposes each boy receives a pint of pasteurized milk daily in a sealed bottle.

Lavatories, etc.

The lavatory accommodation was inspected; it is situated forward, and consists of trough-closets without partitions. The contents of one large tank flushes the system four times a day; a trough-type urinal is similarly flushed. A separate pedestal water-closet and urinal are available for use at night, but are locked during the day. The hospital has a separate water-closet. As the night urinal opened on the sleeping quarters representation was made that it be completely boarded up, and a new scuttle cut into the ship's side for ventilation; this was carried out at once.

Personal Hygiene

The commander undertook that the crew would adhere strictly to the following instructions:

1. That the boys wash and scrub their hands with hot water and soap immediately after micturition or defaecation.
2. That latrines and urinals be flushed every hour, and seats thoroughly scrubbed each day with disinfectant.
3. That handling of food be restricted to the cook and galley staff (four boys); that no other boys be allowed in the galley.
4. That uncooked vegetables, lettuces, etc., shall not be used.
5. That no new boys shall join the vessel during the present term.
6. That no boys be drafted to sea during the present term.
7. All home week-end leave to be stopped.
8. Football fixtures with other teams to be cancelled, but games ashore permitted among the boys themselves.

Sequence of Cases, and Measures taken after October 5, 1937

October 7.—One of the galley boys reported sick, with pain in the left upper abdomen; temperature 100° F.; he was removed to Fazakerley Hospital for observation. Blood was