

## TWO CURVE PATTERNS IN IDIOPATHIC STRUCTURAL SCOLIOSIS\*

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In the last twenty years great changes have taken place in our views on scoliosis—especially as to treatment—because of the work of American surgeons, notably Risser and Ferguson (1936), Risser (1948), Von Lackum (1948) and Cobb (1948). There is now good evidence that conservative treatment never improves an idiopathic curve. There is indeed little evidence that it diminishes or prevents deterioration. Is it not possible that what we see as we observe these children is the natural history of the disease unfolding as growth occurs and probably uninfluenced by our treatment? Of 353 patients seen at the scoliosis clinic at the Royal National Orthopaedic Hospital and treated by many surgeons and by a wide variety of methods none has ever shown radiographic evidence of improvement, with the exception of a few cases to be detailed later.

If correction and fusion be the only effective treatment, the natural history of the various types of this disease is of great importance because correction is easier early rather than late, and knowledge of the prognosis is of great importance when operation is contemplated. Since only 5–10 per cent of idiopathic curves become severe enough to require correction and fusion, it is of the greatest value to know which they are at an early stage. It would be important if it only enabled us to avoid the usual over-treatment of the remaining 90–95 per cent of patients in whom the prognosis is good. There are many patients at present wearing unnecessary supports and losing time at school at a critical age to attend for exercises, yet their curve pattern is such that a benign course is assured. Moreover the patients in whom correction and fusion are undertaken late involve much hard work with little reward, because the spine is too severely deformed and too rigid for more than a very incomplete correction. In idiopathic scoliosis the two chief factors that influence the prognosis seem to be the age of onset, and more important, the pattern of the curve. Ponseti and Friedman (1950) have recently published a most valuable article on curve patterns in scoliosis; the patterns discussed had been recognised previously but their significance has been fully assessed for the first time by these authors. The present paper deals with the prognosis of two distinct curve patterns, infantile idiopathic scoliosis and primary lumbar idiopathic scoliosis.

### INFANTILE IDIOPATHIC SCOLIOSIS

This curve pattern is termed “idiopathic” because no cause for the scoliosis has been found in the thirty-three cases studied. The writer wishes to stress that this should be considered a preliminary report with regard to this curve pattern.

The typical case may be described as follows. The patient is usually a boy and the scoliosis is noticed in the first year of life because of the backward projection of the ribs on the left side. On examination there is found a structural curve in the mid- or lower thoracic region with compensatory curves above and below. Rotation is very marked clinically and radiographically. As the child grows there will probably be deterioration, sometimes to the extent of very gross deformity. The patient is likely to be undersized, and if the scoliosis becomes severe he may be a dwarf in limbs as well as spine.

Analysis of the group of thirty-three patients shows that there were twenty-one boys and twelve girls. The major curve was to the left in twenty-nine and to the right in four.

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It usually developed a few months after birth and only in two cases was it first noticed after two years (Fig. 1); in both of them it is possible that the curve, although unnoticed, started earlier. The writer considers three years as the latest time of onset of infantile idiopathic curves; after this other curve patterns are seen.

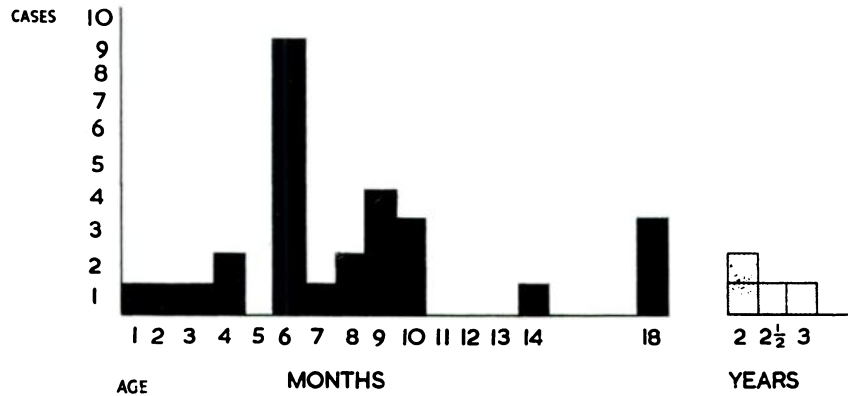


FIG. 1

Age at onset in thirty-three cases of infantile idiopathic scoliosis.

The curve pattern is remarkable for its regularity. In thirty-two of the thirty-three cases it has been a triple curve with the major curve always in the thoracic region (Figs. 2 to 6), but it differs from the adolescent type not only in its age of onset but in being more frequent in boys than in girls, whereas the adolescent curve is nine times more common in girls. Its other characteristic is that the major curve is usually to the left—a feature as marked as the preponderance of right-sided curves in the adolescent pattern. Whereas there are several other patterns of curve in idiopathic scoliosis of later onset, in infants only this one pattern has been seen.

TABLE I  
APEX OF CURVE IN THIRTY-THREE CASES OF INFANTILE  
IDIOPATHIC SCOLIOSIS

Thoracic	7	1 case	
Thoracic	7 and 8	1 case	
Thoracic	8	4 cases	
Thoracic	8 and 9	5 cases	} Thoracic 9 involved in 22 cases
Thoracic	9	12 cases	
Thoracic	9 and 10	5 cases	
Thoracic	10	1 case	
Thoracic	11	3 cases	
Thoracic	11 and 12	1 case	

The major curve is situated in the middle and lower thoracic regions; the apical vertebra is most commonly the ninth thoracic (Table I). The number of vertebrae involved is slightly more variable (Table II).

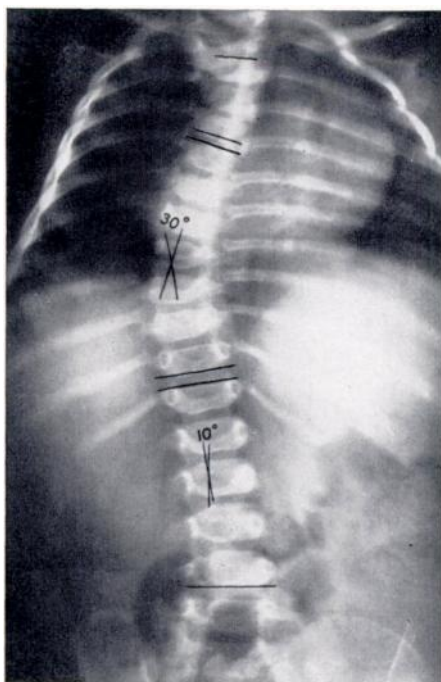


FIG. 2

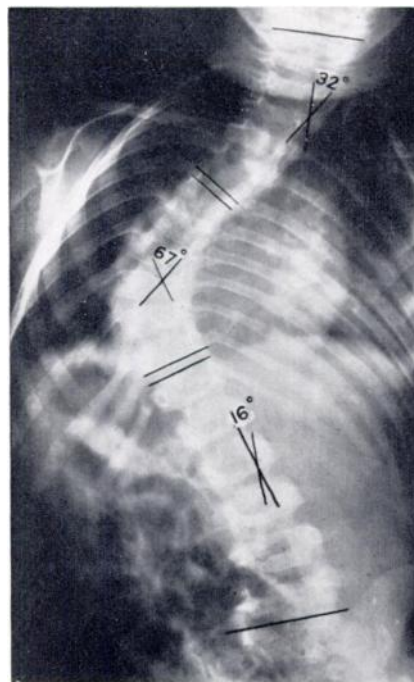


FIG. 3

Figure 2—A boy aged eleven months who had a left major curve of 30 degrees. At the age of two and a half years the curve had increased to 67 degrees (Fig. 3).



FIG. 4

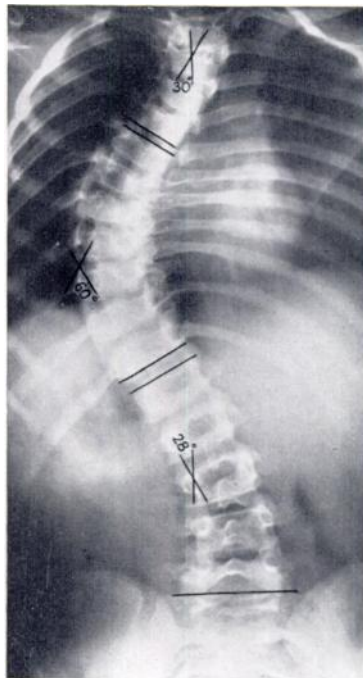


FIG. 5



FIG. 6

Figure 4—A boy at the age of two years with a 32 degrees major curve. At the age of eight this had increased to 60 degrees (Fig. 5). Note the left curve, the absence of congenital changes and the marked rotation. The photograph (Fig. 6) shows the patient at the age of eight years.

**Prognosis**—In four cases the curve has disappeared; in none of these was it severe—the worst was 20 degrees and in all it had disappeared before the age of two years. Eleven curves have remained stationary during the period of observation, but only three of these have been watched for more than two years—the longest for five years (Figs. 7 and 8)—and it is to be doubted whether they will all remain stationary. With these possible exceptions the patients tend to become worse, though by no means always to a serious degree (Figs. 2 to 6 and 9 to 11). Of thirty-three patients, twelve have so far attained a major curve exceeding 50 degrees, the worst being 155 degrees supine; it is certain that more will do so as they grow. In general, the increase of curve has been steady and progressive (Table III). It may be that in this series several adult cases seemingly typical have been excluded unnecessarily. Early films were not available and congenital scoliosis cannot now be excluded.

TABLE II  
EXTENT OF CURVE IN THIRTY-THREE CASES OF INFANTILE  
IDIOPATHIC SCOLIOSIS

	Lower level				
	T.9	T.10	T.11	T.12	L.1
Upper level					
T.4	1	2	1	—	1
T.5	—	2	3	—	—
T.6	1	2	7	4	1
T.7	—	1	—	4	—
T.8	—	—	—	1	—
T.9	—	—	—	1	1

TABLE III  
PROGRESSIVE INCREASE OF MAJOR CURVE DURING GROWTH IN A TYPICAL  
CASE OF INFANTILE SCOLIOSIS

Age in years . . . . .	1	2	3	5	6	7	8	11
Degrees of curvature	30	39	59	61	76	82	101	127

**Treatment**—Most of these patients have had exercises, plaster-of-Paris beds, and supports, but have not improved. Two patients are at present undergoing correction in preparation for fusion. In three cases the compensatory curves are already so rigid as to render correction impossible.

**Etiology**—All patients with congenital changes in the vertebrae have been excluded. Two patients are mentally retarded; two have congenital heart disease; and one has paraplegia, probably secondary to the scoliosis.

There is little detailed reference in the literature to scoliosis in infants. Harrenstein's (1936) report of forty-six cases of scoliosis in infants discusses the same problem but there are several important differences. In twenty-nine cases he considered rickets to be the cause; they were curvatures occurring in the second year of life. No example of rickets was seen

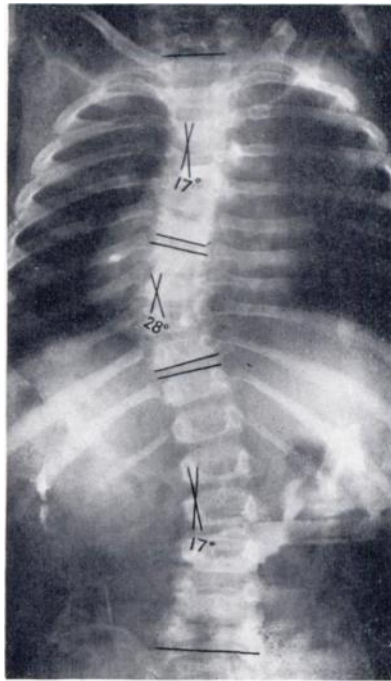


FIG. 7

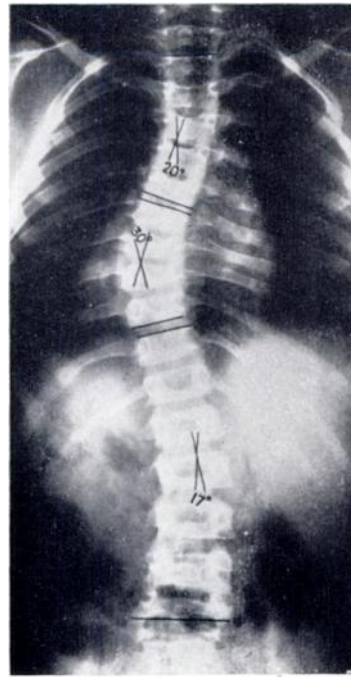


FIG. 8

Figure 7—Twenty-eight degrees curve in a boy aged two years. At the age of seven this was still only 30 degrees (Fig. 8). This favourable course is unusual.

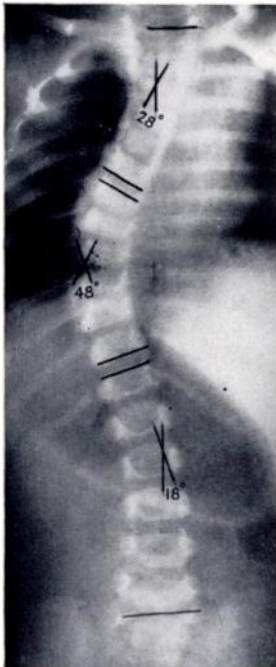


FIG. 9

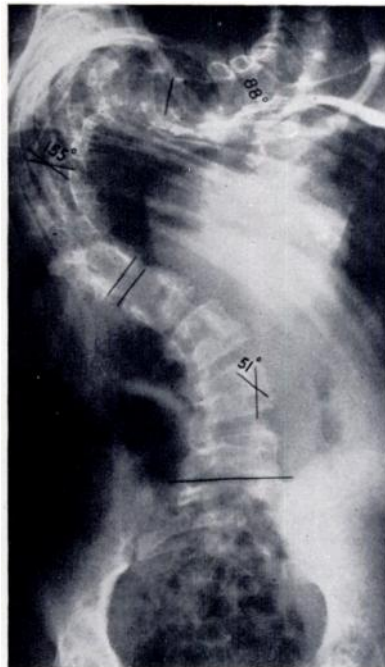


FIG. 10

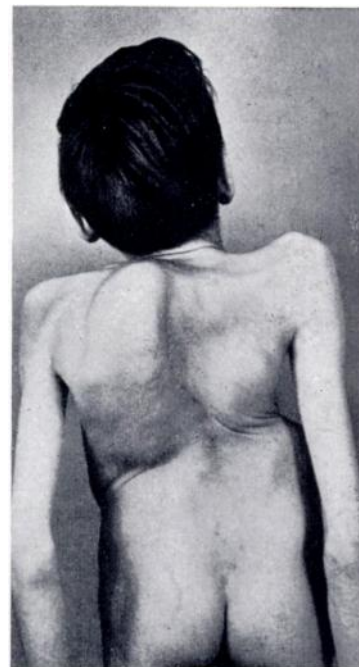


FIG. 11

Figure 9—A boy with a left curve of 48 degrees at ten months. Figure 10—At the age of fourteen years he has a curve of 155 degrees supine despite much conservative treatment. Figure 11 is a photograph of the same boy. The major and compensatory curves are too rigid for correction.

in this series. Harrenstein noted a preponderance in girls. Further, he claimed good results from corrective plasters in a group of cases with a single curve and rotation. With the possible exception of two of the patients who underwent spontaneous correction no such cases have been seen in this series. All our remaining patients had three curves and rotation. Several patients were seen with single curves but without rotation; these were regarded as postural and have been excluded from the series. It is difficult, however, to compare the two groups because serial radiographs are not available in Harrenstein's report and some of the illustrations are difficult to interpret. Ponseti and Friedman (1950) did not discuss this pattern.

#### PRIMARY LUMBAR IDIOPATHIC SCOLIOSIS

In America it has been recognised for some years that idiopathic structural scoliosis with a major curve in the lumbar region has a benign course. Seldom if ever does it require

TABLE IV

AGE AT ONSET OF PAIN IN THIRTY-THREE CASES OF PRIMARY LUMBAR IDIOPATHIC SCOLIOSIS

Age at onset of pain (years)	Number of cases
10-19	1
20-29	8
30-39	12
40-49	5
50-59	7
Females 29; males 4	
Youngest 17 years; oldest 57 years	

TABLE VI

EXTENT OF MAJOR CURVE IN THIRTY-THREE CASES OF LUMBAR SCOLIOSIS

Level	Number of cases
T.9 to L.2	2
T.10 to L.3	4
T.11 to L.3	7
T.12 to L.3	13
L.1 to L.3	3
L.1 to L.4	3
L.2 to L.4	1

TABLE V

ANALYSIS OF MAJOR CURVE IN THIRTY-THREE CASES OF LUMBAR SCOLIOSIS

Apical vertebra	Number of cases
T.12	1
T.12 and L.1	3
L.1	8
L.1 and L.2	5
L.2	12
L.2 and L.3	3
L.3 and L.4	1
L.1 and L.2 involved in 31 cases	
Right curves 18; left curves 15	

TABLE VII

SEVERITY OF CURVE IN THIRTY-THREE CASES OF LUMBAR SCOLIOSIS

Greatest major curvature	. 80° supine
Average major curvature	. 41° supine
Rotation: moderate	. 7 cases
severe	. 22 cases
very severe	. 4 cases

correction and fusion and even in its severest forms it is not very ugly. Figures 12 and 13 illustrate the typical pattern. A feature of this type of scoliosis to which reference has not been found in the literature is that it frequently becomes painful. Of 353 patients with all types of scoliosis, sixty-nine complained of some pain; in fifty-nine of these the scoliosis was idiopathic. And of those patients with painful scoliosis no less than thirty-three had the primary curve in the lumbar region, and yet it is an unusual pattern, accounting for only 23.6 per cent of idiopathic scoliosis (Ponseti and Friedman 1950). All cases in which the



FIG. 12



FIG. 13

Figure 12—Radiograph of a girl aged seventeen years with a typical lumbar scoliosis. Figure 13—The photograph shows minimal deformity; the appearance is not very much worse even when the curvature is severe.

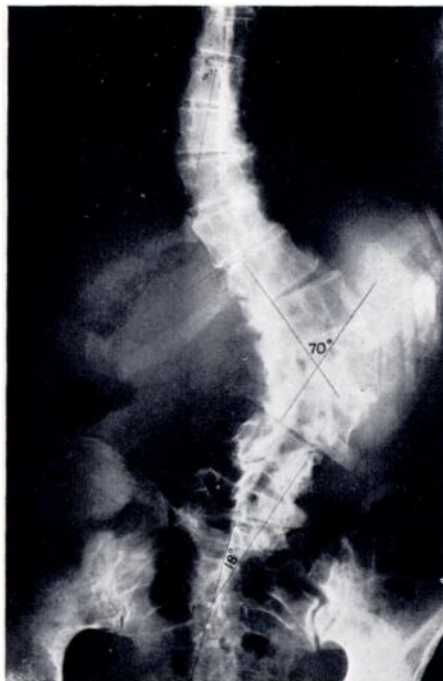


FIG. 14



FIG. 15

A woman aged fifty years who complained of backache. The radiograph (Fig. 14) shows a 70 degrees lumbar curve; there is marked osteoarthritis of the posterior joints. The photograph (Fig. 15) shows only slight deformity but illustrates the characteristic rigid back when osteoarthritis has supervened.

pain was severe were of this type. Pain usually becomes noticeable towards middle age (Table IV). It is an aching pain localised over the area of rotated vertebrae in the lumbar region. In seven cases the pain radiated to the legs, but straight leg raising was normal and peripheral nerve changes absent. Radiographs show a curve with the apex at L.1 or 2 and marked osteoarthritis of the posterior intervertebral joints, which are presumably the seat of the pain (Figs. 14 and 15). Movement was limited in all except five patients. The curve was to the right in eighteen patients, to the left in fifteen (Table V). It consisted of a short major lumbar curve with a small compensatory curve usually at L.4 and L.5, and a J-shaped compensatory curve above (Tables VI and VII).

Osteoarthritis was evident on radiographic examination in twenty-six cases out of thirty-three and disc degeneration in seventeen. Occasionally, because of the extreme rotation at the junction of the middle and lower curves, there was an apparent "shift."

**Treatment**—Corsets have usually relieved the pain; so far only one patient has required fusion.

**Comment**—It is interesting that in the quadruple pattern of scoliosis, with two major curves, the lower being lumbar, pain has been noticed a few times in the lower curve. Moreover, painful osteoarthritis has been observed in patients with primary thoraco-lumbar curves. Two patients with congenital scoliosis, with a pattern similar to these lumbar curves, have attended because of pain. It seems therefore that when the primary curve is in the lumbar region there is a particular liability to pain from secondary osteoarthritis.

#### SUMMARY

Infantile idiopathic scoliosis is a structural scoliosis seen in infants, usually boys, with the major curve to the left in almost all cases, and almost invariably in the mid- or lower thoracic region. It occasionally disappears, but in general the curve tends to increase. In the absence of any discoverable etiology it is termed "idiopathic" and it is believed not to differ in essentials from the more common adolescent scoliosis.

Lumbar idiopathic scoliosis has a good prognosis as to deformity, but leads more often than any other curvature to degenerative arthritis and pain in later life.

I wish to acknowledge the help I have received from members of the staff of the Royal National Orthopaedic Hospital who have referred cases to the scoliosis clinic. I am also grateful to many surgeons from other hospitals who have generously referred cases, and to Mr Eric Lloyd for allowing me to see radiographs of some of his cases. Finally I would like to thank Dr John Cobb, of the Hospital for Special Surgery, New York, for stimulating my interest in scoliosis: he is a skilful teacher and an enthusiast.

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