Acta orthop. scand. *48*, 177–180, 1977

PREVALENCE OF ADOLESCENT IDIOPATHIC SCOLIOSIS IN HUNGARY

Á. BELLYEI, A. CZEIZEL, O. BARTA, T. MAGDA & L. MOLNÁR

Department of Orthopaedics, University of Medical Sciences, Pécs, Laboratory of Human Genetics, National Institute of Hygiene, Budapest and Tuberculosis Dispensary Department, Dombóvár, Hungary.

The prevalence of AIS was studied by examining 22,624 microfilms and obtaining additional clinical and radiological information in 201 out of 223 selected cases. In our material the total prevalence of scoliosis was 8.8–9.7 per thousand, whereas the prevalence of AIS was 5.1–5.4. Considering only AIS over 10° the prevalence was 2.91 per thousand.

Key words: idiopathic scoliosis; prevalence

Accepted 2.i.77

According to the age at onset, the sex, the type and location of the curve and the prognosis three groups of idiopathic scoliosis (i) infantile, (ii) juvenile and (iii) adolescent can be distinguished (Beals 1973, James 1973, Mau 1972, Wynne-Davies 1968, 1975). Our study gives an account of the prevalence of adolescent idiopathic scoliosis (AIS) in Hungary.

MATERIALS AND METHODS

When surveying the prevalence of scoliosis at least five methodological aspects have to be taken into account:

1. *Definition of AIS.* AIS can be defined as a stable, more or less fixed, progressive curve of the spine accompanied by a rotation around the vertical axis of the vertebrae and a torsion in the horizontal plane, occurring between the ages of 10 and 14, predominantly (90 per cent) on the right side and mostly in girls.

2. *Age.* As AIS generally appears at 10–14 years of age only those over 14 years were examined.

3. *Definition of the sample.* A series of fluorograms (microfilms) taken during routine X-ray screening were used. (i) The examinations were obligatory; therefore, the requirement of completeness was fulfilled appropriately; (ii) The X-ray screening did not entail any selection for scoliosis; (iii) Microfilm seemed to be adequate for diagnosing scoliosis.

4. *Number of elements in the sample.* Taking into consideration the prevalence of scoliosis reported in the literature, 2–6 per thousand (Table 1), about 20,000 was set as the number of elements so that 2 S.D. falls below 20 per cent.

5. *Method of examination.* After a screening based on microfilms, an exact diagnosis using full-size radiography was made in each of the selected cases.

In 1974–75, 22,624 microfilms from a definite geographical and administrative area (Dombóvár district) were examined. They had been taken in 1971 as part of the continual X-ray screening which has been carried out for those over the age of 14 in Hungary, since 1961. So not less than four, but in some cases 14 microfilms, could be examined in 11,450 females and 11,174 males. Comparing the microfilms of good quality showing the upper part of the lumbal spine we were able to eliminate several technical mistakes and in many cases to recognize the progress of scoliosis.

The examination was carried out in several stages: (i) The phthisiologist selected cases with the slightest signs of scoliosis or any other defects.

Table 1. The prevalence of adolescent idiopathic scoliosis

Authors	Year	Country	Definition	Age	Sample
Shands & Eisberg	1955	USA	AIS	14	representative
Lettow	1965	Democratic Republic of Germany	IS	0–18	representative
Wynne-Davies	1968	Scotland	AIS	10–18	representative
Kane & Moe	1970	USA	AIS	14	hospital
Filho & Thompson	1971	Canada	AIS	?	hospital
Our material	1975	Hungary	AIS	14	representative

(ii) The microfilms of 413 selected cases were looked through by two orthopaedists independently (in order to eliminate subjectivity) and in 223 cases a distinctly visible curve was found on each microfilm.

(iii) These 223 scoliotic patients were requested to come for radiologic and genetic examinations during the spring of 1975. A total of 204 patients responded (91 per cent); 5 of them had died, and 14 did not appear even after repeated requests.

(iv) A detailed case history was obtained and a clinical examination made. A full-size X-ray exposure of the spine in the standing position was taken for each of the 204 patients. The angle of curvature was determined according to Cobb's method (Neugebauer 1972).

RESULTS AND DISCUSSION

In three of the 204 patients who came for the examination, scoliosis was not found. Thus, based on 201 cases the total prevalence value for scoliosis, in the population of 22,624 individuals over 14 years of age, was 8.8 ± 0.6 per thousand. This figure includes all types of scoliosis. *AIS* occurred in 116 cases, so its prevalence is 5.1 ± 0.5 per thousand. The frequency of the so-called clinical cases (over 10°) was only 2.91 ± 0.35 per thousand (66 cases). These values can only be considered as minimal prevalences since 19 patients were not examined. With only the microfilms available in these cases a diagnosis with a 98.7 per cent level of accuracy could be made; thus 8 of the 19 cases could be regarded as AIS, and 11 as other types of scoliosis. In this way the real prevalence of AIS is 5.4 ± 0.5 per thousand, whereas the total prevalence of scoliosis is 9.7 ± 0.6 per thousand.

It is important from the point of view of evaluating the prevalence values in our survey that curves between 5–10° were also involved. In earlier definitions of occurrence, in nearly all cases only curves over 10° have been taken into account. We did not adhere to this for three reasons: (i) The milder cases are also needed for further genetic survey. (ii) The microfilm plus clinical and X-ray examinations formed a reliable basis for the diagnosis of mild as well as more severe cases. (iii) In judging the progression, knowledge of the initial angle is of great importance.

The prevalence of AIS in our country and in Europe, as well as in North-

(AIS) or idiopathic scoliosis (IS) in different countries.

Number of sample	Method	Number of patients	Prevalence per 1000 persons	Sex ratio
15,000	microfilm + X-ray in selected cases	61	4.0	0.2857
81,248	clinical examination	?	6.4	–
7,894	clinical examination + X-ray in selected cases	17	2.2	0.1429
75,290	X-ray	100	1.3	0.2000
?	X-ray	413	1.8	0.1000
22,624	microfilm + clinical examination + X-ray in selected cases	66 (above 10°)	2.9	0.2941
		116 (all cases)	5.1–5.4	0.4762

Table 2. Type of scoliosis and severity of the curve in 201 scoliotic patients (f=females, m=males).

	5–10° f	5–10° m	11–20° f	11–20° m	21–30° f	21–30° m	31–50° f	31–50° m	51–75° f	51–75° m	over 76° f	over 76° m	Total f	Total m	Grand total No.	Grand total Per cent
Idiopathic	28	22	24	7	8	3	13	3	2	2	4	0	79	37	116	57.6
Congenital	2	6	8	12	1	2	–	–	–	–	1	4	12	24	36	17.6
Sprengel	1	1	5	–	–	–	–	–	–	–	–	–	6	1	7	3.5
Scheuermann	5	3	–	3	1	–	–	–	–	–	–	–	6	6	12	6.0
Osteoporosis	3	2	2	3	–	–	–	–	–	–	–	–	5	5	10	5.0
Rickets	–	1	–	–	1	–	–	–	–	–	2	–	3	1	4	2.0
Statical	3	5	1	1	–	–	–	–	–	–	–	–	4	6	10	5.0
Poliomyelitis	–	–	–	–	–	1	–	–	–	–	1	–	1	1	2	1.0
Recklinghausen	1	–	–	–	–	–	–	–	–	–	–	–	1	–	1	0.5
Bechterew	–	1	–	–	–	–	–	–	–	–	–	–	–	1	1	0.5
Cerebral palsy	–	–	–	1	–	–	–	–	–	–	–	–	–	1	1	0.5
Spondylitis tuberculosis	–	–	–	–	1	–	–	–	–	–	–	–	1	–	1	0.5
Total	43	41	40	27	12	6	13	3	2	2	8	4	118	83	201	100.0

America (only data from these continents are at present available) is almost the same (Table 1).

The type of scoliosis and the severity of the curve was determined by clinical and radiological examination in the 201 scoliotic patients (Table 2). They were divided into six groups according to the angle of the curve (as given by Cobb) (Table 2). Among curves over 30° only AIS (24 cases), congenital scoliosis (5 cases), scoliosis caused by rickets (2 cases) and paralytic scoliosis (1 case) were represented.

In the population examined there were slightly more females than males; ratio 1:1.02. Among the 201 cases of scoliosis the proportion of females was somewhat,

though not significantly, higher (1:1.4). In AIS, however, the female predominance became marked (1:2.1) and it increased proportionally with the severity of the curve (over 10°, the male:female ratio was 1:3.4).

REFERENCES

Beals, R. K. (1973) Nosologic and genetic aspects of scoliosis. *Clin. Orthop.* **93**, 23–32.

Filho, N. A. & Thompson, N. W. (1971) Genetic studies in scoliosis. *J. Bone Jt Surg.* **53**-A, 199.

James, J. I. P. (1973) The etiology of idiopathic scoliosis. *Israel. J. med. Sci.* **9**, 705–710.

Kane, W. J. & Moe, J. H. (1970) A scoliosis-prevalence survey in Minnesota. *Clin. Orthop.* **69**, 216–218.

Lettow, F. (1965) Probleme der Atiologie und Therapie der idiopatischen Skoliose. *Beitr. Orthop.* **12**, 385–394.

Mau, H. (1972) Etiology of idiopathic infantile scoliosis. *Reconstruct. Surg. Traum.* **13**, 184–190.

Neugebauer, H. (1972) Cobb oder Ferguson. Eine Analyse der beiden gebräuchlichsten Röntgenmessmethoden von Skoliosen. *Z. Orthop.* **110**, 342–356.

Shands, A. R. & Eisberg, H. B. (1955) The incidence of scoliosis in the state of Delaware: A study of 50,000 minifilms of the chest made during a survey for tuberculosis. *J. Bone Jt Surg.* **37**-A, 1243–1249.

Wynne-Davies, R. (1968) Familial (idiopathic) scoliosis. A family survey. *J. Bone Jt Surg.* **50**-B, 24–30.

Wynne-Davies, R. (1975) Infantile idiopathic scoliosis. *J. Bone Jt Surg.* **57**-B, 138–141.

Correspondence to: Dr. Árpád Bellyei, Department of Orthopaedics, H–7643, Pécs, Ifjuság utja 31, Hungary.