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A LONG TERM FOLLOW-UP STUDY OF NON-TREATED SCOLIOSIS

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It is a well known fact, that severe lateral curvature of the spine causes respiratory disturbances and an overload of the lung and the heart (1, 2, 5, 9, 10, 17, 20). Reports have been published on the effect in the respiratory volume in scoliotic patients and it has been said that curvatures about 50° to 60° will cause considerable lowering of the vital capacity in these patients (6, 7, 8, 14). Other reports have been published on the indirect effect on the heart (2, 5, 10). Thus we know that a lateral curvature will decrease the vital capacity, but very few papers have been published on the life expectancy in these patients.

In large autopsy materials severe scolioses have been found in 0.5 per cent (20). In such studies the mean age at death (30–50 years) for corpses with lateral curvatures of their spines has been found to be lower than for the average population, especially if these curves were known to have started adolescence (5, 17, 20). In a communication of a 50-year follow up on 113 cases of idiopathic scolioses who were seen 1913–1918 in Stockholm, *Nilsonne & Lundgren* (15) reported a 100 per cent increase in mortality compared to people born in the year 1900.

Previous follow-up studies have been concerned mainly with the result of different types of non-operative and operative treatment. These, however, cover only a limited period of time up to the end of the growth period of the patients, (3, 4, 11, 13, 16, 18, 19, 22). While the results of non-operative treatment have been very discouraging with the exception of the Milwaukee-brace (3, 4), opinions differ with regard to the result of the operative treatment. It is obvious, however, from the latest reports, that more and more drastic measures have been adopted in order to achieve and secure a straight spine (11, 12, 19, 22). Wedge resections of vertebral bodies and different kinds of internal

supports have been advocated. Today the operative treatment of scoliosis is often of great magnitude and mortality has been reported (11).

It would, therefore, be of interest to have a long term follow-up on untreated scoliotic patients with regard to life expectancy and to working capacity. This, of course, is regardless of the cosmetic disability, which always exists.

MATERIAL

This material consists of those patients with a scoliosis who looked for medical advice to the Department of Orthopaedic Surgery in Gothenburg during the years 1927 to 1936.

During these years all patients in the western part of Sweden covering a population of about 1,900,000 people were sent here for orthopaedic advice and it can certainly be said that most of the patients with a lateral curvature of the spine of some magnitude in this region were seen. However, at that time no treatment was advised except occasional stretch exercises.

From the available charts it is impossible to say how bad the curves were but in about 50 per cent of the cases photography of the back was taken. No roentgenograms were made. The possible etiology of the scoliosis and the age when the curve was first noticed are also listed. The curve was regarded as congenital if it was noticed under the age of 1 year. With regard to the purpose of this paper it is considered of relatively minor importance whether it was a definite congenital curve or a structural infantile scoliosis. The miscellaneous group consists of two cases of scoliosis due to tuberculosis of the spine, one case of neuro-fibromatosis and one case of thoracogenic curve.

Table 1. Etiology, sex and direction of main curve in the thoracic or thoracolumbar region in 130 patients.

Curve convex to	Idiopathic		Rachitogenic		Poliomyelitic		Congenital		Miscellaneous	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Right	12	40	3	10	6	10	3	3	1	–
Left	–	7	7	8	2	5	7	2	2	2
	59		28		23		15		5	

In this report only those patients were followed who during the above-mentioned period of time were under the age of 25 years at their first visit. A total of 130 patients fall into this category. It was not possible to differentiate between either the localization or the exact extent of the curves.

It is seen from Table 1 that 75 per cent were women and 25 per cent men. The composition of the material with regard to the different etiological groups, sex and direction of the curve does not differ much from other materials (18, 19, 20, 22).

The average age of the patients at their first visit was 14 years, (1–25 years).

Table 2. Causes of death. 20 patients out of 117.

Age of patient when first seen	Sex	Type of curve according to orig. records	Age at death	Main cause of death
9	♀	idiopathic right sided thoracic	42	Kyphoscoliotic cardiopathy with cor pulmonale
12	♀	poliomyel. right sided thoracic	44	Kyphoscoliotic cardiopathy with cor pulmonale
25	♂	idiopathic right sided thoracic	44	Kyphoscoliotic cardiopathy with cor pulmonale
25	♀	rachitog. right sided thoracic	36	Kyphoscoliotic cardiopathy with cor pulmonale
16	♀	tbc spondylitic left sided thoracic	16	Nephritis
17	♀	idiopathic right sided thoracic	43	Suicide
16	♀	polio right sided thoracic	44	Kyphoscoliotic cardiopathy with cor pulmonale
9	♀	rachitog. right sided thoracic	43	Kyphoscoliotic cardiopathy with cor pulmonale
9	♀	congenital right sided thoracic	30	Kyphoscoliotic cardiopathy with cor pulmonale
15	♂	rachitog. right sided thoracic	24	Kyphoscoliotic cardiopathy with cor pulmonale
12	♀	rachitog. left sided thoracic	40	Kyphoscoliotic cardiopathy with cor pulmonale
13	♀	idiopathic left sided thoracic	24	Uremia
20	♂	polio right sided thoracic	34	Kyphoscoliotic cardiopathy with cor pulmonale
11	♀	congenital left sided cervicodorsal	44	Kyphoscoliotic cardiopathy with cor pulmonale

Table 2 (cont.)

Age of patient when first seen	Sex	Type of curve according to orig. records	Age at death	Main cause of death
1	♀	congenital left sided thoracic	23	Kyphoscoliotic cardiopathy with cor pulmonale
17	♀	neurogen. left sided thoracic	46	Carcinoma of the uterus
25	♂	rachitic right sided thoracic	45	Kyphoscoliotic cardiopathy with cor pulmonale
15	♀	idiopathic right sided thoracic	50	Kyphoscoliotic cardiopathy with cor pulmonale
16	♀	congenital right sided thoracic	46	Kyphoscoliotic cardiopathy with cor pulmonale
12	♀	polio left sided thoracic	28	Kyphoscoliotic cardiopathy with cor pulmonale

RESULT OF THE FOLLOW-UP IN 1966

It was possible to trace a total of 117 patients. Of these, 20 were dead, as listed in Table 2. It can be seen that 16 of these died from cardiopulmonary diseases probably related to the lateral curvature of the spine.

A statistical analysis was made to show the number of deaths in an average Swedish population with the same age and sex distribution as the present material. The number of expected deaths in such a material was 10,4.

The observed number in this material was 20. This obviously is a statistically significant increase.

When the material was divided into etiological groups as in Table 3 it was also found that the number of deaths in the two groups "congenital" and "miscellaneous" were significantly raised in comparison with the idiopathic group.

Those 97 patients that were still alive and were located all replied to a questionnaire where they had to state:

1. Whether they regarded the curve as increased or unaltered since their first visit.
2. If they claimed any disability compensation.
3. If they at the present time or previously had had any serious heart or lung trouble or used any constant medication.
4. What kind of work they performed.
5. Long standing periods of back-ache.
6. Constant use of corset or brace.

Table 3. Number of patients deceased and greatly disabled in the different etiological groups. Follow-up results in 117 patients.

	Idiopatic	Rachitogenic	Poliomyelitic	Congenital	Miscellaneous
No. of patients traced	52	27	21	13	4
No. of patients deceased	5	5	4	4	2
No. of patients receiving disability compensation (Disabled to 75% or more)	10	7	5	5	1
(% deceased and disabled in each group	15 (29%)	12 (45%)	9 (43%)	9 (70%)	3 (75%)

If anything was unclear in the answer from the patients, they were again questioned specifically either by letter or over the telephone. In 12 cases the patients were examined by the author.

1. With regard to the first question it was found that all the patients answering the follow-up who belonged to the congenital or miscellaneous group had increased their curves while in the other groups this was an inconstant finding irrespective of whether the curve was detected before the age of 16 or after that age. (Table 4). It should be mentioned, however, that about 50 per cent of the patients who were first seen at the age of 16 or later claimed that their curves had progressed.

2. In this material a total number of 28 patients (30 per cent) claimed disability compensation which in Sweden during the actual period of

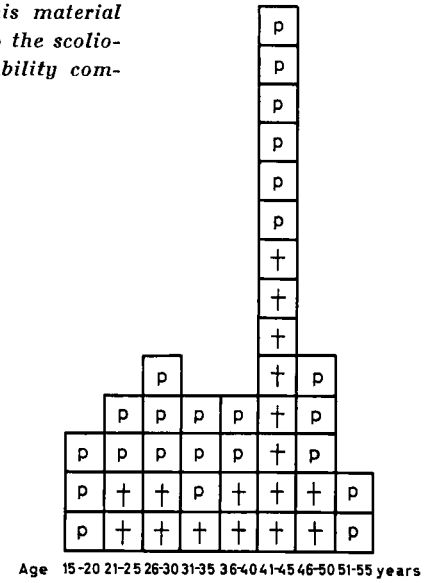

Figure 1. Age when the patients in this material died from causes directly attributable to the scoliosis (†)or when they first received disability compensation, (p).

Table 4. Subjective impression of increase of curve at follow-up in 97 patients.

	Idiopatic		Rachitogenic		Poliomyelitic		Congenital		Miscellaneous	
No. of patients traced	47		22		17		9		2	
Age of first visit	increase	no incr.	increase	no incr.	increase	no incr.	increase	no incr.	increase	no incr.
< 16 y.	13	10	9	5	7	5	8	0	2	0
≥ 16 y.	12	12	2	6	2	3	1	0	0	0

time meant that they were regarded as having at least a reduction of ⅔ of the normal working capacity.

Four of these received their compensation from other causes than those attributable to the scoliosis, such as imbecility (2 patients) and severe poliomyelitis affecting also the lower extremities (2 patients).

When the lateral curvature of the spine or diseases attributable to this deformity were the cause of the working incapacity the average age at which this was claimed was at 36 years (16–51 y) Figure 1.

3. Another 15 patients reported serious heart and lung troubles and 10 of these were on constant medication with digitalis or similar drugs.

4. Of those engaged in full time work, 48 had some kind of light occupation while 21 were in medium hard work. No one was occupied in hard manual labour.

5. Pain in the back was a relatively constant finding in 39 of the 97 patients and this symptom was found in about the same percentage in all the different etiological groups.

6. Only 24 patients used a brace or corset of any kind.

DISCUSSION

This follow-up study on 117 patients with lateral curvature of the spine shows that the deformity, irrespective of what its cause might be, is a very serious one. It confirms that a severe scoliosis causes grave disturbance in the function of the lungs and the heart.

The original material consisted of 130 patients but 13 of these could not be traced. With regard to age, sex and type of scoliosis this group did not differ from the rest of the material and the outcome of these patients, with all probability, will not alter the conclusions presented.

From the results it is shown that this group of patients suffered from nearly 100 per cent increased mortality as compared to the general population. It should be emphasized that the present material also comprises a number of less severe curves but as previously mentioned it was impossible from the available charts to draw any conclusion regarding the severity of the curve, since no roentgenograms were made. It can only be said that in the group of 97 surviving patients contacted, the curve was noted to be minor in 12. In none of the charts of the deceased could this statement be found. Thus with all probability the mortality rate of a severe scoliosis (80° or more) is well over 100 per cent compared to the average population.

This is also supported by the fact that the highest mortality rate was found in the groups "congenital" and "miscellaneous". Such curves are known to progress to very severe ones in most cases. (13, 19). Table 3.

The decreased ability to perform ordinary work of these patients is seen from the number claiming disability compensation. 24 of the 28 patients not working blamed their incapacity on their scoliosis or related diseases.

A comparison can be made with an investigation performed in 1963 on 973 men in Göteborg born in the year 1913. Of these 23 (2.5 per cent) claimed disability compensation, 13 of those on psychiatric grounds. Of the remaining 950 men, one third was occupied in heavy labour, one third in medium hard work and one third had some kind of collar work. (21).

In the present group of 97 patients that was followed there were 32 men who were seen or contacted at the average age of 48 years. Of these, 7 could not perform any work at all (22 per cent), while 15 (60 per cent) were engaged in collar work and 10 (40 per cent) had a medium hard work. No one was occupied in heavy labour.

Thus it is clear that lateral curvature of the spine also reduces the working capacity to a very great extent.

Pain in the back was a relatively constant symptom in 39 of the 97 patients followed. This is probably due to the severe degree of osteoarthritic changes that always will occur in these patients. Two patients reported constant severe disabling pain.

Only 25 of the 97 patients reported a constant use of brace or corset in spite of the fact that these are given to the patients at no expense in Sweden.

The follow-up results obtained in the twelve patients who were examined by the author are included in the above presentation. In three of these patients roentgenograms revealed a primary lumbar curve.

It is known that those with low thoracolumbar or lumbar curves will be less disabled from cardio-pulmonar insufficiency (7, 20). Unfortunately it was not possible to differentiate the exact extent and site of the primary curve from the charts available. It is probable, however, that in the number of patients surviving without disability, a relatively high proportion of primary lumbar curves is to be found.

It is thus likely that the increased rate of mortality in patients with a cervico-dorsal or dorsal scoliosis of some severity will be higher than the 100 per cent found in this general material.

SUMMARY

This long term follow-up of non-treated scoliotic patients was done to evaluate the disability and eventual increased mortality rate, that could be suspected from our knowledge of the pulmonary and cardiac distress that develops in some of these patients. Of the 130 patients who were seen in the department from 1927–1936, 117 could be traced. Of these 20 were deceased. In a similar group of the general population the number of expected deaths were 10.4. 16 of the patients in this material died from kyphoscoliotic cardiopathy with cor pulmonale.

With regard to the etiology of the lateral curve the congenital, thoracogenic and neurogenic ones were found to have a worse prognosis than the idiopathic, rachitogenic and poliomyelitic scoliosis.

In 39 out of 97 patients, pain in the back was noted as a commonly occurring symptom.

RESUME

Cet examen à long terme chez des malades scoliotiques qui n'ont pas subi de traitement a été effectué pour juger de leur incapacité de travail et éventuellement du taux plus élevé de mortalité, que l'on pouvait soupçonner en partant des connaissances que nous avons des troubles pulmonaires et cardiaques qui se développent chez certains de ces malades. Il a été possible de retrouver la trace de 117 des 130 malades observés dans notre Département entre 1927 et 1936. 20 d'entre eux étaient décédés. Dans un groupe correspondant de la population générale, le nombre des décès aurait vraisemblablement été de 10,4. 16 des malades appartenant à ce matériel sont décédés de cardiopathie cyphoscoliotique avec coeur pulmonaire. En ce qui concerne la capacité de travail, il a été constaté que celle-ci était fortement diminuée par comparaison avec la population générale.

Par rapport à l'étiologie de la courbure latérale, on a constaté que les formes congénitales, thoracogéniques et neurogéniques ont un pronostic plus favorable que les scolioses idiopathiques, rachitogéniques et poliomyélitiques.

Chez 39 des 97 malades, des douleurs dorsales ont été observées comme un symptôme très courant.

ZUSAMMENFASSSUNG

Diese Langfristuntersuchung von nicht behandelten skoliotischen Patienten wurde ausgeführt, um die Invaliditet und möglicherweise erhöhte Sterblichkeit zu bewerten, die man von unserem Wissen hinsichtlich der pulmonalen und kardinalen Schwierigkeiten, die sich bei einigen dieser Patienten entwickeln, vermuten konnte. Von den 130 Patienten, die an der Abteilung von 1927–1936 gesehen worden waren, konnten 117 verfolgt werden. Von diesen waren 20 gestorben. In einer gleichen Gruppe der allgemeinen Bevölkerung ist die Zahl der erwarteten Todesfälle 10,4. 16 der Patienten in diesem Materiale starben an kyphoskoliotischer Cardiopathie mit einem cor pulmonale. Hinsichtlich der Arbeitsfähigkeit fandt man, dass diese im Verhältnis zur allgemeinen Bevölkerung sehr herabgesetzt war.

Hinsichtlich der Ätiologie der lateralen Kurve wurde gefunden, dass die kongenitalen, thorakogenen und neurogenen Skoliosen eine schlech-

tere Prognose haben als die idiopathischen, rachitogenen oder poliomyelitischen.

Bei 39 von 97 Patienten wurden Rückenschmerzen als ein gewöhnlich vorkommendes Symptom beobachtet.

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