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INCREASED SPINAL MOBILITY IN ADOLESCENTS WITH BRONCHIAL ASTHMA

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ABSTRACT. **Spinal mobility was measured in thirty-five adolescents (21 boys and 14 girls) with bronchial asthma. Comparisons were carried out with an equal number of healthy controls matched for sex, age, weight, and height. Thoracic spinal movements of rotation and lateral flexion in girls and of rotation in boys were significantly greater in asthmatics as were the sagittal lumbar movements with the exception of forward flexion in the boys. Sagittal spinal curvatures of the asthmatics did not significantly differ from those of the controls. The results indicate that there are no need of explicit mobilization of thoracic spine in asthmatic children.**

Key words: **adolescents, bronchial asthma, spinal mobility, curvatures.**

Breathing involves anteroposterior movements of the chest cage and movements of the diaphragm (1). The ribs take part in both movements (3) and because each rib articulates with two adjacent vertebrae a relationship between lung function and thoracic spinal movements is possible. In fact, forward and lateral flexion of the thoracic spine has been found to correlate with lung function in adults (7).

Asthmatic children are prone to tension of respiratory muscles, faulty posture, and chest deformities causing a thorax with restricted mobility (4, 9). In the treatment, relaxation and training of muscles as well as mobilization of thoracic stuctures for the purpose of reducing breathing work have been proposed (2, 9).

Tha aim of the present study was to explore if asthmatic adolescents show changes in spinal mobility and posture which should need therapeutical attention.

SUBJECTS AND METHODS

Subjects

The study subjects (21 boys and 14 girls) were chosen from among adolescents (age 12–16) taking part in a one-week summer course for asthmatics. Tables I–III give data on these subjects. Most of them had suffered from asthma for several years (Table II). Table III presents the frequency of asthma attacks during the past year and the drugs used daily in each frequency group. At the time of the study all except two boys and one girl took medicines daily. 71% of the boys and 57% of the girls used more than one drug daily.

Controls were chosen from among a greater population of adolescents who had passed the same measurements of spinal mobility. Each control subject was chosen to match for one asthmatic as closely as possible regarding sex, age, height, and weight.

Methods and statistical analyses

Anamnestic data were collected from questionnaires and interviews. Age was calculated with an accuracy of months.

Spinal mobility and curvatures were measured by goniometric technics using inclinometers and a compass applied to auxiliary tools. Flexion and extension are given as maximum curvatures during the bendings. The methods have been described previously (5, 6).

Statistical significance of differences between the means of the study groups was calculated with the *t*-test for unmatched groups. The effects of drugs, duration of disease, and frequence of attacks on spinal mobility in the subgroups of asthmatics were analyzed by using the *t*-test for unmatched groups and one-way analysis of variance.

RESULTS

The means of kyphosis and lordosis showed no statistically significant differences between asthmatics and controls (Table I).

The mobility of the thoracic spine in the study groups is shown in Table IV. Rotation and lateral flexion in girls and rotation in boys were significantly greater in asthmatics. Of the measurements of the lumbar spine (Table V), all sagittal movements except flexion of the boys were significantly greater in the asthmatics compared to the controls.

Fig. 1 shows the thoracic rotation and lumbar flexion in relation to the duration of asthma and the use of corticosteroids. The figure indicates greater mobility in asthmatics with a disease history of 7 years or more, which was statistically significant ($p<0.05$). Boys using corticosteroids had larger ($p<0.05$) thoracic rotation. But otherwise amounts

Table I. *Data on the study subjects*

p=statistical significance between the means of asthmatics and controls

	Boys					Girls				
	Asthmatics n=21		Controls n=21			Asthmatics n=14		Controls n=14		
	M	SD	M	SD	p	M	SD	M	SD	p
Age (years)	14.2	1.1	14.0	1.3	NS	14.3	1.2	14.3	1.2	NS
Height (cm)	159.7	10.2	160.5	11.5	NS	160.8	8.3	161.4	6.6	NS
Weight (kg)	50.4	10.7	48.6	10.4	NS	51.0	8.7	51.6	9.5	NS
Lordosis (degrees)	29.7	6.5	28.0	8.1	NS	26.9	6.3	27.3	6.4	NS
Kyphosis (degrees)	36.5	9.4	39.5	11.8	NS	38.4	10.5	32.9	8.4	NS

Table II. *Duration of asthma*

	Boys	Girls
≥7 years	12	8
6–3 years	4	5
≤2 years	5	1

and kinds of medicines as well as frequences of asthma attacks had no significant effects on spinal mobility in the asthmatics.

DISCUSSION

The number of subjects is quite small, but matched controls and similar outcome in boys and girls strengthen the relevance of the results. As to their age the subjects were in different pubertal phases, which may affect spinal mobility (8), but matching of the controls counteracts these effects on the results.

According to this study, there is no restriction of thoracic spinal mobility in adolescents with asthma. There was no significant disposition to deviation of sagittal curvatures in the asthmatics, either. There is thus no indication for explicit mobilization of the thoracic spine in asthmatic children.

Greater spinal mobility in the asthmatics was a surprising result. It could be due to, though it seems unlikely, more physical exercises including breathing exercises and chest physical therapy. This hypothetical correlation has, however, not been studied.

In contrast to the controls, the asthmatics were examined in the summer, but this and the small amount of physical exercises during the short courses are unlikely to explain differences between

Table III. *Frequency of asthma attacks during the past year*

Number of subjects in each group (N) and their daily use of drugs. 1 = chromones, 2 = sympathomimetics, 3 = corticosteroids, 4 = methylxanthines

	Boys					Girls				
		Drugs					Drugs			
	N	1	2	3	4	N	1	2	3	4
Every week	9	3	6	6	2	5	3	3	2	1
1–3 times a month	5	2	3	2	0	5	3	1	3	1
2–11 times a year	5	3	2	1	2	2	0	1	1	1
0–1 time a year	2	2	0	1	1	2	2	0	0	0
Total	21	10	11	10	5	14	8	5	6	3

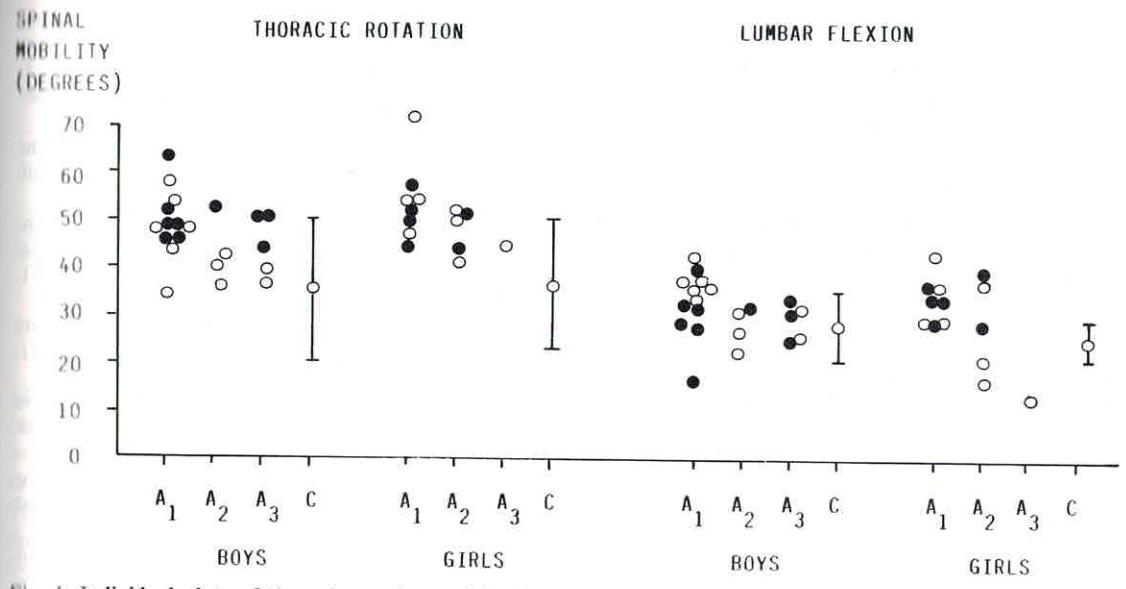

Fig. 1. Individual plots of thoracic rotation and lumbar flexion of asthmatics grouped according to the duration of disease (A 1≥7 years, A 2=6–3 years, A 3≤2 years) and daily use of corticosteroids (● = user, ○ = nonuser). Means and standard deviations of controls (C) indicated ($\overline{\underline{\top}}$).

Table IV. *Mobility (degrees) of thoracic spine in adolescent boys and girls with asthma and in controls*
Statistical significance between the means of asthmatics and controls (*p*)

	Boys					Girls				
	Asthmatics		Controls			Asthmatics		Controls		
	M	SD	M	SD	*p*	M	SD	M	SD	*p*
Flexion	64.4	7.2	69.9	9.4	NS	65.9	10.4	62.9	9.3	NS
Extension[a]	−1.0	12.7	−4.4	14.5	NS	−3.4	11.6	−0.7	12.3	NS
Flexion + extension	63.6	10.3	65.4	14.0	NS	62.4	12.6	62.2	11.4	NS
Lateral flexion	77.4	8.0	77.0	8.4	NS	81.2	7.4	69.0	14.5	<0.02
Rotation	46.6	7.2	35.6	14.2	<0.02	50.9	7.4	36.9	14.0	<0.01

[a] Negative figures mean that ventral concavity of the thoracic spine persisted during extension.

Table V. *Mobility (degrees) of the lumbar spine in adolescent boys and girls with asthma and in controls*
Statistical significance between the means of asthmatics and controls (*p*)

	Boys					Girls				
	Asthmatics		Controls			Asthmatics		Controls		
	M	SD	M	SD	*p*	M	SD	M	SD	*p*
Flexion	31.2	5.9	27.7	7.1	NS	30.5	8.6	26.6	5.7	<0.05
Extension	48.3	7.8	42.0	7.2	<0.02	50.4	7.1	45.2	6.2	<0.02
Flexion + extension	79.5	10.0	69.6	9.4	<0.01	80.9	7.5	71.9	9.9	<0.01
Lateral flexion	40.4	7.8	38.0	7.9	NS	45.4	5.7	42.5	8.2	NS
Rotation	67.4	8.6	71.3	12.6	NS	63.0	12.0	69.5	8.3	NS

the groups. The effects of different drugs in present use did not explain greater spinal mobility of the asthmatics, either.

One factor of importance for the increased spinal mobility in asthmatic adolescents might be the long-term effect of the disease during growth: asthmatic breathing may make use of compensatory chest and spinal movements also including those of the upper lumbar spine. In addition, increased laxity of joints and connective tissue in asthmatics may be connected with decreased physical activity or long-term use of medicines, especially corticosteroids.

A bold hypothesis would be that increased general elasticity of connective tissue is associated with susceptibility to bronchial asthma. The airways could be supposed to obstruct more easily if the supporting connective tissue of their walls is more elastic.

Even if this study did not find the cause of the increased spinal mobility in asthmatic adolescents, it contradicts the hypothesis of a tendency for spinal stiffness in children with bronchial asthma.

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REFERENCES

1. Guyton, A. C.: Textbook of Medical Physiology, pp. 516–520. W. B. Saunders Company, Philadelphia, 1982.
2. Helmholz, H. F. Jr & Stonnington, H. H.: Rehabilitation for respiratory dysfunction. *In* Krusen's Handbook of Physical Medicine and Rehabilitation (ed F. J. Kottke, G. K. Stillwell & J. F. Lehmann), pp. 771–786. W. B. Saunders Company, 1982.
3. Kampandji, I. A.: The physiology of joints. Vol 3. The trunk and vertebral column, pp. 128–146. Churchill Livingstone, Edinburgh, 1980.
4. McNicol, K. N., Williams, H. B., Allan, J. & McAndrew, I.: Spectrum of asthma in children. I. Clinical and physiological components. Br Med J *IV:* 7–11, 1973.
5. Mellin, G.: Measurement of thoracolumbar posture and mobility using a Myrin inclinometer. Spine *11:* 759–762, 1986.
6. Mellin, G.: Method and instrument for noninvasive measurements of thoracolumbar rotation. Spine *12:* 28–31, 1987.
7. Mellin, G. & Harjula, R.: Lung function in relation to thoracic spinal mobility and kyphosis. Scand J Rehab Med *19:* 89–92, 1987.
8. Mellin, G., Härkönen, H. & Poussa, M.: Spinal mobility and posture and their correlations with growth velocity in structurally normal boys and girls aged 13 to 14. Spine *13:* 152–154, 1988.
9. Tecklin, J. S.: Physical therapy for children with chronic lung disease. Phys Ther *61:* 1774–1782, 1981.

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