

The Effect of Adolescent Idiopathic Scoliosis on the Occurrence of Varicose Veins on Lower Extremities

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ABSTRACT

Introduction: Scoliosis is a complex three-dimensional spine deformity with the frontal plane deflexion (side-shift) of the series of vertebra from the midline and with torque deformity of vertebra, ribs, and the entire trunk towards the apex of curve. Chronic venous diseases present a group of pathological conditions caused by the increased venous pressure. The venous pressure may be increased due to genetics, ligament laxity, general obesity, injuries, and changes in biomechanics of spine and lower extremities, etc. **Aim:** The aim of the study is to evaluate the frequency of the varicose veins in women previously treated for the adolescent idiopathic scoliosis. **Material and methods:** In the period August 1, 2015 - December 30, 2015 the Team for scoliosis in the Institute for the Physical medicine and Rehabilitation „Dr Miroslav Zotović“ in Banja Luka in study program has clinically assessed 89 women previously treated for the adolescent idiopathic scoliosis (AIS) and the control group of 87 women without history of scoliosis. **Results:** Results of the study led to conclusion that occurrence of the varicose veins was more frequent in the group of women who were treated for the AIS (23/89 or 25.8%) in comparison with control group with no history of AIS (7/87 or 8.1%). **Conclusion:** This might relate AIS with some other connective tissue disorder, like venous varices, for instance.

Keywords: adolescent idiopathic scoliosis, varices, veins, risk.

1. INTRODUCTION

Spinal deformities present 27.5% of all deformities of the locomotor apparatus (1, 2). Scoliosis, the most common type of spinal deformity is a complex three-dimensional spine deformity with the frontal plane deflexion (side-shift) of the series of vertebra from the midline line and with torque deformity of vertebra, ribs and the entire trunk towards the apex of curve (1). This disorder of spinal growth has usually its onset between 10 and 14 years of age (2). AIS is mainly dextroconvex thoracic scoliosis, less often thoracic lumbar or double thoracic scoliosis, and it is accompanied by thoracic hypokyphosis ($\leq 20^\circ$), four times more common among girls (3-5). Clinical concerns are related to the structural changes of the spine, aesthetic problems, back pain, and the functional cardiovascular disorders (6). Beside scoliosis, 10% of AIS patients have leg discrepancy of 1cm or more (6). Leg discrepancy and pregnancy might lead to the pelvic tilt and increased scoliotic curvature. The body compensates these forces with

the increased mobility of the muscles and ligaments, to a certain degree (7). However, scoliosis can cause the hip deformities, pain in herniated disc, acute rheumatism, and vision problems (7-9).

Chronic venous diseases are a group of pathological conditions caused by the increased venous pressure which leads to progressive stasis and consequent inflammatory and trophic changes in subfascial structures, subcutaneous tissue, and skin (6). Venous ulcers present 80% of ulcers of any etiology localized on lower legs (7). Risk factors for development of the chronic venous disease include: arterial hypertension, heart disease, venous thrombosis, lymphedema, age, genetic predisposition, ligament laxity, general obesity, smoking, sedentary life style, arterial venous shunt, elevated estrogen and pregnancy, injuries and changes in biomechanics of spine and lower extremities (8, 9). Clinical examination of the superficial veins and Color Doppler Scan of deep veins are prerequisites for diagnosis of varicose veins.

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Changed biomechanics of lower legs due to congenital or acquired bone deformity of lower legs and pelvis produces changes in mechanic support for muscles and ligaments for the bone. This further changes the physiological influence of the muscle pump on the blood vessels, primarily venous circulation (10). Scoliosis, pelvic tilt, leg discrepancy, pregnancy might lead to disproportion of biomechanical forces on lower extremities. These bone instabilities, joined with changes in collagen strength and metabolism impact the quality of the connective tissue. In some hereditary pathological conditions the integrity of the matrix proteins in the skin is lost which impacts on blood vessels leading to onset of varicose veins (11), like in AIS (12). Explanation for this statement could be in pathological collagen synthesis in walls of varicose veins. Smooth muscle cells synthesized more collagen I, less collagen III and similar quantities of collagen V. This imbalance is cause of the lower quality of the blood vessel wall (13). Collagen, as the main component of the connective tissue, is a complex protein which provides necessary quality (strength) for skin, tendons and bones. Herniations of pelvic organs and other disorders such as varicose veins and bone instabilities are associated with changes in collagen strength and quality (14).

The aim of the study was to establish the frequency of the varicose veins in women previously treated for the adolescent idiopathic scoliosis.

2. PARTICIPANTS AND METHODS

This study explores the frequency of varicose veins in population of women clinically assessed and previously treated by the Team for scoliosis in the Institute for the Physical medicine and Rehabilitation „Dr Miroslav Zotović“ in Banja Luka. All participants underwent study procedures during the period 1.8.2015 - 30.12.2015. The inclusion criteria were: female, reproductive age, data about type of treatment, and signed informed consent for participation in the study. Study did not include subjects who had scoliosis due to another disorder, trauma, or pregnancy. The control group consisted of women with corresponding age admitted for rehabilitation at the time of the study in the Institute for the Physical medicine and Rehabilitation „Dr Miroslav Zotović“. The reasons for their rehabilitation were other pathological processes on the locomotor system, except idiopathic scoliosis. All control group subjects underwent the same examinations and questions.

Based on reports of the Team for scoliosis, all participants were distributed in three groups, according to the type of treatment:

- Group 1 - participants treated with physical procedures only,
- Group 2 - participants treated with combined physical procedures and spinal braces,
- Group 3 - participants treated surgically.

The assessment of the venous system was done by a physical medicine and rehabilitation specialist, and an angiologist through clinical examination of superficial veins of lower extremities and ultrasound examination. The apparatus LOGIQ P6 PRO was used for ultrasound

examination of venous system. Based on the above, the condition of venous system was presented as:

- Normal condition of venous system - with no changes visible with inspection and ultrasound diagnostics.
- Moderate venous disease - persons with varicose veins visible with inspection without trophic changes and with the ultrasound verified obstruction in superficial net or perforate veins (C2-3 acc. to CEAP Classification) (14, 15).
- Severe venous disease - inspection reveals trophic changes with the ultrasound verified obstruction in deep venous system (C4-6 acc. to CEAP Classification).

Data obtained from this study were stored in the MS Excel 2007 database, and for all statistic analysis, SPSS 17 statistic program was used. Data was processed using the standard statistic methods, both from domain of descriptive statistics and domain of statistical deduction (nonparametric X² test). As statistically significant were taken values where p < 0.05. For calculation of the sample size were used formulas and Cohen nomogram tables. Based on these, it was concluded that valid statistical assessment required minimal sample of 86 participants. The approval of the responsible Ethical Board was obtained for this study.

3. RESULTS

Results were presented though two modalities: descriptive data and data obtained though the statistical deduction tests. Descriptive presentation of study data were shown with descriptive statistical parameters: age, body mass, height for both experimental and control group.

Experimental group (women treated for idiopathic scoliosis) included 89 women, while the control group (women who has never been treated for the idiopathic scoliosis) included 87 women. As presented in the Table 1, average age in the experimental group was 30.9, and in the control group 29.9 years, average height in the experimental group was 168.6 cm, and in the control 169 cm; weight-in experimental group the average was 63.6 kg, while in control group it was 67 kg. The values of these parameters are close and confirm that according to these traits the control group was not statistically significant.

Idiopathic scoliosis	Mean	Mod	Median	SD	Min.	Max.
Age at beginning of treatment *	11.7	12	12	2.9	6	17
Actual age*	30.9	20	34	7.9	20	43
Weight**	63.6	60	62	9.6	45	86
Height***	168.6	164	167	6.5	157	186
Control group	Mean	Mod	Median	SD	Min.	Max.
Actual age*	29.9	27	29	6.7	17	42
Weight**	67	66	66	12.7	43.5	119
Height***	169	169	169	6.2	144	188

Table 1. Descriptive presentation of the observed parameters. *age, **body mass in kilograms, ***height in centimeters

Age at time when diagnosis was established and when the treatment commenced in our study varies between 6

and 17 years (mean = 11.7). This corresponds to the period of the most intense growth so visual and functional deficits become most pronounced. It is also the age when self inspection is most present and most critical. In group of 89 participants with idiopathic scoliosis the treatment was: with physiotherapy (PT) 73 (82%), combined physiotherapy (PT) and brace 14(15.7%) and surgically 2 (2.3 %). In the study sample only two participants had surgical treatment. One participant was treated at age of 9, and the other at age of 15, with satisfactory results.

Results of the study led to conclusion that varicose veins are more common in the experimental group (23/89 or 25.8%) in comparison with the control group (7/87 or 8.1%). With use of the X^2 test the value is $X^2=9.854$; for $df=1$, Asymp. Sig (2 tailed) = $0.002 < 0.01$, so we rejected the hypothesis about the independence of variables and accept the hypothesis that difference is statistically significant ($p<0.01$). There is statistically significant higher frequency of varicose veins in women previously treated for the idiopathic scoliosis.

	Experimental groups (n=89)	Control group (n=87)	Asym. Sig (2tailed)
Varicose veins	23	7	0.002*

Table 2. Varicose veins in experimental an control group. * $X^2 = 9.854$; $df = 1$; ($p<0.01$)

4. DISCUSSION

Body posture and workload significantly impact the occurrence of the varicose veins. Non- physiological loading on joints carries higher risk for development of varicose veins than connective tissue disorders (14). Patients with severe AIS, Lenke tip 1A have shown the restriction of the cardiorespiratory tolerance on maximal exercises, which did not improve, not even two years after the operation. Usually, mild deformities could be corrected with timely therapy and appropriate approach while only a certain percentage requires the additional treatment modalities. The first recommendation is early detection and timely commencement of the conservative treatment which prevent the progression of the curve and complications of the advanced scoliosis.

Whenever needed, the application of brace is usually combined with physiotherapy, in order to prevent the severe deformities and surgical treatment. Watanabe and coworkers have done the examination of 2759 high school students in order to assess the probability of scoliosis development. Beside clinical, radiological examination, the assessment included a questionnaire with 38 questions about demographic and social factors, sport practices, health condition, way they were delivered, etc. (15). Questionnaire was filled out by 2747 (99.6%) respondents. Excluded were high school students with heart conditions, neurological or congenital spine deformities. 2.600 students met criteria of the study. The study shown that AIS was 1.5 time more common in respondents whose mother had scoliosis. Additionally, classical ballet, positive family history and low BMI could be linked with the onset of the AIS (15). Schlösser and coworkers in his survey explores the relationship between organs anatomy and convex spine curvature, with studying the frequency and convexity

of idiopathic scoliosis. With this study he supported hypothesis about correlation between organs anatomy and convexity of the curve in scoliosis. Convexity of the thoracic curve is predominantly on right primary dyskinesia, patients often have total inversion of the thoracic organs (16). AIS over 100° as a rule cause restrictive pulmonary ventilation disorders of various degree while some authors think that idiopathic scoliosis over 70° leads to the irreversible pulmonary damage (5).

5. CONCLUSION

In our study we concluded that there is statistically significant higher frequency of varicose veins in women previously treated for the idiopathic scoliosis. Idiopathic scoliosis should be observed as disorder of the multifactorial etiopathogenesis and should be treated accordingly, especially as it can lead to damage of other organ systems. Modern approach to the treatment of idiopathic scoliosis means the establishment of specialized teams for scoliosis in health facilities which developed expertise for this field.

- Conflict of interest: none declared.

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