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ORIGINAL ARTICLE / ОРИГИНАЛНИ РАД

Factors associated with idiopathic adolescent scoliosis in female population – Preliminary results

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SUMMARY

Introduction/Objective Idiopathic scoliosis (IS) is an orthopedic condition of multifactorial origin. The aim of our study was to evaluate the factors that are associated with IS in female population and factors associated with varicose veins in females with IS.

Methods This retrospective-prospective cross-section study included 89 patients (the study group) and 87 controls. The following parameters were analyzed: body weight, body height, presence and the degree of varicose veins (the first, second, and third degree), and age (group in the range of 17–26 years, in the range of 27–36 years, and in the range of 37–46 years).

Results The study group has significantly lower body weight ($p = 0.046$), significantly higher proportion of varicose veins ($p < 0.001$) compared to controls, significantly lower proportion of patients aged 27–36 years ($p = 0.014$), and significantly higher proportion of patients aged 37–46 years ($p = 0.025$) compared to controls. There is significantly higher proportion of patients in the study group with the first degree of varicose veins ($p = 0.007$). There is weak positive correlation between body weight and body height in the group of patients without varicose veins ($R = 0.456$) and in the group with the second degree of varicose veins ($R = 0.291$), while for the group with the first degree of varicose veins there is moderate positive correlation ($R = 0.543$).

Conclusion Our preliminary findings point out that lower body weight and presence of varicose veins are significantly associated with IS. The group of patients with IS above 37 years of age tends to have significantly higher proportion of varicose veins.

Keywords: idiopathic scoliosis; varicose veins; age; body weight; body height.

INTRODUCTION

Idiopathic scoliosis (IS) is an orthopedic condition that is defined as a pathologic state of multifactorial origin, with a major relevance of those genetic and biomechanical factors that have impacts on the central nervous system, growth and metabolism [1, 2, 3]. The diagnosis is established on the base of clinical examination, radiographic imaging, and stereophotogrammetry. Assessment of patients with scoliosis includes medical history, clinical, physiatrist and neurological examination, and diagnostic tests [4]. Treatment of IS can be conservative and/or surgical.

Previous studies underscored that in certain hereditary pathological conditions, such as IS, the loss of integrity of the matrix proteins in the skin affects blood vessels, so that high incidence of varicose veins ensues [5, 6]. Conditions such as varicose veins and bone fragility are associated with changes in the strength of collagen and changes in metabolizing it [7]. In previous reports, there is insufficient information on the incidence of complications such as varicose veins in women affected with IS, although the theory of the defect in the synthesis of collagen and connective tissue suggests a higher incidence of these complications in the population of women treated for IS. It is unknown to what extent these complications are represented in the aforementioned population in relation to the population of women who are not treated for IS, and if it can even be promptly diagnosed and treated.

Therefore, the aim of our study was to determine the factors that are associated with IS in the female population and factors associated with varicose veins in females with IS.

METHODS

This study was designed as a retrospective-prospective cross-section study that investigated the incidence of varicose veins in the population of women with idiopathic scoliosis, treated at the Clinic for Physical Medicine and Rehabilitation "Dr Miroslav Zotović" in Banja Luka, Republic of Srpska, Bosnia and Herzegovina. The study group included 89 patients, while the control group comprised 87 participants. The

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inclusion criteria were female gender and signed informed consent of participation in the study. The exclusion criteria were secondary scoliosis and pregnancies. Patients from the control group were subjected to the same questions, tests, and examinations.

This study was approved by the relevant ethical committee (Ethics Committee of the Clinic for Physical Medicine and Rehabilitation "Dr Miroslav Zotović", Banja Luka) and followed by the adoption of the necessary documentation – the Notification for Respondents of the Study and Informed Consent. Prior inclusion in the study all participants were informed about study protocol and informed consent was obtained.

Further parameters were analyzed: body weight, body height, presence and degree of varicose veins, and age (groups in the age ranges of 17–26 years, 27–36 years, and 37–46 years).

The examination by the physical medicine specialist included the clinical examination and ultrasound examination of the state of the venous system and was presented as follows: normal state of the venous system (without any observed changes); medium stage expression of the venous disease (varicose veins confirmed by clinical inspection, but without trophic changes; the ultrasonic examination verified obstruction in the superficial system or in the perforated veins (C2–C3 according to Comprehensive Classification System for Chronic Venous Disorders – CEAP – classification)); and severe venous disease (trophic changes observed by inspection and ultrasonic examination verified obstruction of the deep venous system (C4–C6 according to CEAP classification)).

Statistical analysis

Categorical data were presented as whole numbers and percents, while continuous variables as median values with standard deviation and analyzed by SPSS Statistics for Windows, Version 17.0 (SPSS Inc., Chicago, IL, USA). Chi-squared test was used for statistical analysis of categorical data, while Mann–Whitney U-test and Student's t-test for independent samples for analysis of continuous variable. Pearson's correlation was performed to assess the correlation between body height and body weight in the group of patients with IS regarding the presence and the degree of varicose veins. Values with $p < 0.05$ were considered to be statistically significant. The minimal, statistically valid sample size was determined to be 86 subjects according to the Cohen tables.

RESULTS

In Table 1 we present distribution of evaluated parameters in evaluated groups of participants. The study group has significantly lower body weight ($p = 0.046$), and significantly higher proportion of varicose veins ($p < 0.001$) compared to controls (Table 1). The study group has significantly lower proportion of patients aged 27–36 years ($p = 0.014$) and significantly higher proportion of patients aged 37–46 years ($p = 0.025$) compared to controls (Table 1).

In the control group there is significantly higher proportion of participants without varicose veins ($p < 0.001$), and significantly higher proportion of patients in the study group with the first degree of varicose veins ($p = 0.007$) (Table 2).

There is non-significant difference for evaluated variables (age, body weight, and body height) in both the study and the control group with regard to the degree of varicose veins ($p > 0.05$) (Table 2).

In Figure 1, correlations between body height and body weight in patients with idiopathic scoliosis with regard to the presence and degree of varicose veins are presented. There is weak positive correlation between these two variables in the group of patients without varicose veins ($R = 0.456$) and the group with the second degree of varicose veins, ($R = 0.291$), while for the group with the first degree of varicose veins there is moderate positive correlation ($R = 0.543$) (Table 3).

DISCUSSION

This research is based on the theory that bone fragility is associated with changes in the strength of collagen and changes in its metabolism, where one of the crucial factors could be the quality of connective tissue [8]. Disruption in the synthesis of collagen is typical of varicose veins. Smooth muscle cells from varicose veins synthesize more collagen I,

Table 1. Distribution of evaluated parameters in the study group and the control group

Evaluated parameters			Study group (n = 89)	Control group (n = 87)	p-value
Age (years)		MV ± SD	30.9 ± 7.9	29.9 ± 6.7	0.367*
Body weight (kg)			63.6 ± 9.6	67.0 ± 12.7	*0.046**
Body height (cm)			168.6 ± 6.5	169.0 ± 6.2	0.677*
Varicose veins		n (%)	23 (25.8)	7 (8.0)	*0.001***
Age	17–26 years		31 (34.8)	28 (32.2)	0.710**
	27–36 years		26 (29.2)	41 (47.1)	*0.014***
	37–46 years		32 (36.0)	18 (20.7)	*0.025***

*Student's t-test;
**χ^2-test

Table 2. Distribution of varicose veins regarding the severity degree and participants' age between evaluated groups of participants

Varicose veins n (%)		Study group (n = 89)	Control group (n = 87)	p-value
None		66 (74.1)	80 (92.0)	*0.001**
First degree		17 (19.1)	5 (5.7)	*0.007**
Second degree		6 (6.8)	2 (2.3)	0.157*
Third degree		0 (0)	0 (0)	-
Participants with varicose veins				
Age	17–26 years	2 (8.7)	0 (0)	0.419*
	27–36 years	7 (30.4)	4 (57.0)	0.199*
	37–46 years	14 (60.9)	3 (43.0)	0.400*

*χ^2-test

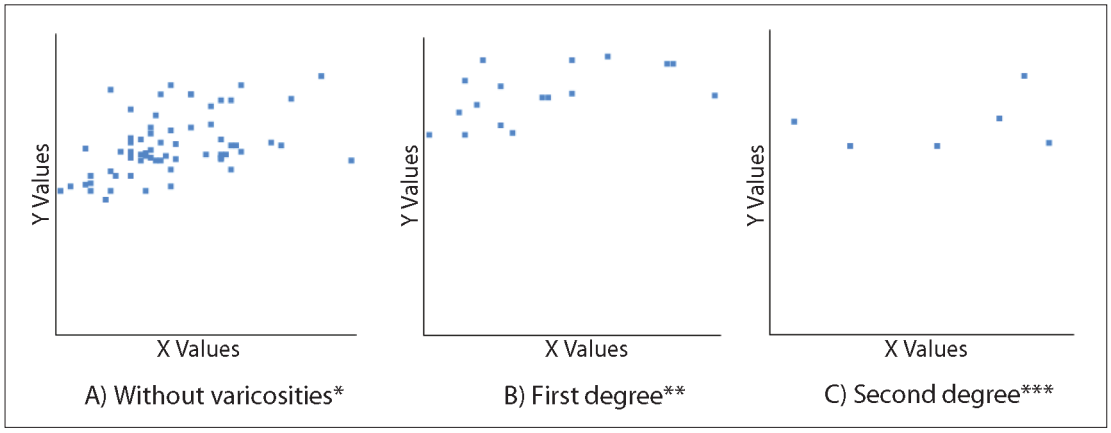

Figure 1. Correlations between body height and weight in the group of patients due to the presence of varicose veins and their degree of severity

*R = 0.456; **R = 0.543; ***R = 0.291; X values – body height; Y values – body weight

Table 3. Distribution of evaluated parameters in the group of participants with different degrees of varicose veins

Evaluated parameters	Study group		p-value*
	First degree	Second degree	
Age (years) (MV ± SD)	36.6 ± 5.1	34.3 ± 6.0	0.308
Body weight (kg) (MV ± SD)	64.9 ± 7.4	68.8 ± 8.9	0.646
Body height (cm) (MV ± SD)	169.4 ± 7.0	174.4 ± 8.2	0.219
Evaluated parameters	Control group		p-value**
	First degree	Second degree	
Age (years) (MV ± SD)	35.8 ± 3.0	36.0 ± 2.8	0.939
Body weight (kg) (MV ± SD)	83.7 ± 20.4	73.5 ± 10.6	0.546
Body height (cm) (MV ± SD)	170.2 ± 5.0	166.8 ± 7.8	0.469

*Mann–Whitney U-test;
**Student's t-test

less collagen III, and similar amounts of collagen V. This imbalance is a possible reason for the mechanical properties of the tissue, which, under these conditions, is of poorer quality [9, 10]. It should be stated that, in current literature, there are reports emphasizing defective synthesis of collagen and bad posture followed by the appearance of varicose veins; however, well-designed studies are still missing.

From the clinical point of view, we have noticed in the study that females with diagnosed IS had significantly lower weight. Even though there were non-significant differences in age between the two studied populations, age distribution frequencies demonstrated that it could be considered a significant factor associated with IS. Our results underline that females above 37 years of age have more frequent IS, while those between 27 and 36 years of age have significantly lower frequency of occurrence. Our findings are to the certain degree consistent with previous reports which stated that age is associated with a prevalence of idiopathic scoliosis [11]. Furthermore, we have pointed out that varicose veins are shown to be a significant factor associated with the presence of IS, where almost 25% of females with scoliosis had varicose veins, while less than 10% of patients in the control group had this condition. Bearing in mind that etiology of idiopathic adolescent scoliosis is multifactorial, including genetic predisposition, abnormalities of connective musculoskeletal tissues, it could be assumed that these individuals are more prone to develop varicose veins [12, 13, 14]. The complexity and multifactorial origin was underlined as well in the study Burwell and Dangerfield [15], where epigenetics was introduced as a concept in the evaluation of adolescent idiopathic scoliosis. They further stated that this type of scoliosis is associated with lower body mass index among other factors. Therefore, patients with IS should be screened for the presence of varicose veins and included into regular follow-up. Considering the degree of varicose vein presence, this study points out that the first degree is significantly more frequent in patients with IS, while the second degree, although frequent in the group of patients, was not significant. This observation could be explained to a certain degree by the assumption that other factors might influence the pathology of the second degree of varicose veins, thus influencing the frequency of occurrence in the population.

Our findings point to the fact that for patients with IS and the first degree of varicose veins there is greater correlation between height and weight, while for those without varicose veins and with the second degree of varicose veins there is lower correlation. Such findings are to the certain degree in line with our previous statement that other factors might play a certain role in the severity degree of varicose veins for patients with IS.

Also, it should be underlined that there are several limitations to this study. First, the study included small proportion of participants in the group of varicose veins. Second limitation refers particularly to the actual age of female participants where increase of age along with other factors might influence the frequency of varicose vein occurrence and the degree of such pathology. Therefore, further studies are needed on larger samples of patients and with longer follow-up observational periods.

CONCLUSION

Our findings demonstrate that lower body weight and presence of varicose veins are significantly associated with IS. The group of patients with IS above 37 years of age tends to have significantly higher proportion of varicose veins.

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Фактори који су повезани са идиопатском адолесцентном сколиозом у женској популацији – прелиминарни резултати

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САЖЕТАК

Увод/Циљ Идиопатска сколиоза (ИС) представља патолошки ентитет мултифакторијалног узрока.

Циљ рада је утврдити факторе који су повезани са ИС у женској популацији и факторе који су повезани са варикозним венама код испитаница са ИС.

Методе У ову ретроспективно-проспективну студију пресека укључено је 89 испитаница, док је у контролној групи било 87 испитаница. Анализирани су следећи параметри: телесна тежина, телесна висина, присуство и степен тежине (први, други и трећи степен) варикозних вена и године живота (група између 17 и 26, између 27 и 36 и између 37 и 46 година).

Резултати У студијској групи регистрована је значајно нижа телесна тежина ($p = 0,046$), значајно већа учесталост варикозних вена ($p < 0,001$) у поређењу са контролном, значајно нижа учесталост ових промена код болесника животне доби од 27 до 36 година ($p = 0,014$) и значајно веће присуство истих код болесника старије животне доби од 37 до 46 година ($p = 0,025$), у поређењу са контролном групом. У студијској групи је регистрована значајно већа учесталост болесника са проширеним венама првог степена ($p = 0,007$). Утврђено је да постоји блага позитивна корелација између телесне тежине и висине у групи болесника без варикозних вена ($p = 0,456$) и у групи болесника са варикозним венама другог степена ($p = 0,291$), док је у групи болесника са варикозним венама првог степена утврђена умерена позитивна корелација ($p = 0,543$).

Закључак Прелиминарни резултати ове студије показали су да су нижа телесна тежина и присуство проширених вена значајно повезани са ИС. Група испитаница са ИС преко 37 година је имала значајно чешће проширене вене у односу на контролу.

Кључне речи: идиопатска сколиоза; проширене вене; године живота; телесна тежина; телесна висина