BONE MINERAL DENSITY ESTIMATED BY OSTEORISK IN PATIENTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS

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ABSTRACT

Objective: The prevalence of osteoporosis in patients with Adolescent Idiopathic Scoliosis (AIS) is believed to be higher than in the general adolescent population. An alternative to radiology for the characterization of bone mineral density may be through correlative indexes like the Osteorisk index, which is easy to access and low in cost, and which helps the doctor in the request for Bone Densitometry. Our belief that osteoporosis can affect the evolution and treatment of AIS was what motivated us to conduct this study. Our objective was to subjectively evaluate bone mineral density by the Osteorisk index in patients with AIS. Methods: Healthy patients (control group, n=30) and patients with AIS (n = 30) were evaluated, documenting age, weight and height, and establishing the Osteorisk. The unpaired Student t test was performed, with a level of significance of p <0.05. Results: The mean Osteorisk found for the patients with AIS was 6.38 ± 2.2 while in the control group, it was 8.27 ± 2.14, which represents a low risk of developing osteoporosis in both groups. Comparing these means between the groups, a lower Osteorisk was observed in the AIS group. Conclusion: Our study showed that there is low risk of developing osteoporosis in patients with AIS. **Level of Evidence I, Prospective study.**

Keywords: Bone density. Scoliosis. Osteoporosis.

INTRODUCTION

Scoliosis is taken to mean every lateral deviation of the spine by more than 10° in radiographs taken in the frontal plane, consisting of a three-dimensional deformity that compromises the cardiorespiratory system as well as the musculoskeletal system, and can lead to severe abnormalities. Approximately 10% of cases of curve progression require surgical intervention,[1] whereas Adolescent Idiopathic Scoliosis (AIS) is the most frequent of all scoliosis types, mainly affecting female patients aged between 10 and 16 years,[2] with a prevalence of about 2 to 4% of the population.[3]

The etiology and the pathogenesis of AIS remain unknown, yet it is argued that its cause is multifactorial due to the association of the development of scoliosis with physiological changes related to growth and to hormone secretion.[4] Other theories associate the etiology with genetic inheritance, abnormal development of the central nervous system and changes of collagen,[5] yet none of these parameters has had its role proven in the genesis of the development of AIS.

Osteoporosis, in turn, is a metabolic disorder that is more common in adult bone[6] and rare in youths. However, the prevalence of osteoporosis in patients with AIS is greater than in the pediatric and adolescent population in general.[7] Previous reports indicate that 27 to 38% of the female population with scoliosis are osteopenic;[8-9] moreover, the presence of osteopenia was suggested as a prognostic factor of scoliosis curve progression.[10]

According to the International Society for Clinical Densitometry (ISCD) there is no densitometry definition of osteoporosis for the population of children and adolescents, since, unlike adults, it is not known at which point low bone mineral density predisposes to the risk of fracture. Evidence of an insufficiency fracture sustained as a consequence of minimum trauma is used as a criterion for the definition of osteoporosis in this age bracket.[11] One alternative to radiology for characterization of bone mineral

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density can be through correlative indexes, which make use of provenly determinant variables in the pathological development process of osteoporosis. One of the various indexes studied and compiled with this intention that merits special emphasis is the Osteorisk index.

Tools such as the Osteorisk index provide a low cost alternative of easy access that act as an aid for physicians in requesting the bone mineral densitometry, gold standard test for the diagnosis of osteoporosis, which, however, involves a high cost.

Considering that AIS mainly affects women and that the presence of osteoporosis can interfere in the evolution and in the treatment of this disease, we were motivated to conduct this survey, with the objective of assessing the risk of osteoporosis, related to low bone mineral density, estimated through Osteorisk, comparing it with a sample of healthy individuals.

METHODS

Prospective study, of a descriptive and comparative nature, authorized by the Institutional Review Board of the actual institution under number 046/2010.

Two groups of individuals took part in this study: a) AIS Group (n=30): patients with AIS in preoperative period for surgical correction of the installed spinal deformity; b) control group (n=30): healthy individuals of equivalent age bracket and gender.

The inclusion criteria for the AIS group were patients with AIS, of both sexes, aged between 10 and 16 years, in preoperative period of surgical correction of spinal deformity. In relation to the control group, this consisted of healthy individuals, from a similar age bracket to that obtained in the AIS group, students of a school from the same region. The exclusion criteria were the patients with AIS who had already undergone surgery for correction of AIS, as well as the patients without surgical indication, submitted to the conservative treatment. Patients who exhibited some pathological process associated with AIS were also excluded.

A scale with stadiometer was used to measure weight and height, making it possible to calculate the Osteorisk through the formula: 0.2 x [(weight in Kg) - (age in years)].

Osteorisk values below 1 are considered low risk of developing osteoporosis, while in high risk cases this value is lower than -2 and in the category of medium risk of developing osteoporosis this value is between -2 and 1.[12,13]

This was the basis of a comparative analysis performed between the AIS group and the control group, mainly aiming to compare the Osteorisk index.

We used univariate statistical analysis through the unpaired Student's t-test. The resources of the Microsoft Office/Excel (2007) and GraphPad Prism Software (San Diego, CA, USA, 2005) were applied for this purpose, while p-values < 0.05 were considered statistically significant.

RESULTS

Our sample was composed of 30 individuals in each group, seven of whom were male (23.3%) and 23 female (76.7%), in both groups. The average age observed (Table 1) was similar (AIS group: 14.30 ± 1.97 *vs.* control group: 14.23 ± 1.79 years), which allowed a homogeneous sample in relation to sex and age bracket, making the analysis of the other parameters more trustworthy.

We did not find any differences in the height of the individuals studied (Table 1). However, in the present study we observed a significant reduction of the parameters weight (Figure 1) and Osteorisk (Figure 2) in the AIS group, when compared with the control group.

The mean value of Osteorisk found for the patients with AIS was 6.38 ± 2.2 while in the control group it was 8.27 ± 2.14, which represents low risk for developing osteoporosis. When the mean values of Osteorisk were compared in the two groups a significant difference occurred.

Table 1. Characteristics of the samples of the Control group (n = 30) and AIS (n = 30), in relation to age (in years), weight (in Kg), height (in m) and Osteorisk index; Unpaired Student's t-test: *p < 0.05.

Groups/Parameters	Control	AIS	p-value
Age (years)	14.23 ± 1.79	14.3 ± 1.97	0.837
Weight (Kg)	55.6 ± 11.63	46.2 ± 12.27*	0.004*
Height (m)	1.63 ± 0.08	1.59 ± 0.11	0.085
Osteorisk	8.27 ± 2.14	6.38 ± 2.2*	0.01*
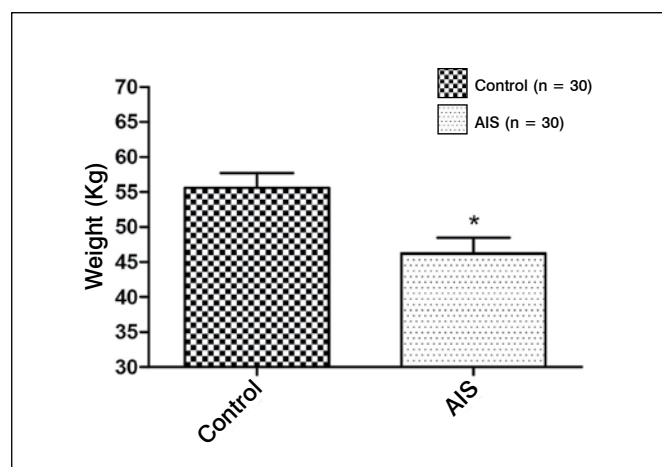
Figure 1. Difference betwen the mean weight (expressed in Kg) found in the Control and AIS groups; unpaired Student's t-test: *p < 0.05.
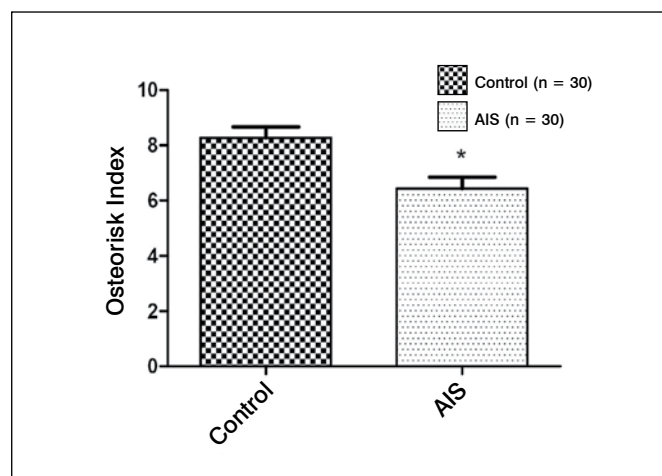
Figure 2. Comparison between the mean of the Osteorisk index found in the Control and AIS groups; unpaired Student's t-test: *p < 0.05.

DISCUSSION

Osteorisk was created to categorize the risk of osteoporosis, being built with a basis on a study conducted at six Latin American centers, which after multivariate regression analysis of eight risk factors for osteoporosis, established a model using only the age and body weight for its calculation.[12]

Low bone mineral density is an important factor associated with AIS, although it has not been determined whether it is a causal factor or, simply, a consequence of its pathogenic process. Burner et al.[14] established the first report on the association of osteopenia with AIS, using the Singh Index, in 1982. From then on, other researchers conducted studies correlating low bone mineral density with factors related to patients with AIS.[4]

We used Osteorisk in our study as we consider it an important tool for the tracking and follow-up of bone mineral density in individuals with AIS, besides assisting the physician in requesting the bone densitometry.

A major Brazilian study corroborated the accuracy of Osteorisk for the clinical screening of low bone mineral density, through the analysis of 461 women over 50 years of age. When compared with quantitative calcaneal ultrasonometry, Osteorisk presented sensitivity of 64%, specificity of 6.7%, negative predictive value of 89% and positive predictive value of 30.6%.[13]

About 90% of the peak bone mass is accumulated in the second decade of life,[15] which makes adequate bone mass accumulation at this time essential to prevent osteoporotic fractures in the adult. It is believed that patients with AIS may have a lower peak bone mass, thus increasing the risk of their developing osteoporosis and another complications related to physiologic delay.[8,16]

Our study demonstrated the existence of a low risk for developing osteoporosis in both groups; however, in the group with AIS, the quantitative mean obtained through Osteorisk presented statistical difference when compared with the control group, where the AIS group is more prone to unfavorable evolution with respect to the reduction of bone mineral density, demonstrated by the reduction of this index.

It is worth emphasizing that the Osteorisk index estimates the risk of osteoporosis, whereas in cases in which this index indicates medium or high risk, it is necessary to request the gold standard test for evaluation, which is the bone densitometry, accompanied by an investigation into the osteopenic or osteoporotic process in question.

As the Osteorisk index is easily applicable, entails a low cost and does not lead to the damage resulting from radiation exposure caused by bone densitometry, we propose that an estimate of the bone mineral density of individuals with AIS be made on a routine basis, through a calculation of the Osteorisk. This enables better supervision of the patient with AIS, with the intention of preventing the possibility of low bone mineral density becoming a curvature aggravation factor, requiring further investigation and, if appropriate, adequate intervention. Moreover, in cases of patients earmarked for surgical treatment to correct installed spinal deformity, the bone density analysis can avoid intra- and postoperative complications, such as the difficulty of surgical spinal fixation in these patients.

CONCLUSION

Our study demonstrated low risk for developing osteoporosis in the patients with AIS, estimated through the Osteorisk, which was also observed in the population of healthy individuals comparatively. However, the Osteorisk was statistically lower in patients with AIS, which may suggest greater propensity for the risk of osteoporosis when compared with the individuals without the disease.

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