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Original article

Bone mineral density evaluation among patients with neuromuscular scoliosis secondary to cerebral palsy☆

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ABSTRACT

Objective: To evaluate bone mineral density among patients with neuromuscular scoliosis secondary to quadriplegic cerebral palsy.
Methods: This was a descriptive prospective study in which both bone densitometric and anthropometric data were evaluated. The inclusion criteria used were that the patients should present quadriplegic cerebral palsy, be confined to a wheelchair, be between 10 and 20 years of age and present neuromuscular scoliosis.
Results: We evaluated 31 patients (20 females) with a mean age of 14.2 years. Their mean biceps circumference, calf circumference and body mass index were 19.4 cm, 18.6 cm and 16.9 kg/m^2, respectively. The mean standard deviation from bone densitometry was −3.2 (z-score), which characterizes osteoporosis.
Conclusion: There is high incidence of osteoporosis in patients with neuromuscular scoliosis secondary to quadriplegic cerebral palsy.

Avaliação da densidade mineral óssea em pacientes portadores de escoliose neuromuscular secundária a paralisia cerebral

Palavras-chave:
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RESUMO

Objetivo: avaliar a densidade mineral óssea em pacientes portadores de escoliose neuromuscular secundária à paralisia cerebral tetraespástica.
Métodos: estudo prospectivo, descritivo, em que se avaliaram, além da densitometria óssea, dados antropométricos. Como critério de inclusão, adotamos pacientes com paralisia cerebral tetraespástica, cadeirantes, entre 10 e 20 anos e com escoliose neuromuscular.

☆ Work developed at Hospital Santa Casa de Misericórdia de Vitória, ES, Brazil.
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Resultados: avaliamos 31 pacientes, 20 do sexo feminino, cuja média de idade foi de 14,2 anos. A média da circunferência bicipital, da panturrilha e do IMC foi de 19,4 cm, 18,6 cm e 16,9 Kg/m^2, respectivamente. O desvio padrão médio encontrado na densitometria óssea foi de –3,2 (*z-score*), o que caracteriza osteoporose.

Conclusão: existe elevada incidência de osteoporose em pacientes portadores de escoliose neuromuscular secundária à paralisia cerebral tetraespástica.

Introduction

Many neuromuscular diseases lead to development of spinal deformities. Among these, cerebral palsy is the most frequent: its incidence may range from 25% to 100% of such patients, depending on the degree of neuromuscular involvement.[1] Its etiological origin is secondary to imbalance between the muscle forces in the axial skeleton,[2] caused by lesions in the upper and lower motor neurons.[3] Scoliosis usually presents a C-shaped format, in association with pelvic obliquity, and it frequently progresses even after skeletal maturity has been reached.[4]

Thus, in cases of severe deformity, or in those in which progression of the curve is detected, surgical treatment becomes necessary, with the aims of avoiding progression and restoring or maintaining the sagittal and coronal balance and the capacity to sit, thereby leading to a great improvement of the patients' quality of life.

In these cases, despite the need to perform surgical treatment, the complication rate is very high and is directly related to the impairment of cardiorespiratory and gastrointestinal function and the nutritional grade shown by the patient.[5] Among all the possible complications arising from surgery, infection and loosening of the synthesis material used for correcting the deformity are the ones most frequently observed.[6]

Failure of fixation of the pedicle screws in the spine may occur due to osteoporosis of the vertebra, caused by factors such as the severity of the neurological impairment, increasing difficulty in eating and use of anticonvulsants.[7]

Very few studies have analyzed the bone mass of patients with tetraspastic cerebral palsy. Many complications can result from loosening of the synthesis material in such patients. This can be prevented through correct analysis of bone metabolism and early treatment of patients who present low bone mass. We conducted the present study with the objective of analyzing the bone mass of patients with cerebral palsy who also had neuromuscular scoliosis. Through this, it might become possible to adopt appropriate preventive measures for avoiding the development of osteoporosis and consequently to achieve improvement of their quality of life.

Sample and method

This was a prospective study of descriptive nature for which data covering the period from February 2012 to January 2013 were gathered. The inclusion criteria were that the patients needed to present neuromuscular scoliosis due to cerebral palsy, with a tetraspastic component, and were using a wheelchair. Patients aged less than 10 years and over 20 years and patients whose scoliosis was not of neuromuscular origin due to cerebral palsy were excluded.

A convenience sample was used, which was formed as the patients came to the orthopedic outpatient clinic of a philanthropic hospital in Vitória. In total, 31 patients were evaluated (20 females), with a mean age of 14.2 years. Subsequently, each patient's bone mass was determined by means of bone densitometry on the lumbar spine, on the Lunar Prodigy Advance densitometer, model PA+41606, which produces digitized densitometry scans by means of X-rays, from a special constant 76 kV source with an efficient *k*-edge dose filter. The densitometry was also computer-assisted, by means of the Windows-based Prodigy Bis software.

The results were represented numerically by means of absolute values and percentages and were documented in accordance with protocols. The data analysis was performed using the software Microsoft Office/Excel 2007® and GraphPad Prism® (San Diego, CA, USA).

In addition to bone mass, anthropometric data were evaluated, such as measurements of estimated height, weight, body mass index (BMI), biceps circumference and calf circumference. Specific data such as whether the patient had undergone gastrostomy, was doing physiotherapy or was using an adapted wheelchair were also ascertained. Furthermore, laboratory tests such as hemogram, TSH, free T4, potassium, calcium, serum iron, ferritin, transferrin, C-reactive protein (CRP), total proteins and albumin were performed.

To calculate BMI, the formula used was $BMI = W/H^2$, in which W = weight and H = estimated height. The estimated height was calculated by means of the following formula: $H = (2.69 \times KH) + 24.2$, in which KH was the distance from the knee to the heel.[8]

Results

Among the 31 patients analyzed, 11 were constantly doing motor physiotherapy. Only 11 were using adapted wheelchairs; the remaining 20 were using conventional wheelchairs.

The anthropometric measurements were: weight, 28 kg; height, 143.6 cm; biceps circumference, 19.4 cm; calf circumference, 18.6 cm; and BMI, 16.9.