J Pediatr (Rio J). 2016;xxx(xx):xxx–xxx

Jornal de Pediatria
www.jped.com.br

ORIGINAL ARTICLE

Bone mineral density in children with idiopathic nephrotic syndrome☆

Ghada Mohamed El-Mashad[a], Mahmoud Ahmed El-Hawy[a,*], Sally Mohamed El-Hefnawy[b], Sanaa Mansour Mohamed[a]

[a] *Menoufia University, Faculty of Medicine, Pediatrics Department, Menoufia, Egypt*
[b] *Menoufia University, Faculty of Medicine, Biochemistry Department, Menoufia, Egypt*

Received 26 November 2015; accepted 24 May 2016

KEYWORDS
Nephrotic syndrome;
Bone mineral density;
DXA scan

Abstract
Objectives: To assess bone mineral density (BMD) in children with idiopathic nephrotic syndrome (NS) and normal glomerular filtration rate (GFR).
Methods: Cross-sectional case–control study carried out on 50 children: 25 cases of NS (16 steroid-sensitive [SSNS] and nine steroid-resistant [SRNS] under follow up in the pediatric nephrology unit of Menoufia University Hospital, which is tertiary care center, were compared to 25 healthy controls with matched age and sex. All of the participants were subjected to complete history taking, thorough clinical examination, laboratory investigations (serum creatinine, blood urea nitrogen [BUN], phosphorus [P], total and ionized calcium [Ca], parathyroid hormone [PTH], and alkaline phosphatase [ALP]). Bone mineral density was measured at the lumbar spinal region (L2–L4) in patients group using dual-energy X-ray absorptiometry (DXA).
Results: Total and ionized Ca were significantly lower while, serum P, ALP, and PTH were higher in SSNS and SRNS cases than the controls. Osteopenia was documented by DXA scan in 11 patients (44%) and osteoporosis in two patients (8%). Fracture risk was mild in six (24%), moderate in two (8%), and marked in three (12%) of patients.
Conclusion: Bone mineralization was negatively affected by steroid treatment in children with NS.

☆ Please cite this article as: El-Mashad GM, El-Hawy MA, El-Hefnawy SM, Mohamed SM. Bone mineral density in children with idiopathic nephrotic syndrome. J Pediatr (Rio J). http://dx.doi.org/10.1016/j.jped.2016.05.010

* Corresponding author.
E-mails: mahmodelhawy18@yahoo.com, mahmoud.elhawi@med.menofia.edu.eg (M.A. El-Hawy).

http://dx.doi.org/10.1016/j.jped.2016.05.010

PALAVRAS-CHAVE
Síndrome nefrótica;
Densidade mineral óssea;
Exame DXA

Densidade mineral óssea em crianças com síndrome nefrótica idiopática

Resumo

Objetivos: Avaliar a densidade mineral óssea (DMO) em crianças com síndrome nefrótica idiopática (SNI) e com taxa de filtração glomerular (TFG) normal.

Métodos: O estudo transversal de caso-controle foi realizado com 50 crianças: 25 casos de SNI [16 sensíveis a esteroides (SNSE) e nove resistentes a esteroides (SNRE) com acompanhamento na unidade de nefrologia pediátrica do hospital da Menoufia University, centro de cuidados terciário] foram comparados com 25 controles saudáveis do grupo de controle com idade e sexo equivalentes. Todos os participantes foram submetidos a anamnese completa, exame clínico completo, exames laboratoriais [creatinina sérica, nitrogênio ureico no sangue (BUN), fósforo (P), cálcio (Ca) total e ionizado, paratormônio (PTH) e fosfatase alcalina (ALP)]. A densidade mineral óssea foi mensurada na região da coluna lombar (L2-L4) no grupo de pacientes usando a absorciometria por raio-X de dupla energia (DXA).

Resultados: Os níveis de cálcio total e ionizado eram significativamente menores, ao passo que o fósforo sérico, a FA e o PTH eram maiores em casos de SNSE e SNRE que nos controles. A osteopenia foi documentada pelo exame DXA em 11 pacientes (44%) e a osteoporose, em dois pacientes (8%). O risco de fratura era leve em seis (24%), moderado em dois (8%) e acentuado em três (12%) dos pacientes.

Conclusão: A mineralização dos ossos foi afetada negativamente pelo tratamento com esteroides em crianças com SN.

Introduction

Childhood nephrotic syndrome (NS) is defined by nephrotic-range proteinuria, generalized edema, hypoalbuminuria, and hyperlipidemia with normal renal function.[1] Idiopathic nephrotic syndrome (INS) is the most frequent renal disease in children.[2] Childhood NS typically follows a relapsing-remitting course, often requiring recurrent courses of glucocorticoids (GC), but with low systemic inflammation during remission.[3]

Bone mass deposition begins during fetal life and continues during infancy and adolescence, stabilizing at the beginning of adulthood.[4] During childhood and adolescence, skeletal modeling results in sex- and maturation-specific increases in bone density. Metabolic bone disease (MBD) is characterized by changes in skeletal mineralization due to poor bone mineral content (BMC).[5] Children may be especially vulnerable to the effects of GC on bone formation and peak bone mass.[6]

Prednisone is the first-line treatment for INS to induce remission, to prevent relapses and to avoid side effects of the disease.[7] Prolonged administration of prednisone interferes with growth and bone mineralization, and has deleterious effect on basic cellular mechanisms that are important in the development and maintenance of bone strength.[7,8] Steroids are known to cause osteoporosis and affect BMC and bone mineral density (BMD) in children.[9] Glucocorticoids have a suppressive effect on osteoblastogenesis in the bone marrow and promote the apoptosis of osteoblasts and osteocytes, thus leading to decreased bone formation.[10] There is some evidence to suggest that GC may increase bone resorption by extending the lifespan of pre-existing osteoclasts.[11] Glucocorticoids may also promote calcium loss through the kidneys and gut, and this negative calcium balance can itself lead to increased bone remodeling and osteoclastic activity due to secondary hyperparathyroidism.[12]

Children with INS are at risk for MBD, accompanied by important alterations of mineral and bone metabolism.[13]

Therefore, it was hypothesized that patients with NS would have BMD deficits when compared to their peers. This study was designed to determine BMD in children with INS and normal glomerular filtration rate (GFR).

Methods

This study was carried out on 50 children after approval of the Ethical Committee of Faculty of Medicine, Menoufia University, and a written consent was obtained from the guardians of patients and controls. Children were divided into two groups:

Group I

Included 25 children aged 1–15 years who fulfill the clinical criteria for INS (heavy proteinuria > 40 mg/m^2/h, hypoalbuminemia < 2.5 g/L, hypercholesterolemia > 250 mg/dL, and edema) with normal renal function (normal glomerular filtration by Schwartz formula).[14] Patients with secondary NS, with other conditions unrelated to NS that could affect bone health, and patients who received prior medication for osteoporosis or vitamin D preparations before or during the study were excluded.

All of the children with INS were treated according to the standard protocol.[14] The initial therapy consisted