Bone Mineral Density in Children with Steroid-Sensitive Nephrotic Syndrome


Departments of Pediatrics, Endocrinology and Metabolism and Division of Biostatistics, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India

ABSTRACT

Objective. To observe the influence of prednisolone treatment on bone mineral density (BMD) in children with idiopathic nephrotic syndrome.

Methods. Dual-energy X-ray absorptiometry of lumbar spine (L1-L4) was performed on 40 patients (18 first episode and 22 relapsers) of steroid sensitive idiopathic nephrotic syndrome.

Results. Patients of first episode and relapsers had comparable values of mean age, weight, height, body mass index, serum calcium, phosphate, spine area, bone mineral content (BMC) and BMD. Relapsing nephrotic syndrome patients received significantly higher mean total cumulative dose of prednisolone in comparison to first episode (p<0.001). The BMD Z-scores were normal in 39 of 40 (97.5%) patients. On regression analysis, it was found that both BMC and BMD did not correlate with cumulative dose of prednisolone, when other co-variants such as age, weight, height and spine area were adjusted.

Conclusion. Bone mineral density in steroid sensitive nephrotic syndrome is unaffected by cumulative dose of prednisolone therapy both in first episode as well as relapser group of patients.

Key words: Nephrotic syndrome; Relapsers; Prednisolone; Bone mineral density

Glucocorticoids remain the mainstay of therapy in idiopathic nephrotic syndrome. It has been observed that nephrotic syndrome itself is associated with changes in bone and mineral metabolism, which may get further aggravated by steroid therapy. The bone loss with resulting fracture is one of the sequelae of steroid therapy. Children, who require more than four courses of oral corticosteroid, are at increased risk of fracture. Patients receiving greater than physiological dose (≥ 7.5 mg of prednisolone per day) for 1 to 6 months duration are at risk of significant loss of trabecular bone in axial skeleton such as spine, hips and ribs. The early changes can be detected in the spine and femoral neck.

Children may be vulnerable to the effects of glucocorticoids on bone formation including peak bone mass. Decreased bone mineral density (BMD) has been described in various pediatric disorders with a correlation among glucocorticoids, bone deficit and risk of fracture, but some of the detrimental effects on bone may be due to underlying inflammatory diseases also. Leonard et al. reported no significant change on bone mineral content (BMC) in patients of steroid sensitive nephrotic syndrome. There is paucity of reports evaluating the BMC and BMD in different sub-groups of nephrotic syndrome on varying doses of steroid therapy. Therefore, the present study was undertaken to evaluate BMC and BMD in sub-groups of steroid sensitive idiopathic nephrotic syndrome and their influencing factors, if any.

MATERIALS AND METHODS

Forty children with steroid-sensitive idiopathic nephrotic syndrome [anasarca, proteinuria (≥40 mg/m²/hr), hypoalbuminemia (serum albumin<2.5g/dl), hypercholesterolemia (serum cholesterol > 200mg/dl) and normal renal function], aged 1 to 10 yr, who reported consecutively, were selected for the present study from the Pediatric Nephrology clinic. None of the...
patients had gross hematuria, hypertension, bony pain, fractures, signs of hypocalcaemia and any systemic disease known to produce nephrotic syndrome. Children were not receiving calcium and vitamin D during study. The study was approved by Institute Ethical Committee. Informed consent was obtained from parents of each patient.

Patients were further classified as First attack nephrotic syndrome (FANS) with first episode and Relapsing nephrotic syndrome (RNS : Infrequent relapsers-less than 2 within 6 months or less than 4 relapses in any 12-month period and frequent relapsers-two or more within 6 months or 4 or more relapses within any 12-month period). FANS and RNS patients were treated as per guidelines recommended by Bagga et al.6 During treatment, response to therapy was assessed by clinical examination and proteinuria. All patients were steroid responders. Renal biopsy was not performed in any of the patients. Weight and height were measured with the use of a digital scale and a wall mounted stadiometer, respectively during enrollment.

Dual energy X-ray absorptiometry (DXA) of Lumbar spine was performed by thin mode scans (Lunar, GE Medical system) using pencil beam at completion of therapy, in first episode and infrequent relapsers, whereas in frequent relapsers, when patient was on alternate day therapy during remission. The observed values of BMC were noted. BMD was recorded and analyzed by comparing with normative data reported by Southard et al.7 The mean and standard deviations of age and sex matched controls were derived by their data and ‘Z-score’ for BMD (L1 to L 4 spine) was calculated using the formula:

\[ \text{‘Z-score’} = \frac{P - M_{\text{am}}}{SD_{\text{am}}} \]

Where,  
\( P \) = Patient’s bone density 
\( M_{\text{am}} \) = Bone density of controls 
\( SD_{\text{am}} \) = SD of controls

The low BMC or MBD was defined, when ‘Z-score’ was less or equal to -2. The data was analyzed using SPSS software version 10. The regression analysis was performed to find out the influencing factors for BMC and BMD.

**RESULTS**

Out of 40 patients, there were 28 male and 12 female. Eighteen patients were of first episode and 22 belonged to relapsing nephrotic syndrome (14-infrequent and 8 frequent). The comparisons of various parameters in both the groups are presented in Table 1. The mean age, weight, height, body mass index, serum calcium, phosphate, spine area, BMC and BMD did not differ significantly between the two groups. The total cumulative doses of prednisolone were significantly higher in RNS. Only one case had BMD ‘Z-score’ less than 2.

The correlation of BMC and BMD with various parameters is depicted in Table 2. Both BMC and BMD had significant positive correlations with age, weight, height, spine area and total cumulative dose of prednisolone. Further regression analysis showed that BMC and BMD did not correlate with cumulative dose of prednisolone, when other co-variants were adjusted.

**DISCUSSION**

In the present study, majority of patients had normal BMD and was uninfluenced by cumulative dose of prednisolone, when other co-variants were adjusted.