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Endoped Abstract

A Novel Method for Bone Health Assessment in Pediatric Patients with Type 1 Diabetes

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Background and Aims

Patients with type 1 diabetes (T1DM) have a 1.2–2.5 times higher risk for fractures [1], which is already evident at an early age [2]. Childhood and adolescence are crucial for peak bone mass (PBM) attainment. It was estimated that a 10% increase in PBM would delay osteoporosis onset by 13 years [3], whereas a 10% increase in the age of menopause would delay it by just 2 years [4]. Thus, simple and reliable methods for bone health screening in these patients are needed. Our aim was to assess bone health index (BHI) in pediatric patients with T1D and its relation to bone and calcium metabolism and disease-specific factors like: age at onset, duration, control and insulin dose.

Material and Methods

Sixty-five patients with T1DM and mean age 11.23 ± 3.89 years had left hand radiographs for bone age assessment completed. Their mean age at disease onset was 5.46 ± 3.35 years, mean disease duration 5.23 ± 3.76 years and mean HbA1c- 83 mmol/mol (9.7%). Blood and 24 h urine samples were collected for bone and mineral metabolism assessment. All patients were interviewed for calcium intake evaluation. BHI, BHI SDS and bone age were determined by the BoneXpert® program.

Results

The mean BHI value was −4.41 ± 0.67 (n = 65), whereas the mean BHI SDS was −1.15 ± 1.19 (n = 54) with median −1.13 (−4.18 to 1.68). In 20.37% (n = 11), BHI SDS was

<–2SD with mean value -2.82 ± 0.69, $p < 0.001$. These patients had lower levels of beta cross laps (0.77 ± 0.33 ng/mL vs. 1.17 ± 0.47 ng/mL), osteocalcin (47.20 ± 14.07 ng/mL vs. 75.91 ± 32.08 ng/mL), serum magnesium (0.79 ± 0.05 mmol/L vs. 0.83 ± 0.06 mmol/L) and phosphorus (1.48 ± 0.29 mmol/L vs. 1.71 ± 0.28 mmol/L), but higher ionized calcium (1.29 ± 0.04 mmol/L vs. 1.26 ± 0.05 mmol/L), $p < 0.05$, compared to patients with BHI SDS in the normal range.

Patients with decreased BHI SDS had lower calcium intake as well (344.50 ± 155.36 mg per day vs. 1404.97 ± 360.67, $p < 0.05$). BHI had a positive correlation with IGF-1 level ($r = 0.474$, $p = 0.001$), whereas BHI SDS showed a negative one with disease duration ($r = -0.284$, $p = 0.038$). Both BHI and BHI SDS had positive correlations with age at disease onset ($r = 0.484$, $p < 0.001$ and $r = 0.307$, $p = 0.024$). No correlations were found with the other bone turnover markers, HbA1c, insulin dose, height, weight, or BMI.

Conclusions

Decreased cortical bone mineral density (cBMD) was observed in 20.37% of all examined patients. Earlier age at onset and longer diabetes duration appeared to be important factors in the determination of cBMD in patients with poor metabolic control. It would be of interest to follow up the observed changes in cBMD and/or to assess interventions like improved metabolic control, vitamin D and calcium supplementation, increased physical activity.

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Conflicts of Interest: The authors declare no conflict of interest.

Reference

1. Weber, D.; Schwartz, G. Epidemiology of Skeletal Health in Type 1 Diabetes. *Curr. Osteoporos. Rep.* **2016**, *14*, 327–336. [CrossRef] [PubMed]
2. Weber, D.R.; Haynes, K.; Leonard, M.B.; Willi, S.M.; Denburg, M.R. Type 1 diabetes is associated with an increased risk of fracture across the life span: A population-based cohort study using The Health Improvement Network (THIN). *Diabetes Care* **2015**, *38*, 1913–1920. [CrossRef] [PubMed]
3. World Health Organization. *Assessment of Fracture Risk and its Application to Screening for Postmenopausal Osteoporosis. Report of a WHO Study Group*; WHO Technical Report Series; No 843; WHO: Geneva, Switzerland, 1994.
4. Hernandez, C.J.; Beaupre, G.S.; Carter, D.R. A theoretical analysis of the relative influences of peak BMD, age-related bone loss and menopause on the development of osteoporosis. *Osteoporos. Int.* **2003**, *14*, 843–847. [CrossRef] [PubMed]