Bone Mineral Density in Patients with Type 1 Diabetes Mellitus by DEXA and QCT

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OBJECTIVES

Type 1 DM (T1DM) has been associated with low bone mineral density (BMD) measured mostly by dual energy X-ray absorptiometry (DXA). DXA is of great value for accessing BMD and fracture risk but provides no insight into the structural characteristics of bone or on elements that might contribute to bone strength. Quantitative Computed Tomography (QCT) provides a 3-dimensional image, measuring bone's volume directly as density, independent of the surrounding soft tissue, distinguishing trabecular and cortical bone. Limited data exist on BMD measured by QCT in T1DM. In the present study, we have evaluated BMD in patients with T1DM by two different methods, DXA and QCT.

METHODS

- We studied:
  - 81 patients with T1DM (Group D) (age: 36±9.7 years, M/F: 32/49) with duration of diabetes >5 years
  - 70 healthy controls (Group C) matched for age, sex and body mass index (BMI)
- Postmenopausal women were excluded from the study
- Subjects with conditions or medications that could interfere to bone metabolism were also excluded
- In both groups, we measured:
  - glycated hemoglobin (HbA1c)
  - BMD at lumbar spine (LS) (L1-L4) and femoral neck (FN) by DXA
    (Hologic Discovery QDR Series Densitometer, Hologic Inc., Bedford, MA)
  - *BMD of vertebral trabecular bone (L1-L3) by QCT*
    (Toshiba Aquilion 16-slice multislice computed tomography unit, phantom for QCT)

RESULTS

	D	C	p-value
Number	36	35	
Sex (M:F)	32:49	29:41	
Age (y)	36±9.7	35.6±9.1	0.43
Duration of DM (y)	16.1±9.9	-	
BMI (kg/m²)	23.3±8.1	23.7±8.3	0.390
HbA1c (%)	8.1±1.3	5.0±0.6	0.001

	D	C	p-value
DXA LS TOTAL BMD	1.02±0.2	1.05±0.14	0.030
DXA LS T-SCORE	-0.27±1.53	0.71±1.65	0.020
DXA LS Z-SCORE	-0.31±1.61	0.78±1.76	0.010
DXA FN TOTAL BMD	0.69±0.12	0.89±0.11	0.043
DXA FN T-SCORE	0.2±1.51	1.41±1.1	0.041
DXA FN Z-SCORE	-0.1±1.47	1.35±1.04	0.037

- BMD (g/cm²) and z-score measured by DXA were lower in Group D compared to C at LS (p=0.030, p=0.010) and at FN (p=0.043, p=0.037)
- LS z-scores (L1-L3) measured by QCT were lower in Group D compared to C (L1: p=0.031, L2: p=0.041, L3: p=0.038)
- In both groups, mean LS z-scores measured by QCT were lower compared to DXA (D: -0.31±1.61 versus -0.16 +1.08, p=0.022) (C: 0.06 +1.12 versus 0.27±1.41, p=0.036)
- Measured by DXA, in Group D, 9/81 patients (11.1%) had osteopenia and 1/81 had osteoporosis (1.2%) at LS and 5/81 (6.2%) had osteopenia and 1/81 had osteoporosis (1.2%) at FN
- Measured by QCT, in Group D, 14/81 patients (17.3%) had osteopenia and 2/81 patients (2.5%) had osteoporosis at LS
- In Group C, none of the subjects had osteopenia or osteoporosis measured by both methods
- The lower DXA z scores were negative correlated with young onset age (r=-0.74, p=0.021) and longer duration of T1DM (r=-0.78, p=0.032) but not with glycaemic control (r=0.36, p=0.18)
- LS z-scores measured by QCT were negative correlated only with young onset age (r=-0.71, p=0.033)

CONCLUSIONS

Patients with T1DM have lower BMD compared with healthy controls, measured by both DXA and QCT. Young onset age and duration of DM seem to strongly affect BMD. The choice of measuring method may define a different degree of bone loss.

References

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