**Association Between Bone Mineral Density and Type 1 Diabetes Mellitus: A Meta-analysis Of Observational Studies**

**INTRODUCTION**
- Various studies have reported that Bone Mineral Density (BMD) is reduced in patients with Type 1 Diabetes Mellitus (T1DM).
- In fact, osteopenia has been described in T1DM patients long ago, even before the availability of modern techniques to measure BMD.
- However, the data is not consistent among all the reported studies.
- Potential mechanisms leading to osteopenia in patients with T1DM are: Autocrine destruction of beta cells in type 1 diabetes.

**OBJECTIVE**
To perform a meta-analysis to estimate the difference in BMD between T1DM and non-diabetic populations.

**METHODOLGY**
- **Eligibility Criteria**
  - Cases: T1DM patient (of any age group)
  - Control: Healthy subject (non-diabetic)
- **BMD Measurement**:
  - BMD was measured by dual energy X-ray absorptiometry (DXA).
- **Statistical Analysis**:
  - Meta-analysis showed that BMD in T1DM patients was significantly lower at many regions.

**RESULTS**
- **Forearm**:
  - Pooled mean difference of BMD in patients with T1DM when compared with control: 
    - **Men**: -0.305 (95% CI: -0.479 to -0.130) 
    - **Women**: -0.254 (95% CI: -0.480 to -0.038)
- **Hip Region**:
  - Pooled mean difference of site-wise BMD in patients with T1DM when compared with control:
    - **Femoral neck**: No significant difference was found in BMD (in both men and women)
    - **Total Hip**: 0.717 (95% CI: 0.560 to 0.874) 
  - **Osteoporosis**:
    - Men with T1DM are more prone to osteopenia than women.
    - Estrogen adequacy and/or use of estrogen-based oral contraceptive pills might be the reason for higher bone mass in women compared to men.

**DISCUSSION**
- Proposed pathogenic mechanisms leading to reduced BMD in T1DM patients:
  - **Hyperglycemia**
  - **Autocrine inflammation**
  - **Increased PPAR-γ activity**
  - **Osteoblast hypofunction**
- Factors influencing bone in T1DM patients:
  - **Age of onset**
  - **Deficit of IGF-I and Vitamin D**
- **Conclusion**:
  - Recombinant human PTH may be effective in the treatment of osteoporosis in patients with T1DM.

**REFERENCES**

**CONCLUSIONS**
- Both men and women with T1DM have propensity to have lower bone levels.
- Multiple factors can influence BMD in individuals with T1DM:
  - **Age**
  - **Gender**
  - **Menopause status**
  - **Bone type**
- Large prospective epidemiological studies are required to confirm our findings.