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# The Role of Bone Mineral Densitometry in Patients with Complex Regional Pain Syndrome

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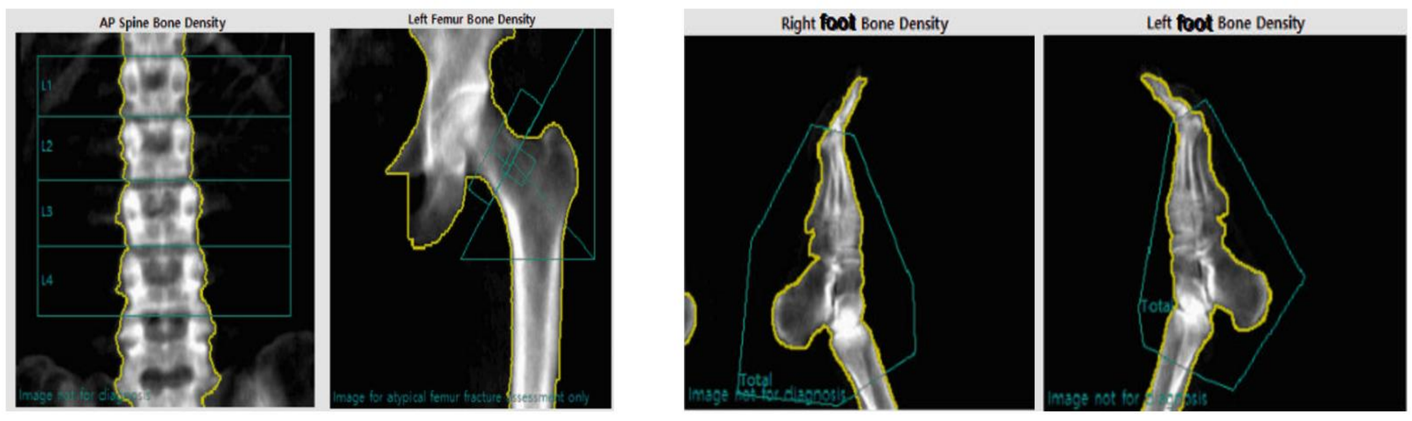
## Introduction

- ✓ Complex regional pain syndrome (CRPS) has been described as being associated with localized bone loss, and one proposed mechanism involves increased bone turnover and microvascular disturbance in the affected limb.
- ✓ Unlike conventional bone mineral density (BMD) assessment, which primarily focuses on the spine and femur, targeted BMD enables direct quantitative evaluation of bone loss at the injured site.
- ✓ Objective: To investigate the association between "Targeted BMD" (at the injured site) and clinical parameters in CRPS patients.

## Methods

- ✓ Design: Retrospective chart review (2020–2025) of 49 suspected patients; 41 confirmed CRPS (Budapest criteria) and 8 non-CRPS controls.
- ✓ Data Collection - Clinical data: Age, disease duration, NRS, trophic changes, and weight-bearing status
  - Imaging data: Three-phase bone scan, Targeted BMD at the injured site
- ✓ Analysis: Simple linear regression, One-way ANOVA, and Student's t-test using SPSS v26.

**Figure 1.** Conventional BMD and Targeted BMD




## Results

**Table 1. Comparison of BMD between CRPS and non-CRPS**

| Patients | CRPS (N=41) | | Non-CRPS (N=8) | |
|---|---|---|---|---|
| Onset to exam date | 774.2 ± 824.9 | | 486.0 ± 686.4 | |
| Male : Female | 27 : 14 | | 3 : 5 | |
| Age (years) | 49.3 ± 13.2 | | 38.0 ± 16.5 | |
| BMD | affected | unaffected | affected | unaffected |
| | 0.848 ± 0.238 | 1.024 ± 0.235 | 0.758 ± 0.293 | 0.860 ± 0.325 |
| BMD(%) (affected-unaffected) / unaffected | -16.9 ± 14.3 | | -11.6 ± 18.5 | |
| P-value | ***0.001**** | | 0.382 | |

- ✓ In the CRPS group, the BMD of the affected limb was significantly lower than that of the unaffected limb
- ✓ In contrast, the non-CRPS group showed no statistically significant side-to-side difference

**Table 2. BMD comparison: Clinical parameters**

| Parameters | Parameters | P-value |
|---|---|---|
| Disease duration | 24.9 ± 27.2 | ***0.004**** |
| Age (years) | 49.3 ± 13.2 | 0.652 |
| Numeric rating scale | 7.8 ± 1.6 | 0.907 |
| Three-phase bone scan | III, SSS, DDD, DDS, DDI, SSI, SII, IIS | 0.600 |

**Table 3. BMD comparison: Duration(3 phase), Weight bearing**

| Parameters | BMD decline (mg/cm²) | | | P-value |
|---|---|---|---|---|
| Duration (3 phase) | < 5m (n=11) | 5-12m (n=8) | ≥ 12m (n=22) | 0.096 |
| | - 14.0 ± 12.6 | - 9.2 ± 10.0 | - 21.0 ±15.2 | |
| Weight bearing (n=31) | Full (n=13) | Partial (n=15) | Non (n=3) | 0.424 |
| | - 13.1 ± 10.6 | - 19.2 ± 15.6 | - 22.0 ± 18.4 | |

- ✓ **Disease Duration:** Significantly associated with greater BMD decline overall(Table 2.). Categorical comparison showed a non-significant trend of more bone loss with longer duration(Table 3).
- ✓ **Weight-Bearing:** Lower-limb patients showed a descriptive trend of increased BMD loss as weight-bearing decreased, but it was not statistically significant(Table 3).
- ✓ Age, pain severity(NRS), and three-phase bone scan patterns were not significantly associated with the degree of BMD decline(Table 2).

**Table 4. Comparison of Targeted BMD between Normal and Abnormal Groups Based on Clinical Parameters**

| Parameters | No. of patients | BMD decline (mg/cm²) | | P-value |
|---|---|---|---|---|
| M : F | 27 : 14 | -17.67±15.31 | -15.36±12.38 | 0.630 |
| Upper limb : Lower limb | 10 : 31 | -16.64±16.12 | -16.96±13.90 | 0.952 |
| | **Normal : Abnormal** | **Normal group** | **Abnormal group** | |
| Trophic change | 18 : 23 | -11.61 ± 14.26 | -21.01 ± 13.12 | ***0.034**** |
| Sweating | 21 : 20 | -15.90 ± 12.28 | -17.91 ± 16.35 | 0.658 |
| Nerve injury | 14 : 23 | -15.79 ± 14.97 | -18.43 ± 13.41 | 0.583 |
| Motor dysfunction | 8 : 33 | -19.40 ± 15.03 | -16.27 ± 14.25 | 0.584 |
| Decreased ROM | 8 : 33 | -16.30 ± 14.15 | -17.02 ± 14.51 | 0.899 |
| Skin color | 7 : 34 | -12.03 ± 11.94 | -17.88 ± 14.65 | 0.329 |
| Skin temperature | 9 : 32 | -17.42 ± 11.24 | -16.73 ± 15.16 | 0.900 |
| Edema | 8 : 33 | -15.00 ± 8.92 | -17.34 ± 15.36 | 0.683 |

- ✓ There were no significant differences in the degree of BMD decline based on sex or the affected site.
- ✓ Patients exhibiting **trophic changes** demonstrated a significantly greater reduction in targeted BMD compared to those without such changes.
- ✓ Other Clinical Signs like sweating, edema, and decreased ROM were not significantly associated with BMD loss.

## Conclusion

- ✓ Focused **BMD is significantly reduced in the affected limbs of patients with CRPS**. This localized bone loss is significantly associated with **longer disease duration** and **trophic changes**.
- ✓ It serves as a practical tool for monitoring localized bone loss in clinical management.
- ✓ Limitations**:** Further validation is required to establish its correlation with traditional BMD methods.