

Risk Factors for Low Trabecular Bone Volume among Patients with Chronic Kidney Disease

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Research Question: What is the prevalence of low trabecular bone volume across renal osteodystrophy groups?

BACKGROUND

- Metabolic bone disease is a common complication of chronic kidney disease (CKD), broadly referred to as CKD-mineral and bone disorder (CKD-MBD).
- It is characterized by biochemical and skeletal abnormalities as well as vascular calcification, while renal osteodystrophy (ROD) solely refers to the skeletal abnormalities.
- ROD can manifest as a high [Osteitis Fibrosa (OF, Figure 1A.) and Mixed Bone Disease (MD, Fig. 1B)] or low turnover bone disease [Adynamic Bone Disease (ABD, Fig. 1C) and Osteomalacia (OM, Fig. 1D)].
- The relationship between ROD type and low trabecular bone volume (BV) has not been explored.

DESCRIPTION OF ORGANIZATION

The Brazilian Registry of Bone Biopsy (REBRABO) is a prospective, national multicenter cohort that aims to provide clinical information on renal osteodystrophy by creating a bone biopsy bank for CKD patients in Brazil.

METHODS

This was a retrospective cross-sectional subanalysis of the REBRABO data. Iliac crest bone biopsies were performed on 511 patients between August 2015 – December 2021. Demographic, laboratorial, and bone histomorphometric parameters were analyzed.

- Descriptive statistics for continuous variables were summarized using mean ± SD or medians (25, 75)
- Data normality was tested by the Shapiro-Wilk test.
- Unpaired t-tests/Mann-Whitney tests (continuous variables) and chi-square/Fischer's exact test (categorical variables) were used to analyze differences between patients with and without low BV
- Relationships between variables were examined by linear regression. P values < 0.05 were statistically significant

RESULTS

Figure 1A: Osteitis Fibrosa

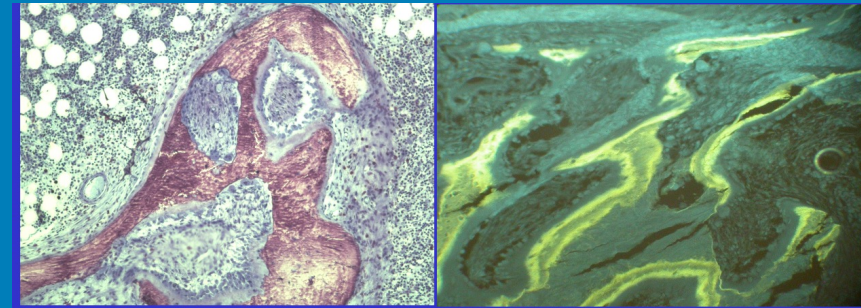


Figure 1B: Mixed Bone Disease

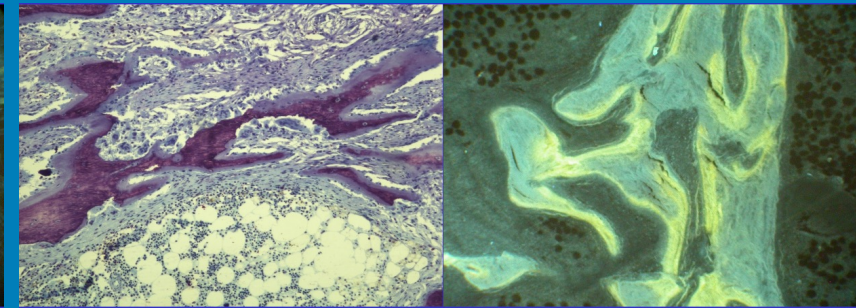


Figure 1C: Adynamic Bone Disease

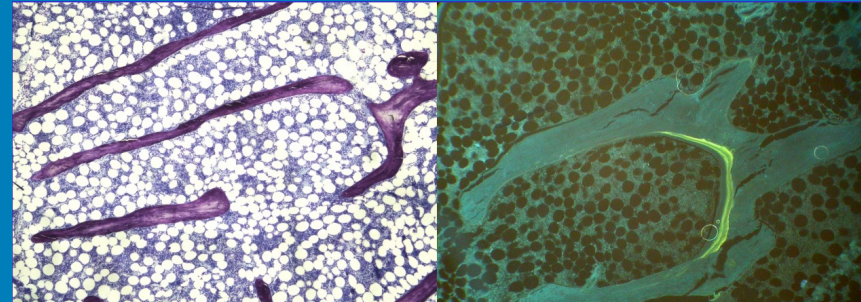
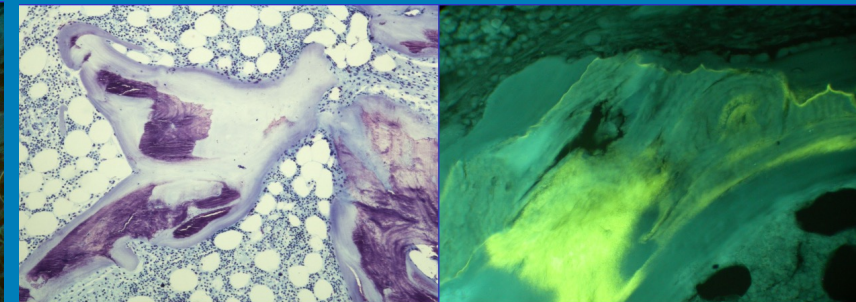


Figure 1D: Osteomalacia



Static imaging vs. dynamic imaging due to Tetracycline

Figure 2: Types of ROD

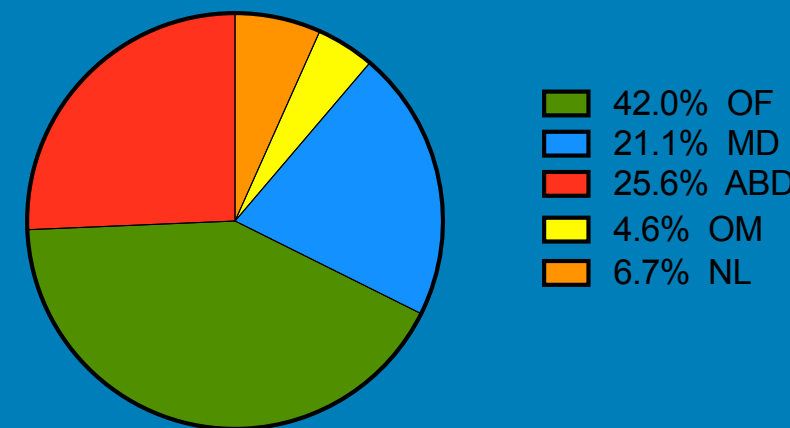


Figure 3: Distribution of patients with normal or low BV

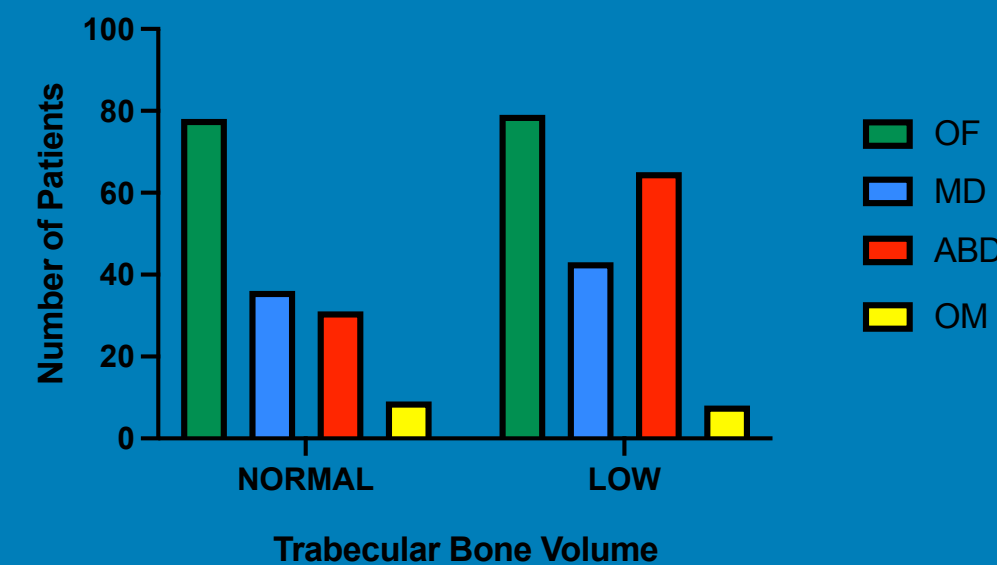


Figure 4A

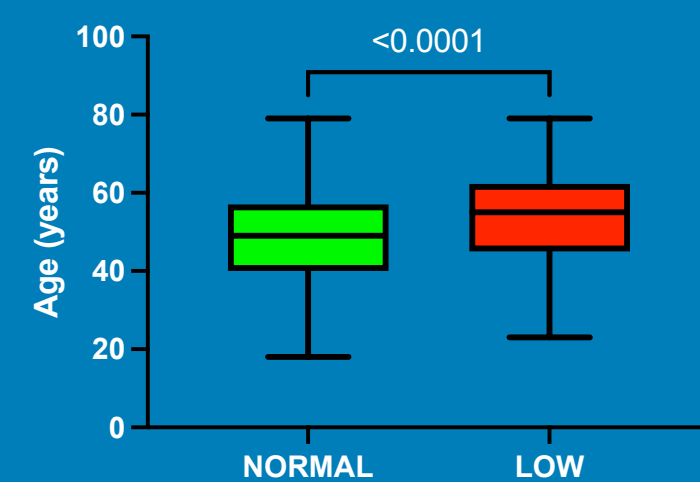


Figure 4B

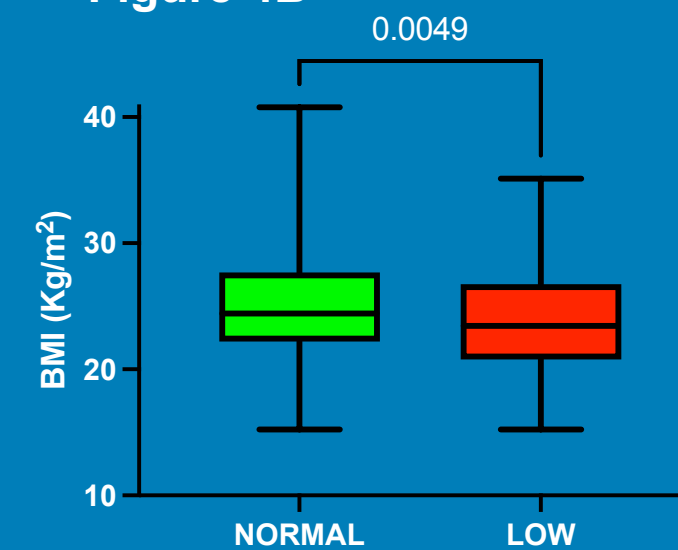


Table 1. Patient Characteristics (n=374)

Parameter	All	Low Trabecular Bone Volume	
		No (n=171)	Yes (n=203)
Age (years)	52 (42, 60)	48 (39, 56)	55 (45, 63)
BMI (kg/m ²)	24.2 (21.7, 27.3)	24.4 (22.3, 27.8)	23.6 (20.9, 26.7)
CKD Duration (months)	108.0 (44.0, 185.5)	108.0 (48.0, 180.0)	102.0 (40.5, 191.8)
Dialysis Vintage (months)	84.0 (36.0, 156.0)	84.0 (42.5, 144.5)	84.0 (36.0, 156.5)

Table 2. Logistic regression analysis to identify factors associated with low trabecular bone volume (R² 0.157)

Variable	Hazard ratio	Confidence interval		p
		Lower	Upper	
Age, each year	1.05	1.05	1.07	<0.001
BMI, each 1 kg/m ²	0.90	0.85	0.95	<0.001
ABD	1.88	1.08	3.26	0.026
PTH, pg/mL	1.00	1.00	1.00	0.581
White race	1.10	0.70	1.73	0.671

- The median age and BMI of the 374 patients were 52 (42-60) years and 24.2 (21.7-27.3) kg/m², respectively.
- Low BV was found in 50.3% of patients with OF, 54.4% with MD, 67.7% with ABD, and 47.1% with OM.
- Patients with low BV (52%) were older and with a lower BMI (Figure 4A and 4B, respectively). Low BV also was more common in patients with ABD. Multivariate analysis disclosed that low BV was associated with age (HR =1.05), BMI (HR=0.90), and ABD (HR=1.88), as show in Table 2.

DISCUSSION

- The proportion of patients with low BV is greater in ABD than other forms of ROD, and this association between ABD and low BV remains significant after adjustment for demographic (age, race), body composition (BMI), and laboratory (PTH) parameters.
- Chronic kidney disease patients who have lower trabecular bone volume are older, have a lower BMI, and are more likely to have adynamic bone disease than any other form of renal osteodystrophy.

REFERENCES

- Carbonara, C.E.M, et al., Overview of renal osteodystrophy in Brazil: a cross-sectional study. Braz. J. Nephrol, 2023.
- Martin, K.J. and González, E.A., Metabolic Bone Disease in Chronic Kidney Disease. J Am Soc Nephrol 18: 875–885, 2007