

Low Bone Density in Patients with Pancreatic Adenocarcinoma: Another Component of Cachexia

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Background: Pancreatic ductal adenocarcinoma (PDAC) is the deadliest of all common malignancies. Cancer cachexia, a devastating syndrome of systemic wasting, affects 80% of patients with PDAC. Muscle atrophy is a common hallmark of cachexia, but the endocrine signaling factors that heighten cachexia may also influence bone biology. We aimed to assess bone density in surgical patients with PDAC. We hypothesize that patients with PDAC have lower bone density than expected and that osteopenia may influence surgical outcomes.

Methods: Patients with PDAC that underwent surgery at the University of Florida (Gainesville) between 2011 and 2017 were included. PDAC cases were matched to non-cancer control cases by age, sex, and comorbidities. Mean radiation attenuation (HU) of the lumbar vertebral bodies was used to measure bone density from preoperative computed tomography (CT). Lumbar (L3) skeletal muscle area was measured using sliceOmatic software.

Results: Seventy-seven patients with appropriate CT scans were identified that underwent upfront resection for PDAC; average age was 69 (39-84) years. As expected, bone density inversely correlated to age ($R = -0.4922$, $p < 0.0001$). Patients with PDAC had significantly lower lumbar radiodensity compared to non-cancer control patients (131.8 HU vs. 157.7 HU, $p < 0.05$). 80% of patients with PDAC were classified as osteopenic compared to 50% of control patients ($p < 0.01$). Similarly, patients with PDAC were more likely to have frank signs of vertebral degeneration (41% vs. 13%, $p < 0.05$). 75% of patients had low muscle mass, and these patients had significantly lower bone density (129.6 HU vs. 154.8 HU, $p < 0.01$). Bone density correlated with lumbar skeletal muscle index ($R = 0.3315$, $p < 0.005$).

Conclusion: Surgical patients with PDAC have lower bone density than non-cancer patients. Low bone density may worsen outcomes and increase post-operative complications. The mechanisms driving bone remodeling in cancer patients deserves further investigation, but vitamin D administration may be of benefit. Understanding osteopenia in conjunction with cancer cachexia will improve PDAC survival.