Pain, Functional Outcomes, and Opioid Utilization Following Vertebral Augmentation with Tumor Ablation in Metastatic Vertebral Compression Fractures

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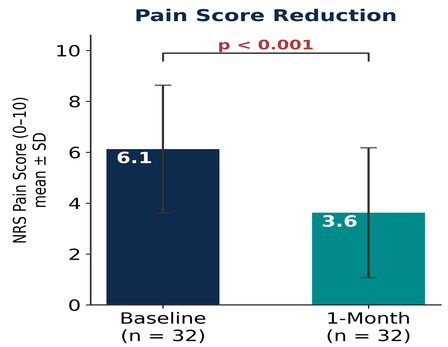
BACKGROUND

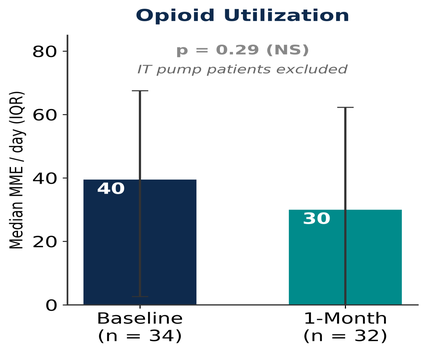
- Vertebral compression fractures (VCFs) affect ~ 1.5 million Americans annually and are markedly more prevalent in cancer patients due to metastatic bone disease.[1]
- Metastatic VCFs are a major source of pain, disability, and opioid utilization in oncology populations.
- Balloon kyphoplasty is an established minimally invasive intervention providing rapid pain relief and functional improvement in cancer patients.[2]
- Radiofrequency tumor ablation has emerged as an effective adjunct for tumor debulking and pain palliation, with durable relief sustained up to 12 months.[3]
- However, vertebral augmentation alone may leave residual kyphosis, soft tissue damage, and deconditioning—potentially compromising long-term outcomes.
- Real-world data on patient-reported functional outcomes and opioid trajectories after combined vertebral augmentation and tumor ablation remain limited in oncology populations.
- Physical rehabilitation has shown promise in enhancing musculoskeletal recovery after spinal procedures, improving strength, mobility, and reducing complications.
- Yet, its role as a structured adjunct to vertebral augmentation remains largely unexplored.

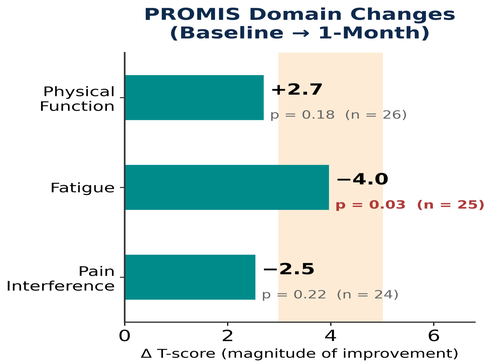
METHODS

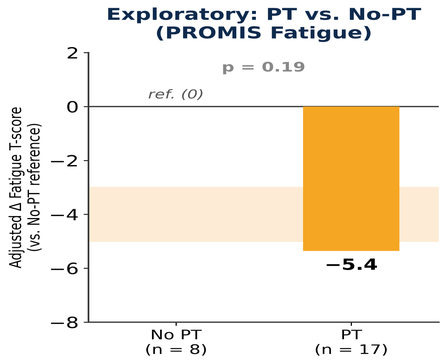
- IRB-approved retrospective chart review of adult patients with metastatic spinal disease undergoing vertebral augmentation with or without tumor ablation at Emory University (2020–2025).
- Outcomes included numeric pain scores (NRS 0–10), PROMIS Physical Function, Fatigue, and Pain Interference scores, opioid use in MME/day, PT participation, and 90-day readmissions.
- Opioid MME was calculated from PDMP and inpatient MAR; intrathecal pump patients were excluded, buprenorphine was flagged separately, and methadone was converted using tier-based dose-dependent factors.
- Pre-to-post changes were assessed with paired Wilcoxon signed-rank tests; exploratory PT vs. no PT comparisons used Mann-Whitney U tests and ANCOVA adjusting for baseline scores.

RESULTS









Shaded gold bands = Minimally Clinically Important Difference (MCID), 3–5 T-score points

Cohort (per procedure, n = 36)

- Age 62.6 ± 12.0 y; 80.6% female
- Breast 41.7%; multiple myeloma 22.2%
- 83 levels; 32 kyphoplasty + ablation
- 33 unique patients (3 repeat procedures)
- PT referral placed: 66.7%
- 90-day readmission: 22.2%
- Complications: 1 (2.9%)

DISCUSSION

- Vertebral augmentation with adjunctive tumor ablation provided clinically meaningful short-term pain relief, with a mean 2.5-point NRS reduction at 1 month ($p < 0.001$).
- Despite significant pain improvement, median opioid utilization did not significantly decrease (40 → 30 MME/day, $p = 0.29$), highlighting a potential disconnect between procedural analgesia and opioid de-escalation.
- PROMIS Fatigue improved significantly (−4.0 T-score points, $p = 0.03$), within the 3–5 point MCID range; Physical Function (+2.7, $p = 0.18$) and Pain Interference (−2.5, $p = 0.22$) trended favorably but did not reach significance.
- In exploratory analyses, PT participation was associated with a numerically greater reduction in PROMIS Fatigue (adjusted difference −5.4 T-score points, $p = 0.19$), a magnitude at or above the published MCID; the study was not powered to detect between-group differences.

CONCLUSION

- Vertebral augmentation with adjunctive tumor ablation provides significant short-term pain relief in patients with metastatic vertebral compression fractures.
- Despite meaningful procedural pain reduction, opioid de-escalation did not automatically follow — suggesting that pain relief and opioid management require separate, targeted interventions.
- Wide variability in opioid use (IQR 3–68 pre; 0–62 post), including methadone and buprenorphine regimens, underscores the need for individualized opioid management.

REFERENCES

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[3]Levy J, David E, Hopkins T, et al. Radiofrequency ablation provides rapid and durable pain relief for the palliative treatment of lytic bone metastases independent of radiation therapy: final results from the OsteoCool Tumor Ablation Post-Market Study. *Cardiovasc Intervent Radiol.* 2023;46(5):600–609.