Minimally Invasive Ablation, Cement, and Screw Fixation of Periacetabular Metastases Demonstrates Long-Term Improvement of Pain and Functional Outcomes: A Prospective Cohort Study

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INTRODUCTION:
Minimally invasive management of periacetabular metastases has increased in popularity in recent years. In patients with limited life expectancy and poor surgical candidacy, percutaneous combined radiofrequency ablation, cement, and screw fixation can improve pain and functional status. The procedure relies on focal cancer cytoreduction, cement reinforcement, and screw fixation to prevent additional osteolytic loss. Long-term durability of minimally invasive stabilization is unclear. In this study, we report 1 to 4-year follow-up in a prospective cohort to determine if post-operative improvement in pain and functional outcomes are maintained.

METHODS:
A single-center prospective cohort study of 96 patients (104 acetabuli; average follow-up 14.9 ± 15.5 months) was conducted of all osteolytic periacetabular metastases treated by combined radiofrequency ablation, cement, and screw fixation from 2017 to 2024 (**Figure 1 and 2**). Surgical indication included clinical pain, functional impairment, impending or completed pathological fractures, and subchondral defects. Patients were followed until death or to longest-available follow-up. Primary data collected included a combined pain and functional score (1=bedbound, 10=full ambulation), Eastern Collaborative Oncology Group (ECOG) scores, and revision procedures. T-test was used to compare pre- and post-operative scores at two-weeks. Two-week post-operative and long-term follow-up (6-months, 12-months, 24-months, 36-months, and 48-months) were compared to evaluate long-term change.

RESULTS:
Nearly all patients experienced improvement (2-weeks post-op) in pain and functional status (94 patients; 97.9%). Out of 43 bedbound or wheelchair-bound patients, 40 (93.0%) became ambulatory at two-week follow-up. Initial combined pain and functional score improved 3.2 ± 1.6 points (4.5 ± 2.1 at pre-op to 7.7 ± 2.0 at two-week post-op; $P<0.0001$) at two-weeks post-operative follow-up. ECOG scores improved from 3.0 ± 1.1 to 1.2 ± 0.99 at two-weeks post-operative (net change = -2.0, $p<0.0001$).

As of May 2024, 37 of 96 patients are alive (38.5%). 4 of these 37 patients are recent surgeries (follow-up <3 months). Combined pain and functional scores were maintained at all time points: 6-months (n=60; p=0.4907), 12-months (n=41, p=0.7853), 24-months (n=22, p=0.2835), 36-months (n=14, p=0.5681), and 48-months (n=7, p=0.0844) (**Figure 3 and 4**).

There were no instances of surgical site infections, delays to chemotherapy or radiation therapy, conversion to total hip arthroplasty, readmissions, pulmonary embolism, or venous thromboembolism. Five patients (5.2%) required revision ablation and/or cement injection. One patient experienced cement leakage.

DISCUSSION AND CONCLUSION:
Minimally invasive stabilization of periacetabular metastases demonstrates evidence of long-term stability of at least 12-months post-op. Preliminarily, limited evidence shows stability maintained up to 48-months. Longer-term survival is difficult to analyze in oncology studies given poor life expectancy. For patients with extensive cancer burden and limited life expectancy, this procedure can provide satisfactory pain reduction and ambulatory improvement without subjecting patients to open surgery. The procedure does not exclude future open surgery and may bridge patients to open surgery once systemic cancer control is achieved and patients are more medically optimized.

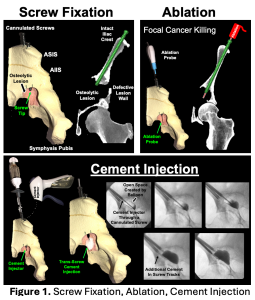


Figure 1. Screw Fixation, Ablation, Cement Injection

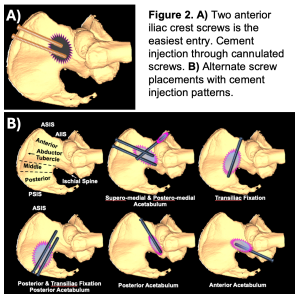
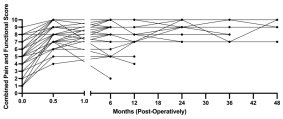


Figure 2. A) Two anterior iliac crest screws is the easiest entry. Cement injection through cannulated screws. **B)** Alternate screw placements with cement injection patterns.



10 **Full functional status. No pain.**
9 **Full functional status. Mild pain.**
8 **Mild limp w/ moderate pain.**
7 **Cane required w/ mild pain.**
6 **Walker/Crutches required w/ moderate pain.**
5 **Walker required w/ severe pain.**
4 **Wheelchair required w/ moderate pain.**
3 **Wheelchair required w/ severe pain.**
2 **Bedbound, can sit w/ moderate pain.**
1 **Bedbound, unable to sit. Severe pain.**

Figure 3. Changes in combined pain and functional scores in patients with at least 6-months follow-up.

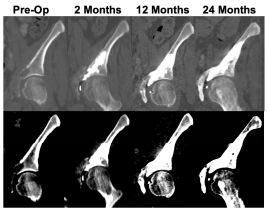


Figure 4. 53F with metastatic breast showing excellent stabilization with ischium bone regeneration.