

Transarterial Therapy in Bone Metastases: Evidence for Pain Palliation, Local Control, and Perioperative Outcomes

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Introduction

- Bone metastases are a major source of morbidity in cancer patients, often resulting in severe pain, functional impairment, and increased surgical risk.
- Locoregional therapies such as TAE and TACE are increasingly utilized for pain palliation, preoperative devascularization, and local tumor control, particularly in cases refractory to standard treatments or with hypervascular lesions.

Purpose

- Locoregional therapies, including transcatheter arterial embolization (TAE) and transarterial chemoembolization (TACE), are increasingly used in the management of bone tumors, particularly for metastatic disease.
- We aimed to critically explore the current use of TAE and TACE for pain palliation, preoperative devascularization, and in select cases, local tumor control in metastatic bone tumors.

AIM: To evaluate the clinical effectiveness and safety of TAE and TACE in the management of bone metastases, with a focus on pain relief, local tumor control, and perioperative outcomes.

What are TAE and TACE?

TAE is a minimally invasive, image-guided procedure where an artery feeding a tumor is selectively blocked using embolic materials (e.g., particles, beads, coils, glue). The goal is to cut off the blood supply to cause ischemia leading to tumor necrosis and pain relief.

TACE is a similar process as TAE, but chemotherapy is also delivered directly into the feeding artery before embolization. The embolization not only starves the tumor but also traps the chemotherapy inside the tumor bed, maximizing local concentration while minimizing systemic toxicity.

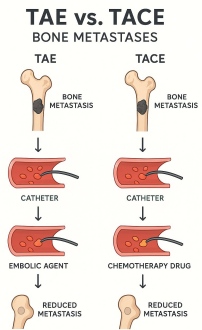


Figure 1. Diagram highlighting the steps of TAE and TACE being used in metastatic bone tumors.

How it works mechanistically:

- Access & Catheterization- A catheter is introduced through the femoral or radial artery under fluoroscopic guidance. The catheter is advanced into the arterial supply feeding the bone metastasis (e.g., iliac artery for pelvic mets, femoral for femur mets, intercostal/vertebral for spine mets).
- Angiographic Mapping- Contrast is injected → vascular anatomy and tumor blush visualized. This confirms the feeding vessels and rules out dangerous collaterals (e.g., spinal cord branches).
- Therapy Delivery-
 - TAE: Embolic particles (microspheres, PVA particles, gelatin sponge, coils) are injected → occlude tumor vessels.
 - TACE: First, chemotherapy (e.g., doxorubicin, cisplatin, mitomycin C) mixed with lipiodol or loaded in drug-eluting beads is infused into the artery.
 - Then embolic material is injected to trap drug + block blood flow.
- Post-Embolization- Tumor undergoes ischemia ± chemo-induced necrosis. Pain reduction occurs within days to weeks; tumor shrinkage or stabilization can follow. Sessions can be repeated depending on tumor burden and clinical response.

Results

Reported Outcomes of TAE and TACE in Bone Metastases	
Domain	Findings
Pain Relief	<ul style="list-style-type: none">60-92% pain relief overallEffective even in radiotherapy-refractory cases
Sarcomas (Osseous and Soft Tissue)	<ul style="list-style-type: none">Pain control in 79%Radiographic necrosis in 76%Tumor size ↓ in >50%Necrosis histologically confirmed in resected specimens
Survival	<ul style="list-style-type: none">1-year survival: 38.9%Median survival: 12 months
Preoperative Role	<ul style="list-style-type: none">Technical success: 96% (hypervascular long bone mets)Significant intra- & postoperative bleedingMean transfusion: <2 units in most seriesEnables low-blood-loss surgery → improved functional outcomes
Safety	<ul style="list-style-type: none">Adverse events: generally mild & transientSerious complications: rare

Table 1. Table summarizing the outcomes of TAE and TACE in the management of bone metastases.

- TAE and TACE demonstrate high rates of pain relief (60-92%) in patients with painful bone metastases, including those refractory to radiotherapy.
- In malignant osseous and soft tissue sarcomas, TAE achieved pain control in 79% and radiographic necrosis in 76% of tumors, with tumor size reduction in over half of cases and histologically confirmed necrosis in resected specimens.
- The 1-year survival rate for metastatic bone tumors was 38.9%, with a median survival of 12 months.
- Preoperative TAE for hypervascular metastatic tumors of long bones is technically successful in 96% of cases and significantly reduces intraoperative and postoperative bleeding, with mean transfusion requirements of less than 2 units in most series.
- TAE enables bloodless or low-transfusion surgery in the majority of patients and improves functional outcomes.
- Adverse events are generally mild and transient, with serious complications being rare.

Conclusion

- Transarterial therapies are effective, rapid-acting, and safe options for pain palliation, local tumor control, and perioperative devascularization in bone metastases.
- Clinical evidence supports their use as adjuncts to standard therapies, especially in patients with refractory pain or hypervascular lesions.
- Ongoing studies will further clarify optimal integration with other modalities and refine patient selection.

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