

# Therapeutic Potential of Transarterial Chemoembolization in Osteosarcoma: A New Path Forward

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## Introduction

- Osteosarcoma is an aggressive primary bone malignancy, most commonly affecting adolescents and young adults.
- Standard management involves neoadjuvant chemotherapy and limb-salvage surgery, but outcomes remain suboptimal for advanced or unresectable disease, and some patients are unable or unwilling to undergo surgery.
- There is a critical need for alternative, less invasive local therapies that can improve tumor control and quality of life.

## Purpose

- Transarterial chemoembolization (TACE) is established in the management of hypervascular tumors and has been explored as a local treatment modality for osteosarcoma, especially in cases where standard surgical or systemic therapies are not feasible.
- We aimed to critically evaluate the therapeutic potential of TACE in osteosarcoma, summarizing findings from exploratory studies that explored locoregional therapies in unresectable or palliative cases.

**AIM:** To evaluate the therapeutic potential of transarterial chemoembolization (TACE) as a local treatment modality in osteosarcoma, focusing on efficacy, safety, and impact on patient outcomes.

## What is TACE?

TACE is a minimally invasive, image-guided therapy that delivers chemotherapy directly into the artery feeding a tumor while also blocking blood flow (embolization) to trap the drug in place and starve the tumor of oxygen and nutrients.

How it works mechanistically:

- Catheterization:** An interventional radiologist threads a catheter (usually via femoral or radial artery) into the arterial supply of the tumor.
- Chemotherapy delivery:** A high concentration of chemotherapy is injected locally (commonly doxorubicin, cisplatin, or methotrexate in bone sarcoma studies).
- Embolization:** Tiny particles, beads, or coils are delivered to block the vessel. This prevents washout of the chemo and causes ischemia, thereby enhancing tumor necrosis.

## TACE in Osteosarcoma

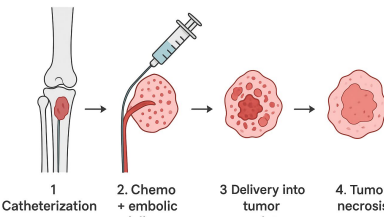


Figure 1. Diagram highlighting the steps of TACE being used in Osteosarcoma.

## Results

Reported Outcomes of TACE in Osteosarcoma	
Domain	Findings
Tumor Response	<ul style="list-style-type: none"><li>Significant necrosis &amp; ↓ volume</li><li>Histopathology: necrosis confirmed in most tumors</li></ul>
Symptom Control	<ul style="list-style-type: none"><li>↓ Pain relief</li><li>↑ Limb function</li><li>Some cases: marked symptomatic improvement</li></ul>
Survival	<ul style="list-style-type: none"><li>1-yr survival: up to 95.5%</li><li>5-yr survival: ~42% (select groups)</li></ul>
Treatment Factors	<ul style="list-style-type: none"><li>Smaller embolic particles → longer relapse interval</li><li>Certain chemo agents → greater necrosis</li></ul>
Safety	<ul style="list-style-type: none"><li>Well tolerated overall</li><li>Low incidence of severe complications</li></ul>
Combination Approaches	<ul style="list-style-type: none"><li>TACE + iodine-125 seed implantation → promising results (case reports)</li></ul>
Limitations	<ul style="list-style-type: none"><li>Evidence mainly from non-randomized studies &amp; case reports</li><li>Optimal patient selection = undefined</li></ul>

Table 1. Table summarizing the results of the Reported Outcomes of TACE in Osteosarcoma.

- Exploratory studies demonstrate that TACE can induce significant tumor necrosis and reduce tumor volume in osteosarcoma, with histopathologic confirmation of necrosis in most treated tumors.
- TACE has been associated with improved pain control and limb function, with some reports noting marked symptomatic relief.
- Survival outcomes vary, but retrospective series report 1-year survival rates up to 95.5% and 5-year rates of 42% in select populations.
- The choice of embolic material and chemotherapeutic agent may influence efficacy, with smaller particle sizes and certain agents associated with longer relapse intervals and greater necrosis.
- TACE is generally well tolerated, with a low incidence of severe complications.
- Combination approaches, such as TACE with iodine-125 seed implantation, have shown promising results in individual cases.
- However, the evidence is limited to non-randomized studies and case reports, and optimal patient selection criteria remain undefined.

## Conclusion

- TACE is being increasingly utilized for osteosarcoma, with expanding indications supported by retrospective data demonstrating tumor necrosis, symptom relief, and potential survival benefits.
- Although formal clinical guidelines specific to osteosarcoma are lacking, the growing body of evidence supports individualized treatment plans based on tumor characteristics, such as vascularity, stage, and resectability.
- Further research is required to clarify optimal patient selection, comparative efficacy of embolic materials and chemotherapeutic agents, and integration with other therapies to optimize outcomes.

## Bibliography

- Ran L, Li F, Jiang L, Yang L, Liu Y. Arterial Perfusion Chemoembolization Combined With Iodine-125 Seeds for Stage IIB Osteosarcoma: A Case Report. *Oncology Letters*. 2025;30(1):347. doi:10.3892/ol.2025.15093. PMID: 40438873.
- Jiang C, Wang J, Wang Y, et al. Treatment Outcome Following Transarterial Chemoembolization in Advanced Bone and Soft Tissue Sarcoma. *Cardiovascular and Interventional Radiology*. 2016;39(10):1420-8. doi:10.1007/s00270-016-1399-x. PMID: 27334571.
- Chu JP, Chen W, Li JP, et al. Clinicopathologic Features and Results of Transcatheter Arterial Chemoembolization for Osteosarcoma. *Cardiovascular and Interventional Radiology*. 2007 Mar-Apr;30(2):201-6. doi:10.1007/s00270-005-0302-y. PMID: 17200904.
- Nagata Y, Mitsumori M, Okajima K, et al. Transcatheter Arterial Embolization for Malignant Osseous and Soft Tissue Sarcomas. II. Clinical Results. *Cardiovascular and Interventional Radiology*. 1998 May-Jun;21(3):208-13. doi:10.1007/s002709900246. PMID: 9626436.

