Evaluation of efficacy and safety in pre-operative transarterial embolization of bone metastases: A local center experience

YT Lit, SC Woo, HL Wong, SY Lam, FH Ng, NY Pan, LF Cheng
Department of Radiology, Princess Margaret Hospital, Hong Kong

1. Introduction

- Incidence of bone metastases has increased with oncological treatment advancements. They significantly impact quality of life and may lead to debilitating sequalae such as spinal cord compression.
- Surgical intervention is one of the main alternative treatments for patients who have failed or unsatisfactory results from initial radiotherapy treatment.
- However, it is notoriously associated with substantial intra-operative blood loss, reportedly up to 2000-18,500ml (mean 6800ml)[5], resulting in morbidity and mortality.
- Pre-operative transarterial embolization (TAE) of bone metastases has hence been increasingly employed worldwide, aiming to devascularize the tumor, in hopes to reduce catastrophic intra-operative blood loss and relieve patient symptoms.

2. Methods

- All cases of bone metastases which underwent pre-operative TAE from January 2019 to December 2023 were retrospectively reviewed.
- Data on patient demographics, pre-operative imaging, both embolization and operative records, pathology results and post-procedural patient outcomes were collected and analyzed.

3. Results

- A total of 11 patients (12 bone metastatic lesions in total) were evaluated.
- Mean age was 64.3 years (range 56-78). Male-to-female ratio was 1.75:1.
- TAE was done at different body regions (Table 1).
- Most lesions were metastasized from renal cell carcinoma in up to 66.7% (8/12). Others were from hepatocellular, thyroid and gastric carcinomas.
- All target lesions were depicted to be hypervascular tumors on pre-embolization catheter angiography.
- Various embolic agents were used (Table 2).
- Technical success, defined as ≥70% obliteration of tumor stain, was achieved in 83.3% (10/12) of cases.
- Among which the mean intra-operative blood loss was 1253.6 mL (range 100-4000); while mean intra-operative red cell transfusion volume was 626.3 mL (range 0-1965).
- No intra-operative blood transfusion was at all required in 20.0% of cases with technically successful TAE.
- None of the patients had post-embolization adverse reactions or major complications.

Table 1. Regions of Embolization

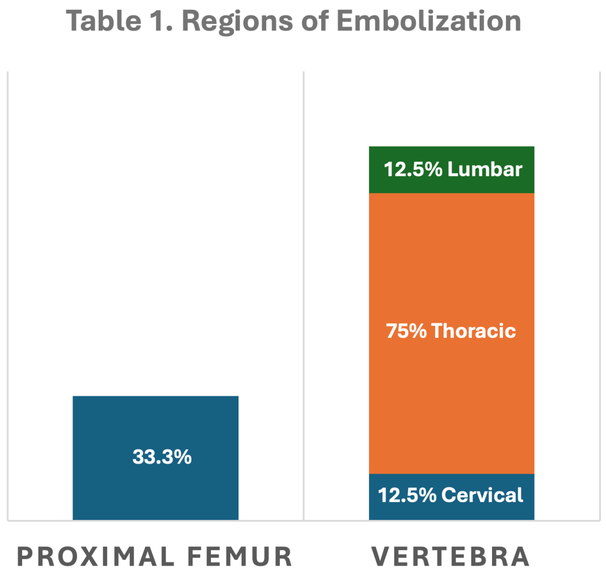
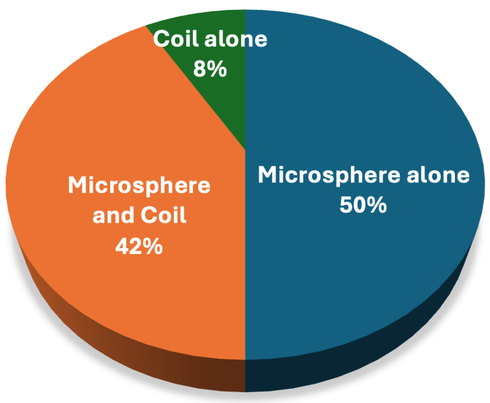


Table 2. Embolic Agents



4. Discussion

- Our results demonstrate that pre-operative transarterial embolization could be **safe and effective** in reducing intra-operative blood loss for hypervascular bone metastases.
- Our technical success rate of 83.3% is **coherent** with past literature, which is reportedly between 43.8% to 90.5%[1].
- **Particles** are often the preferred embolic agents, such as microspheres or polyvinyl alcohol particles. The use or addition of coils has also been described, but usually with individualized considerations and additional precaution[1,4].
- **Femoral vascular access** is commonly used. **Crossover** femoral access can be considered for proximal femoral tumors, when access-to-lesion region is considered technically challenging with the conventional antegrade femoral approach.
- **Adequate pre-procedural planning** minimizes severe complications. This includes relevant history taking and physical examination, cross-sectional imaging (such as CT angiography or intra-operative cone-beam CT)[2], and prior case-based discussion with the multi-disciplinary team.
- **Careful embolization technique** is crucial, including adequate pre-procedural catheter angiographic assessment, choice and sizing of embolic agents, superselection and injection techniques, and sharp clinical judgement[1,2,4].
- Though not encountered in our cohort, well-recognized severe complications include spinal cord and intracranial infarctions[3].

While maximizing tumor devascularization remains the goal, it should **not** be done **at the expense of significant non-target embolization**[2].

[TAE for T12 vertebral metastasis of renal cell carcinoma]

After multiple diagnostic spinal artery angiograms at bilateral T10-L1 levels, further superselective angiograms were done to confirm location of the tumor blush (white arrows, Figures 1-2), which was supplied by bilateral T12 spinal arteries.

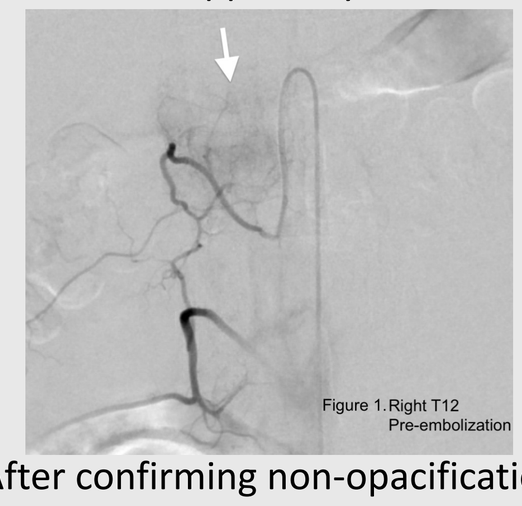


Figure 1. Right T12 Pre-embolization

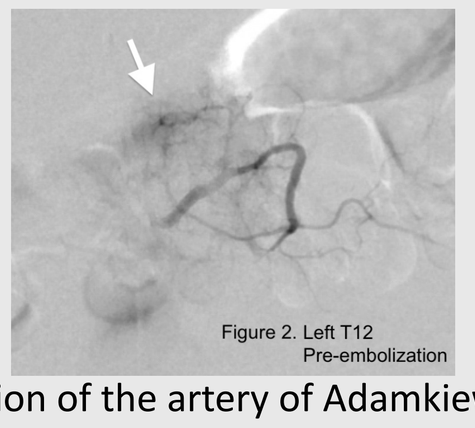


Figure 2. Left T12 Pre-embolization

After confirming non-opacification of the artery of Adamkiewicz and absence of arteriovenous shunts, target embolization was performed at bilateral T12 spinal arteries with 300-500µm Embospheres, until stasis was achieved.

Figure 3. Right T12 Post-embolization

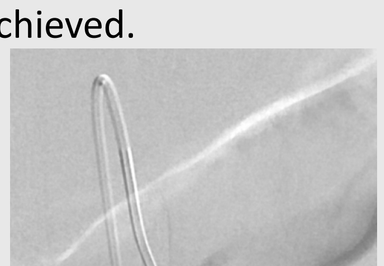


Figure 4. Left T12 Post-embolization

Respective post-embolization angiograms show complete obliteration of tumor vascularity (Figures 3-4). Subsequent surgery was uneventful with no torrential intra-operative bleeding encountered. Patient had no new neurological deficits.

[TAE for right proximal femoral metastasis of renal cell carcinoma]

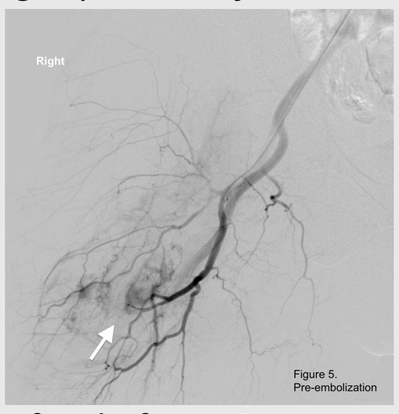


Figure 5. Pre-embolization

Figure 6. Post-embolization

Right profunda femoris artery was cannulated via crossover femoral approach, confirming location of tumor blush (white arrow, Figure 5). Embolization microspheres and coils were deployed. Complete obliteration of tumor vascularity was achieved (Figure 6). No significant bleeding was encountered intra-operatively, with minor blood loss of 100ml only.

5. Conclusion

Pre-operative transarterial embolization of bone metastases could contribute to reduction in intra-operative blood loss and is relatively safe, given careful attention to pre-procedural planning and technique.

References:

1. Faiella E, Santucci D, Vertulli D, et al. Preoperative Embolization of Vertebral Metastasis: Comprehensive Review of the Literature. Diseases. 2023;11(3):109. Published 2023 Aug 28. doi:10.3390/diseases11030109
2. Haber Z. Transarterial Embolization of Bone Metastases. Tech Vasc Interv Radiol. 2023;26(1):100883. doi:10.1016/j.tvir.2022.100883
3. Houten JK, Swiggett SJ, Hadid B, et al. Neurologic Complications of Preoperative Embolization of Spinal Metastasis: A Systemic Review of the Literature Identifying Distinct Mechanisms of Injury. World Neurosurg. 2020;143:374-388. doi:10.1016/j.wneu.2020.08.006
4. Prince EA, Ahn SH. Interventional management of vertebral body metastases. Semin Intervent Radiol. 2013;30(3):278-281. doi:10.1055/s-0033-1353480
5. Sun S. Bone Metastases from Renal Cell Carcinoma: Preoperative Embolization. Medical radiology. Published online January 1, 2006:189-199. doi:https://doi.org/10.1007/3-540-33257-x_15