

Initial single center experience: RFA assisted vertebroplasty and osteoplasty using a bipolar device in the palliation of bone metastases

Elizabeth David, MD, Bo Angela Wan, MD(C), Stephanie Chan BSc(C), Sagi Kaduri, MD, Edward Chow, MBBS, Arjun Saghal, MD, Albert Yee, MD

Introduction

- Both radiofrequency ablation (RFA) and osteoplasty (OP) (aka Cementoplasty) have been used independently in the treatment of painful bone metastases.
- More recent studies have suggested a synergistic effect on pain relief when the two are combined. (1)
- Monopolar RFA systems have been used previously; injury to adjacent structures have been described (2).
- Bipolar RFA delivers energy in a more precise and localized fashion (3, 4), minimizing the risk of injury to adjacent structures.
- RFA use prior to cement injection has been thought to improve control of injection (5, 6, 7).

Objectives: To assess the safety and clinical outcomes of bipolar radiofrequency ablation (RFA) assisted vertebroplasty (VP) and osteoplasty (OP) in pathological and insufficiency fractures.

Materials and Methods

- Patients referred for symptomatic fractures for VP or OP from January 2011 to May 2015 were retrospectively reviewed.
- Bipolar RFA was performed (Osteocool RF ablation system, Baylis Medical) reaching a constant temperature of 70°C over 7 to 15 minutes followed by cement injection.
- Clinical outcomes were evaluated by review of the EMR. Radiological outcomes were assessed with CT. Pre and post procedural pain scores were documented for the RFA subset.
- Statistical analysis
- Descriptive statistics for patient characteristics
- Paired T test used to compare pain scores

Results

- 22 patients in were treated with the RFA assisted technique and 56 with non-RFA patients (Table 1).
- For the 26 RFA assisted patients,
- 4 OPs and 35 VP levels.
- Of these, 4 VP levels were insufficiency fractures. All were technically successful without morbidity or mortality.
- For the 56 patients were treated with a non-RFA assisted technique.
- All these were VPs and 142 levels were treated in total.
- Two levels were insufficiency fractures. All were technically successful without morbidity.
- There was a significantly reduced rate of posterior and venous cement leaks when RFA was used prior to VP.
- Pain scores in the RFA assisted group decreased post procedure with no neuropathic events (Table 2).

Variables	RFA assisted	Non-RFA assisted
Number of patients	22	56
Number of VPs	35	142
Age; mean (SD)	68.4 (15.8)	72 (9.2)
Gender; M (%)	11 (50%)	30 (53.6%)
Lesion type		
Hematological cancer	2 (9.1%)	12 (21.4%)
Solid tumor	12 (54.5%)	9 (16.1%)
Prostate cancer	6 (27.3%)	7 (12.5%)
Osteoporosis	2 (9.1%)	28 (50%)

Table 1: RFA-assisted and non-RFA assisted patient populations

Pain score prior to procedure	Pain score following procedure	Difference [95% confidence interval]	P value
8.4	4.0	-4.4 [3.1 to 5.6]	<0.00001

Table 2: Pain scores in patients before and after RFA assisted vertebroplasty and osteoplasty

Conclusions

- RFA assisted VP and OP using a bipolar device is safe and allows for controlled injection of cement into a thermal cavity with a decrease in venous and posterior cement leaks.
- This is a procedure that can be done under conscious sedation and in the same setting.
- Radiologic outcomes are good with interval stability of lesions treated.
- Pain is improved, most often very quickly.
- Cement injection appears to be more controlled.
- Additional tool / option for pain control in a group of patients with few options (mostly non surgical).
- Can be an adjunct to radiotherapy

References

1. Ralf Thorsten Hoffmann, Tobias F. Jakobs, Christoph Trumm, Christof Weber, Thomas K. Helmlinger, and Maximilian F. Reiser. Radiofrequency Ablation in Combination with Osteoplasty in the Treatment of Painful Metastatic Bone Disease. *J Vasc Interv Radiol* 2008; 19:419 – 425
2. Peter L. Munk, Faisal Rashid, Manraj K. Heran, Michael Papirny, David M. Liu, David Malfair, Maziar Badii and Paul W. Clarkson. Combined cementoplasty and radiofrequency ablation in the treatment of painful neoplastic lesions of bone. *J Vasc Interv Radiol*. 2009 Jul;20(7):903-11
3. M Gofeld, AJM Yee, CM Whyne, MK Akens, P Pezeshki, J Woo, New Palliative Intervention for Painful Metastatic Bone Disease - The OsteoCool™ System. *European Cells and Materials* Vol. 23. Suppl. 3, 2012 (page 11)
4. J. Woo, P. Pezeshki, A.J.M. Yee, C.M. Whyne, M.K. Akens, E. Won, M. Gofeld, Validation of a Novel Bone Tumor RF Ablation System – Physics and Animal Data . GRIBOI, 2011, pp. 46
5. Ryan J. Halpin, Bernard R. Bendok, Kent T. Sato, John C. Liu, Jyoti D. Patel, Steven T. Rosen. Combination treatment of vertebral metastases using image-guided percutaneous radiofrequency ablation and vertebroplasty: a case report. *Surgical Neurology* 63 (2005) 469– 475.
6. Oliver Schaefer, Christian Lohrmann, Marco Herling, Peter Uhrmeister, and Mathias Langer, Combined Radiofrequency Thermal Ablation and Percutaneous Cementoplasty Treatment of a Pathologic Fracture, *J Vasc Interv Radiol* 2002; 13:1047–1050.
7. B.A. Georgy, W. Wong, Plasma-Mediated Radiofrequency Ablation Assisted Percutaneous Cement Injection for Treating Advanced Malignant Vertebral Compression Fractures, *AJNR Am J Neuroradiol* 28:700–05