Ablation of Bone Tumors as a Method of Pain Reduction in Metastatic Cancer

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Introduction

Metastasis to bone is often incredibly painful for patients with cancer. Radiofrequency ablation (RFA) is a technique that uses medium frequency (350-500 kHz) alternating current to generate heat and ablate tissue. Microwave ablation (MWA) uses electromagnetic waves in the microwave energy spectrum (300 MHz-300GHz) to heat and ablate tissue. Cryoablation (CA) uses cooled, thermally conductive fluid-containing probes to freeze and destroy tissue. All three of these locoregional ablation techniques are used for localized tumors (Table 1) but were only more recently adopted in the palliative treatment of metastatic cancer. This review attempts to assess the safety and efficacy profile of RFA, MWA, and CA.

Methods

A keyword search was conducted to identify full-text, peer reviewed retrospective cohort studies and meta-analyses on the safety and efficacy profiles of RFA, MWA, and CA in the palliation of pain related to cancer that has metastasized to the bone.

Table 1: Comparison of Ablation Mechanisms

Method	Mechanism	Examples of Other Established Uses
Radiofrequency Ablation	Heat generation via alternating current	Cardiac arrhythmias, benign tumors
Microwave Ablation	Heat generation via waves on microwave spectrum	Nonmetastatic lung tumors
Cryoablation	Freezing via cooled probes	Prostate and breast cancer

Table 2: Safety and Efficacy of Ablation Methods

Paper	Method	Number of Patients	Percent of Patients Reporting Pain Reduction	Percent of Patients Experiencing Complications
Mehta et al. (2020)	RFA	426	67% after 12 weeks	Not reported*
Cazzato et al. (2021)	MWA	249	88% after 4 weeks	6.4%
Torabi et al. (2025)	CA	309	69% after 4 weeks	9.6%

*While Mehta et al. does not discuss complications, Tomasian et al. (2021) reports a complication rate of 3.0% in a single-center study of 266 patients

Conclusion

Meta-analyses studying each of these modalities of tumor ablation have shown significant reductions in pain scores within days to weeks (Table 2) , which are sustained over several months after the procedure. Each of these procedures may also be combined with cementoplasty or osteoplasty to further enhance palliation and improve mechanical stability. Data regarding these procedures suggests a low rate of complication. Based on this, it seems that RFA, MWA, and CA are therapies that are promising in their efficacy in palliating metastatic bone-tumor related pain. Their low rates of complications are also encouraging in the further adoption of these techniques in easing the pain of patients with metastatic cancer.

References

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