Intramedullary Brachytherapy for the Treatment of Long Bone Metastatic Disease

O'Neill DE, Gannavarapu B, Hrycushko, B, Folkert M, Timmerman R, Callan AK

University of Texas Southwestern Medical Center
Departments of Orthopaedic Surgery and Radiation Oncology

INTRODUCTION

Metastatic disease to long bones is common and incurs significant morbidity and mortality from risk of fracture. Current treatments include bony stabilization with intramedullary nail (IMN) along with whole bone radiation therapy (WBRT) or stereotactic beam radiation therapy (SBRT) The zone of radiation for these techniques includes significant soft tissue exposure outside the lesion of interest.

METHODS

We first performed a cadaver femur model as proof of concept for IMBT. In concert with our radiation oncologist and radiation physicist, we mapped the relationship of the tumors of interest to the medial tip of the greater trochanter using a pre-operative CT scan. A guidewire was then inserted and a cannulated drill was advanced past the cancellous bone of the intertrochanteric region. A subtraction method was used to gauge the depth of the drill within the bone. The guidewire was removed and replaced with the appropriately sized brachy-catheter with radiopaque markers which was advanced to the target position.

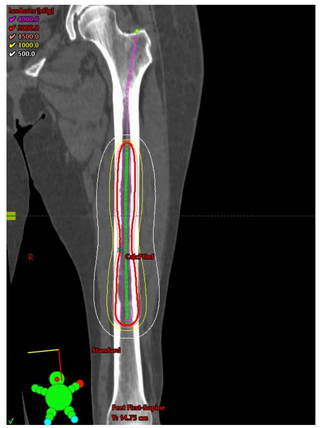

Fig 1: Preoperative radiation mapping of intramedullary tumors.

RESULTS

IMBT was performed on a 75 year old female with metastatic melanoma and impending pathologic fracture to the left femur with three distinct lesions visible on radiographs and MRI. Pre-operative CT scan was utilized to map tumor location and intramedullary radiation plan. We cannulated her femoral canal, placed the brachy-catheter in the appropriate location and her tumors were sequentially irradiated. After her radiation treatment, the brachy-catheter was removed and a femoral nail was placed in standard fashion. We encountered no complications. Patient was ambulating post-operative day one and discharged post-operative day three.

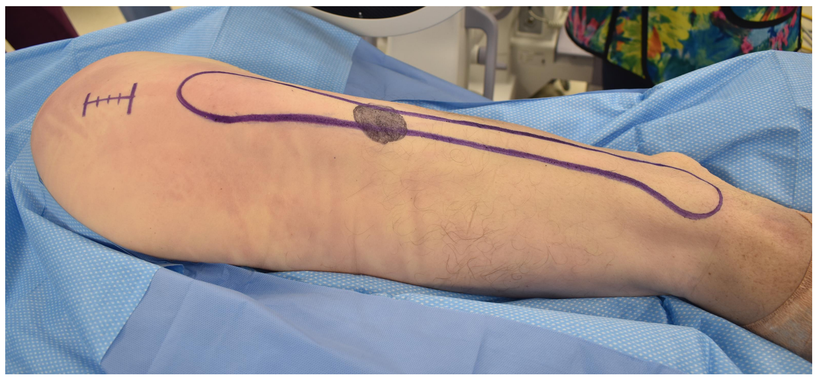

Fig 2: Preoperative skin marking including tumor location and planned incision.

CONCLUSION

Intramedullary brachytherapy is a promising new technique for the treatment of long bone metastatic disease. IMBT maximizes radiation dose to the metastatic tumor and minimizes radiation dose to healthy tissues surrounding the bone. It also allows the patient to resume systemic cancer treatment expediently, while saving the patient time and energy with more standard radiation regimens. While our cadaver model and our trial patient were both treated for femoral metastases, this technique would allow for the treatment of any long bone metastases in a similar fashion. This is a safe technique that allows for single dose treatment of long bone metastatic disease while limiting radiation dose to the surrounding area.

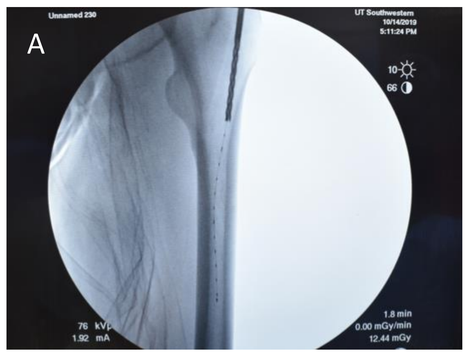

Fig 3A-B: (A) Intramedullary cannulation with drill and passage of brachycatheter using radiopaque marking wire. (B) IMN Placement.

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