



Orthopaedic Oncology Tips & Tricks: **Prophylactic Femoral Nailing for Metastatic Carcinoma**

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Introduction

The diagnosis and treatment of carcinoma that has metastasized to bone is an important component of orthopaedic oncologic care. The likelihood of evaluating a metastatic bone lesion, particularly in an orthopaedic oncology practice, is very high. The most common malignant process affecting bone in patients over 40 years old is metastatic disease, and more than 50% of patients with metastatic carcinoma will develop bony metastases¹. In addition, the skeleton is the third most common target of metastatic disease after the lung and liver. The most common malignancies that metastasize to bone include breast, prostate, lung, thyroid, and kidney carcinomas². Beyond representing a more advanced and aggressive form of disease, bone metastases can destroy the cortical integrity and lead to pathologic fracture. These fractures are associated with a high morbidity, especially those presenting in the lower extremities, as the pain and loss of independent function can be devastating for an already terminally ill patient. Therefore, these lesions should be properly diagnosed and managed to avoid poor functional outcomes and provide improved quality of life. This article will focus on intramedullary nailing of the femur, a common procedure in patient with bone metastases. Many patients present with an actual pathologic fracture, but if a destructive lesion is noted prior to fracture, prophylactic stabilization can be beneficial. By stabilizing the weakened cortex, patients note reduced pain and improved function, allowing them to maintain their independence as they focus on treatment of their primary disease.

Work-up & Diagnosis

The first step in a patient with a suspicious bone lesion is a thorough, well-documented history and physical examination³. The importance of this key step should not be underestimated; in up to 27% of patient with skeletal metastases, the history and physical examination alone can identify the location of the primary malignancy⁴. This effort will help determine whether the lesion is occurring in the setting of a known malignancy or if it is an isolated finding, which in turn dictates the need for a biopsy. Basic laboratory studies should be analyzed, and more specific studies can also

be ordered if certain diagnoses are presumed; for example, prostate specific antigen should be included if there is concern for metastatic prostate cancer. Furthermore, if the presenting lesion is incompletely assessed on plain films, or if further staging is required, more advanced imaging can be requested. This may include ^{99m}Tc bone scan, computed tomography (CT) scan of the chest, abdomen, and pelvis, and magnetic resonance imaging (MRI). Evaluations using advanced imaging have been shown to identify the primary site of the tumor in at least 85% of patients⁵. Finally, a biopsy should be performed to confirm a tissue diagnosis unless the diagnosis is certain (widespread bone and visceral metastasis).

Indications

Current indications for prophylactic femoral nailing are based on criteria outlined by Mirels', which grades these bone metastases on four different criteria: location, pain, radiographic features, and size (Figure 1), with scores ranging from 4 to 12⁶. A score of 8 or above suggests the need for prophylactic fixation. However, prior to intervention, it is important to consider additional factors, including

- Presence of an actual versus impending pathologic fracture
- Specific location of the bone lesion in the femur
- Underlying diagnosis
- Expected survival

These factors may not only alter the type of fixation that is best for the patient but affects various aspects of intraoperative and perioperative care, such as the need for preoperative radiation of the lesion and the timing of chemotherapy. Additionally, for renal and thyroid carcinomas that metastasize to bone, preoperative embolization may be considered, as these tumor types are highly vascular and can cause brisk bleeding intraoperatively. Furthermore, it is important to establish the correct diagnosis prior to any intramedullary instrumentation of the femur, including the guide rod. While carcinoma is commonly treated with femoral intramedullary nailing, a sarcoma requires wide resection of the lesion. Inappropriate treatment with an intramedullary device can lead to the need for an amputation to

Mirels' Criteria			
	Score		
	1	2	3
Site	Upper limb	Lower limb	Peritrochanteric
Pain	Mild	Moderate	Functional
Lesion	Blastic	Mixed	Lytic
Size	<1/3	1/3-2/3	>2/3

Figure 1. Mirels' Criteria [6]

achieve local control of the disease⁷. In addition, the expected survival of the patient should be on the order of 6 to 12 weeks minimum, to justify the pain and risk of surgery⁸.

Operative Technique

In terms of surgical technique, prophylactic nailing of an impending pathologic fracture is similar to intramedullary nailing for an intertrochanteric or femoral shaft nonpathologic fracture, with the primary difference being that the intact cortical bone obviates the need for traction and the oncologic nail has proximal screws into the femoral head and neck. The patient can be placed in the supine position on a radiolucent table with the operative extremity positioned such that adequate AP and lateral fluoroscopic views can be obtained without interference or changes in patient positioning. Full-length, reconstruction type femoral nails are used to provide stability and protect the entire femur⁹. Reamings are often sent during the procedure to confirm the tissue diagnosis. Post-operatively, the patient is made weight bearing as tolerated and is evaluated by physical and occupational therapy. DVT prophylaxis should be tailored to the individual patient, given the elevated risk of thromboembolic disease in the background of cancer. Finally, care should be coordinated with the patient's primary oncology team to ensure that treatment for the primary disease is resumed in a reasonable timeframe; any anti-proliferative medications as well as radiation to the

entire femur are delayed until two weeks after surgery to allow the wound time to heal.

Conclusion

Femoral prophylactic nailing for metastatic carcinoma is an important procedure in orthopaedic oncology, not only as a preventative measure to avoid the complications associated with fracture but also as a palliative measure for pain relief in patients with poor prognoses. While most general orthopaedists will not be required to perform prophylactic nailing, it is vital that they understand how to properly evaluate a patient with a destructive bone lesion as well as the treatment options available, to best counsel their patients and ensure that they receive the highest quality of care.

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