Adult Patient with a Destructive Bone Lesion (Ages 40–80+ Year)

Frank J. Frassica, Renee Genoa, and Gregory Osgood

Take-Home Message

- All patients who undergone surgery for metastatic bone disease are also treated with external beam irradiation and bisphosphonates.
- Prior to surgery for metastatic bone disease in a patient with a single bone lesion, an evaluation (which might include a biopsy) must be done.
- The treatment of myeloma of bone is chemotherapy and bisphosphonates. Surgery is reserved for fractures or impending fractures.
- The treatment of lymphoma of bone is chemotherapy. There is no role for resection.
- Chondrosarcomas are treated with wide resection without chemotherapy or radiation.

As adults age, the patient may develop a destructive lesion in their bone (Table 1). The most common cause of a destructive lesion is a bone metastasis. Other common causes include multiple myeloma, lymphoma, chondrosarcoma, and malignant fibrous histiocytoma.

Very few benign lesions cause symptoms in adults. Paget's disease occasionally causes symptoms. Patients with bone destruction secondary to hyperparathyroidism may also have symptoms. In general enchondromas and bone infarcts do not cause pain.

F.J. Frassica, MD (✉) • G. Osgood, MD
Department of Orthopaedic Surgery, Johns Hopkins University, Baltimore, MD, USA
e-mail: fjfrassica@aol.com

R. Genoa, MD
Department of Orthopaedics, Johns Hopkins University, Baltimore, MD, USA

C. Mauffrey, D.J. Hak (eds.), *Passport for the Orthopedic Boards and FRCS Examination*, DOI 10.1007/978-2-8178-0475-0_47

Table 1 Differential diagnosis of a destructive lesion in the adult patients (ages 40–80+ years)

Benign lesions	Malignant lesions
Enchondroma	Metastatic bone disease
Bone islands	Multiple myeloma
Paget's disease	Lymphoma
Hyperparathyroidism	Chondrosarcoma
	Malignant fibrous histiocytoma (undifferentiated sarcoma)

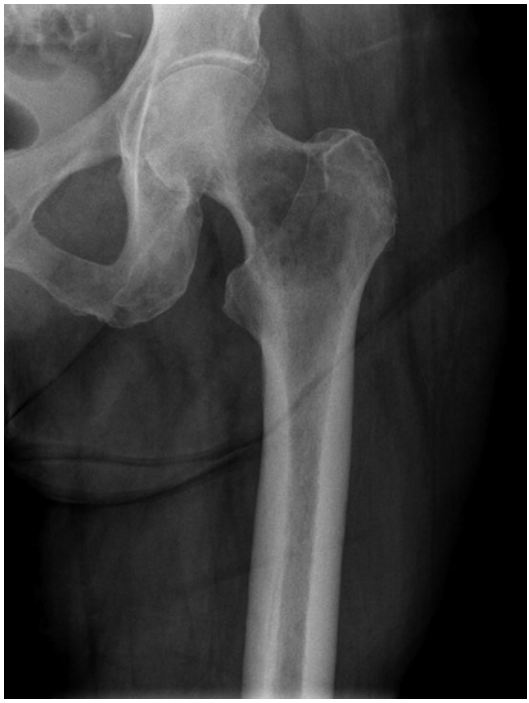

Fig. 1 Anteroposterior radiograph showing a destructive lesion in the proximal femur. The differential diagnosis of this lesion includes metastatic bone disease, multiple myeloma, lymphoma, chondrosarcoma, and malignant fibrous histiocytoma

When a patient presents with a destructive bone lesion (Fig. 1), the clinician does an evaluation to try to find the cause of the destructive lesion. The evaluation scheme is quite simple:

- Computerized tomography scan of the chest, abdomen, and pelvis: This test is rapid (generally less than 3 min) and can be done without contrast. This test is very sensitive for:
  - Lung cancer
  - Kidney cancer
  - Pulmonary metastases
  - Liver metastases
  - Lymph node enlargement

- Technetium bone scan: This test is very sensitive for detecting bone metastases. If there is more than one destructive lesion present (increased uptake on the technetium bone scan and correlation with a radiograph), the differential diagnosis narrows as one can exclude monostotic processes (such as chondrosarcoma or malignant fibrous histiocytoma).
- Laboratory tests
  - Complete blood count
    - Hemoglobin level – low levels of hemoglobin are often indicative of replacement of the bone marrow by a malignancy. Hemoglobin levels of less than 12 mg/dl are a presenting finding in two thirds of patients with muliple myleoma. Patients who have a hemoglobin less than 12 mg/dl and a sedimentation rate greater than 50 mm/h often have multiple myeloma.
    - White blood cell count – high white blood cell counts can occur in patients with hematologic malignancies.
  - Erythrocyte sedimentation rate – elevations of this serum level are found in inflammatory states. Two thirds of patients who present with multiple myeloma have an elevated sedimentation rate (rate greater than 50 mm/h.)
  - Serum calcium and phosphate – high serum calcium level and a low serum phosphorus level suggest hyperparathyroidism as the cause for multiple bone lesions. Certain cancers which are metastatic to the bone such as lung cancer, breast cancer, and lymphomas may have an elevated calcium level and a normal phosphate level.

Decision-making – using this evaluation scheme, there is an 80–90 % chance of finding a cause of a destructive bone lesion. When a cause is not found, a biopsy must be done to determine the nature of the lesion. A biopsy needs to be done as the treatment for the different diagnoses is different.

Depending on the diagnosis, a number of different treatment options are available for each patient. The diagnosis determines what treatment should be offered to the patient:

- Metastatic bone disease – once the malignant cells have spread to the bone, the treatment is palliative for the patient – controlling pain and preventing or treating fracture.
  - Long bone lesions without fracture – the radiation oncologists and the medical oncologist often will ask the surgeon whether there is a risk of fracture (impending fracture). It can be very difficult to predict the risk, but there are several helpful factors to consider.
    - Amount of cortical bone destruction—when there is greater than 50 % cortical bone destruction, there is a greater risk of fracture
    - Localization of the lesion in the bone – when a lesion is eccentric in the bone, there is a much greater risk of fracture than a concentric lesion.
    - Purely lytic bone destruction – when there is no reaction from the bone and a lesion is purely lytic, there is a greater risk of fracture.

    - Location of the lesion in the bone –lesions that involve the diaphysis has a greater risk of fracture than ones in the metaphysis or epiphysis.
    - Hip lesions – lesions in the proximal femur are subject to very high bending and torsional loads. Lesions in this location are very prone to fracture especially when weight-bearing pain is present.

      If the lesion meets the criteria of impending fracture, surgery should be done to prevent fracture. In contrast, if one does not believe the criteria for impending fracture have been met, then nonoperative treatment is chosen.
  - Long bone lesion with fracture – in this scenario, the surgeon must decide whether rigid internal fixation can be accomplished. If rigid fixation is not feasible, then arthroplasty may be the best choice for the patient. If the joint surfaces have been destroyed, then arthroplasty is probably the best method of treatment.
  - Adjuvant treatment – all patients following surgery for metastatic disease need postoperative radiation and bisphosphonate therapy. The external beam irradiation is used to kill the tumor which prevents progression and improves pain scores.

- Multiple myeloma – multiple myeloma is a condition in which a single line of plasma cells (hence monoclonal) becomes a neoplasm with unregulated growth.
  - The treatment of myeloma is chemotherapy and bisphosphonates. The chemotherapy kills the tumors cells, and the bisphosphonates halt the bone destruction.
  - The orthopedic surgeon has three roles
    - At times it is necessary to evaluate the patient and help make the diagnosis with the described evaluation regimen.
    - To evaluate the patient for impending fracture (the same criteria as metastatic disease).
    - To treat fractures with the same criteria that one uses for metastatic bone disease.

- Lymphoma – lymphoma can occur in a single bone or as a manifestation of a patient with widespread disease. Patients with lymphoma of bone present with pain. The pain may start at a very low level such that the pain waxes and wanes in intensity. The symptoms may mimic arthritis, a sports injury, or tendinitis.
  - The role of the orthopedic surgeon is primarily in the diagnosis. When a patient presents with pain suggestive of a tumor and the radiographs are normal, an MRI is necessary to evaluate the bone marrow. If the bone marrow is abnormal, a biopsy must be done to determine the nature of the lesion.
  - The treatment of lymphoma is chemotherapy (referral to a medical oncologist).

- Chondrosarcoma – this is the most common sarcoma in the adult patient. Patients present with pain and sometimes a soft tissue mass. When the clinician does the evaluation scheme, the workup reveals a monostotic lesion.
  - Imaging – the radiographs often show a very characteristic appearing lesion. Intramedullary chondrosarcomas are lesions which often mineralize – show characteristic rings, arcs, and stipples. There are also large erosions, thickening of the cortex, and lysis in the cortex. These findings are so characteristic that the clinician should be able to place chondrosarcoma high on the differential list.
  - Treatment – wide excision of the lesion which involves removal of the entire tumor with a margin of normal tissue. There is no role for chemotherapy or irradiation.
- Malignant fibrous histiocytoma (undifferentiated sarcoma) – this sarcoma can arise in the bone spontaneously or within a preexisting lesion such as a bone infarct, following irradiation, or Paget's disease.
  - Imaging – this high-grade malignant tumor is very nonspecific in its appearance. Usually the lesion is both large and very destructive.
  - Treatment – wide excision of the tumor with a cuff of normal tissue and most patients also receive chemotherapy.