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PSEUDOPATHOLOGIC FRACTURE OF THE NECK OF THE FEMUR

A CASE REPORT

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The most common site for a pathologic fracture due to metastatic disease is the proximal aspect of the femur¹. Recognition of the radiographic characteristics of a fracture that occurs through a primary malignant or metastatic lesion is crucial for proper diagnosis. Failure to recognize radiographic clues can lead to mismanagement of the patient and nontreatment of an underlying malignant disease. Likewise, being overly suspicious about findings on the radiographs can lead to unnecessary testing and can delay prompt surgical treatment. A preexisting lesion should be suspected when a patient who does not have osteoporosis has sustained a femoral neck fracture during normal activity or after minor trauma or when a patient who has a known primary malignant disease has sustained such a fracture. We present the case of a fifty-four-year-old female smoker with no prior medical problems for whom radiographs made after a fall were suggestive of a pathologic subcapital fracture of the right femoral neck. The appropriate evaluation for patients with a pseudopathologic fracture of the femoral neck is reviewed. Our patient was informed that data concerning the case would be submitted for publication.

Case Report

A fifty-four-year-old, obese woman was bumped by a pedestrian and fell from a standing position. She was immediately transported to the emergency department for evaluation. During the interview by the orthopaedic resident on call, the patient described severe right groin pain and an inability to bear weight on the right lower extremity. She had no history of pain in the right hip or groin area. The patient stated that she had a twenty-pack-year history of smoking. She did not have any history of malignant disease or other medical problems, and she took no medications. There was no personal or family history of osteoporosis, and she had had no previous fractures. The range of motion of the right hip was limited, and the patient was unable to perform a straight-leg raise. Results of motor, sensory, and vascular testing of the right lower extremity were normal. Anteroposterior radiographs of the right hip revealed a Garden Stage-IV² subcapital femoral neck fracture, and a well-defined radiographic lucency in the superolateral aspect of the femoral head was suggestive of a pathologic fracture (Fig. 1). Within the lucency,

areas of stippled calcification were observed, raising additional suspicion of a pathologic process. Cross-table lateral radiographs of sufficient quality could not be made because of the patient's body habitus. Radiographs of the contralateral hip revealed normal findings and a grade of VI on the Singh osteoporosis index³. Laboratory studies, including a complete blood-cell count, determination of the electrolyte level, measurement of prothrombin time and partial thromboplastin time, liver-function testing, determination of the level of serum alkaline phosphatase, and serum-protein electrophoresis, revealed values that were within normal limits. The chest



Fig. 1

An anteroposterior radiograph of the right hip shows a Garden Stage-IV subcapital femoral neck fracture. Notice the clearly defined lucency in the superolateral aspect of the femoral head.

radiograph showed no lesions, and the electrocardiogram showed no abnormality.

The suspicious appearance of the femoral neck fracture, considered in conjunction with the relatively low energy of the injury in a nonosteoporotic individual, led to a presumptive diagnosis of a metastatic lesion of the femoral neck with a pathologic fracture. A fellowship-trained orthopaedic oncologist was consulted, and a workup to identify a primary malignant process was initiated. Extensive physical examination revealed no evidence of primary malignant disease. The results were negative on guaiac testing of stool. A plain radiographic bone survey, bone scintigraphy, and computed tomography of the chest, abdomen, and pelvis were unrevealing. A computed tomographic scan of the right hip revealed a displaced subcapital femoral neck fracture; however, the irregularity in the superolateral aspect of the femoral head that had been seen on the plain radiographs was not evident on the computed tomographic scan (Fig. 2).

An internist reviewed the laboratory results, electrocardiogram, and chest radiographs, and the patient received medical clearance for surgical intervention. After completion of the workup for metastatic disease, a cemented unipolar hemiarthroplasty was performed. An intraoperative gross examination of the fracture site revealed a displaced subcapital fracture without evidence of malignant disease. Intraoperative frozen-section analysis as well as gross and histopathologic examination of the femoral head revealed negative findings. The cemented unipolar hemiprosthesis was implanted without complication. A standard postoperative hemiarthroplasty pro-

tolocol was initiated, and the patient was transferred to an inpatient rehabilitation ward after an uncomplicated hospital course. The patient was discharged to home after receiving two weeks of rehabilitation therapy. At twelve months after the fracture, the patient was walking without pain and without assistive devices.

Discussion

Traumatic subcapital fractures of the femoral neck are common, with more than 250,000 occurring in the United States annually⁴. Plain radiographs of subcapital fractures of the femur may simulate a pathologic appearance^{5,6}. Few studies on this subject have been published. Pope et al. reported on two subcapital fractures of the femur for which preoperative radiographs were suggestive of a pathologic etiology⁶. Neither fracture was neoplastic in origin. They used the term *pseudopathologic fracture* to describe a traumatic subcapital fracture of the femur that resembles a pathologic fracture radiographically, and they attributed this appearance to fragmentation and rotation of the femoral head⁶. Schwappach et al. performed a radiographic study of cadaveric femora with a displaced fracture of the femoral neck and retrospectively reviewed their own clinical experience⁷. The cadaver study showed that external rotation of the femoral shaft resulted in an appearance similar to that of a pathologic fracture and that displacement of the femoral shaft accentuated this appearance; Schwappach et al. stated that these changes were independent of fragmentation. These cadaveric findings were confirmed by their clinical retrospective

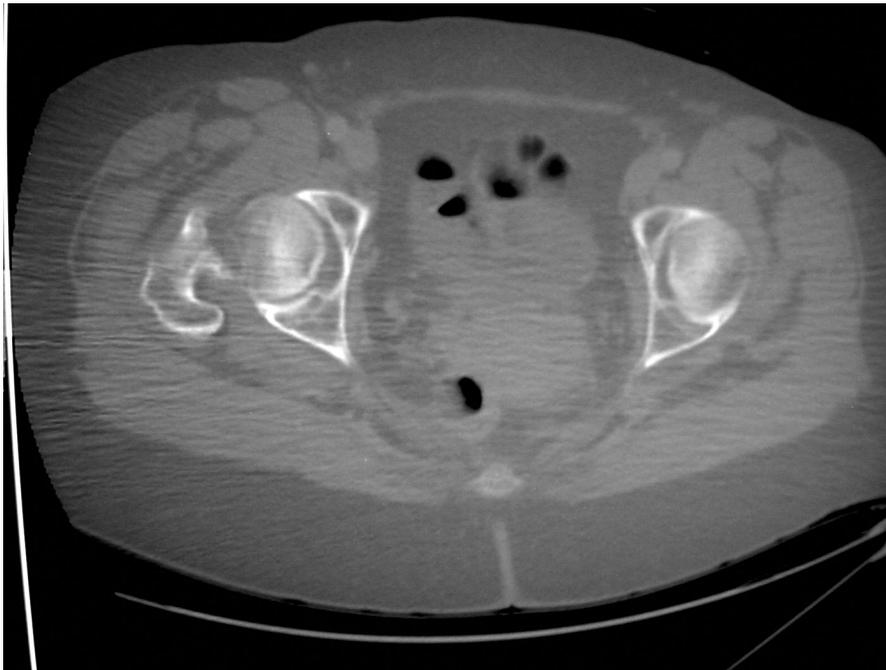


Fig. 2

A computed tomographic scan shows a displaced subcapital femoral neck fracture. The irregularity in the superolateral aspect of the femoral head that was evident on the plain radiographs is not visible here.

review in which 32% of all Garden Stage-III fractures and 24% of all Garden Stage-IV fractures had a radiographic appearance similar to that of a pathologic fracture. None of the fractures that appeared to be pathologic were classified as Garden Stage I or II⁷.

Subcapital fractures that are truly due to metastatic disease are rare, as most pathologic fractures occur distal to the subcapital region⁸⁻¹⁰. On the radiographs of our patient, the apparent radiolucency was eccentric in the superolateral subcapital region, which is different from the central radiolucency that is usually seen with metastatic pathologic fractures of the femoral neck⁷.

In the evaluation of patients with a possible pathologic fracture of the subcapital region of the femoral neck, the first step is to obtain a complete history. The circumstances surrounding the current injury and the degree of trauma can provide information about the strength of the bone. A pathologic process should be suspected if the degree of energy required to cause the fracture was unusually low and the radiographic findings are suspicious. Standard questions regarding general health, including recent weight loss, fevers, night sweats, and fatigue, are important. Also, the presence of prefracture pain in the region of an eventual fracture and a history of diagnosed or treated malignant neoplasms should raise suspicion about a pathologic process. A history of osteoporosis or of insufficiency fractures should be sought. Furthermore, it is important to inquire about relevant risk factors for malignant disease, including smoking, dietary habits, and possible environmental exposures to carcinogens.

The second step in the evaluation is a thorough physical examination. A standard examination, with attention given to the distal neurovascular status, should be performed in all patients. Common primary tumors that metastasize to bone include those of the breast, lung, prostate, thyroid, kidney, and gastrointestinal tract¹¹. Therefore, a complete examination should be performed to search for evidence of a primary malignant process in these regions. Special attention should be directed to the evaluation of a possible soft-tissue mass at the fracture site; to evidence of primary disease, including lymphadenopathy, thyroid nodules, breast masses, prostate nodules, and rectal lesions; and to an examination of any other painful regions to rule out impending fractures. Guaiac testing of stool should be performed for all patients.

A complete laboratory assessment should be performed when attempting to exclude a pathologic lesion. The standard laboratory workup includes a complete blood-cell count, determination of the electrolyte level, and measurement of prothrombin time and partial thromboplastin time. In addition, liver-function tests can be performed to evaluate for metastasis to the liver, the level of serum alkaline phosphatase can be determined to evaluate for metastasis to bone, and serum protein electrophoresis can be conducted to exclude multiple myeloma as a cause of the lytic lesion.

In addition, the plain radiographs must be carefully evaluated when investigating the possibility of a pathologic process. Recognizing the radiographic characteristics of frac-

tures that have occurred through a primary malignant process or a metastatic lesion is crucial for proper diagnosis and treatment. However, being overly suspicious of the findings on the radiographs can lead to unnecessary testing and can delay prompt surgical management. With respect to our patient, the anteroposterior radiograph of the right hip revealed a Garden Stage-IV subcapital femoral neck fracture with a clearly defined lucency in the superolateral aspect of the femoral head.

The low-energy mechanism of injury in our patient combined with the presence of a suspicious lucency on the radiograph of the femoral head led to many additional laboratory tests and radiographic studies. If the computed tomographic scan of the affected hip had been performed first, our suspicion of a pathologic process would have decreased substantially. This would have enabled us to obtain medical clearance and then move forward with definitive surgical management.

After reviewing the case of our patient, we concluded that computed tomography of the affected hip should be the next diagnostic step when plain radiography reveals a lucency in the superolateral aspect of the femoral head in a patient who has a potential pathologic fracture of the subcapital region of the femoral neck but has no history suggestive of malignant disease. If the computed tomographic scan does not demonstrate any evidence of pathologic bone destruction, metastatic tumor, or primary tumor, then we recommend proceeding with operative intervention. The fracture can be inspected at the time of surgery, and a biopsy can be performed if necessary. The surgeon may obtain an intraoperative tissue sample for frozen-section analysis if the gross appearance of the femoral head causes suspicion of malignant disease.

This focused approach to the management of a pseudopathologic fracture of the neck of the femur helps to avoid a lengthy, costly laboratory and radiographic workup. It also can help to expedite surgical intervention, which has been shown to have prognostic importance for patients with hip fractures. If the computed tomographic scan suggests the presence of a pathologic lesion, a thorough search for a primary malignant process should proceed. ■

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