The case:

An 59-year-old woman presented with worsening bilateral hip pain for 6 months. She had been receiving hemodialysis for 12 years.

Figure: Anteroposterior pelvis radiograph showing cysts (arrows) in the right acetabulum and in both femoral necks.

Your diagnosis?

For answer see page 205
Diagnosis:
Dialysis-Related Amyloidosis
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Answer to Radiologic Case Study
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This 59-year-old woman was admitted to the hospital because of inability to ambulate due to bilateral hip pain. She was evaluated in the emergency department. Radiographs revealed lytic lesions in the right acetabulum and both femoral necks (Figure 1). She was initially thought to have multiple myeloma or a metastatic malignancy. The patient stated on admission that she had pain in both groins that had been present for 6 months. Her past medical history included end-stage renal disease, diabetes mellitus type 2, bipolar disease, and peripheral vascular disease. Her surgical history included arteriovenous fistula creation, partial parathyroidectomy, and right midfoot amputation for ischemia. The patient’s parathyroid hormone and creatinine levels were elevated. Her serum calcium level was low. She smoked 2 packs of cigarettes per day.

The patient had been receiving hemodialysis for 12 years. Her workup included a bone scan, which revealed increased uptake in both hips. No other lesions were noted. A computed axial tomography scan showed large lytic lesions of the right supra-acetabular region and bilateral femoral neck cysts (Figure 2). Small lesions were found in the anterior column of the left acetabulum and ilium.

Surgical treatment consisted of 2 operations. The initial procedure involved biopsy of the femoral lesions followed by prophylactic nailing of both femora using cephalomedullary rods without bone graft (Figures 3-4). Three weeks later, curettage of the left supra-acetabular cyst and placement of a Plexur M (Osteotech, Eatontown, New Jersey) allograft was performed. At 3 months, the patient’s pain had resolved.

History of Dialysis-Related Amyloidosis

In 1854, Virchow discovered a unique smooth substance that was deposited in various organs. The material had a positive reaction to iodine on staining. Virchow felt that its staining characteristics were similar to those of pancreatic amylase and thus coined the term “amyloid.” It was not until 1989 that amyloid was implicated in problems with renal hemodialysis, a technique unknown at the time of Virchow. It was postulated that some of the complications of long-term dialysis were caused by periarticular amyloidosis. This resulted from circulating beta-2-microglobulin that had not been cleared by hemodialysis. In addition to bone cysts from amyloid deposits, the high incidence of carpal tunnel syndrome is another manifestation of dialysis-related amyloidosis.

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The authors have no relevant financial relationships to disclose.

The authors thank F. Joseph Pollock, PhD, for technical assistance in preparing this manuscript.

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doi: 10.3928/01477447-20150305-01
syndrome in patients receiving long-term dialysis was attributed to amyloid deposits in the carpal tunnel. It was found that more than one-third of patients who were receiving dialysis for more than 6 years had cysts related to bony infiltration of amyloid.

In 1990, rheumatologists in Spain reported that the condition that had become known as “dialysis-related arthropathy” was associated with amyloid. Two years later, physicians in Japan reported that the development of bone cysts was related to the type of dialysis membranes used. They found that the poor biocompatibility of cuprophane membranes and a long duration of dialysis correlated with the deposition of beta-2-macroglobulin amyloid fibrils. In 1994, it was reported in both Australia and Japan that amyloid cysts can result in femoral neck fractures. It was noted that the anterior superior quadrant of the femoral neck was commonly involved, and that patients with lesions larger than 2.5 cm or lesions that destroy 50% of the femoral cortex are at risk for femoral neck fracture.

In 2000, nephrologists in Boston expressed concern that because of the aging population and the continuing failure of dialysis techniques to eliminate amyloid exposure, this problem might be a “hidden epidemic.” The most recent article on this subject came from Germany in 2014. This review emphasized hope that more advanced hemodialysis techniques would reduce the risk of dialysis-related amyloidosis. It was reported that, in patients receiving dialysis for 10 years or more, the prevalence of the disease had decreased from 68% for conventional hemodialysis to 28% for advanced hemodialysis membranes. It was noted that it remains unknown whether this change will eliminate or merely postpone the risk.

Differential Diagnosis

As in the case presented here, the differential diagnosis usually includes metastatic malignancy, multiple myeloma, and secondary hyperparathyroidism (renal osteodystrophy). Brown tumors of hyperparathyroidism are occasionally difficult to differentiate from amyloid cysts in patients receiving dialysis. The location of the bone lesions is helpful. The lytic lesions associated with secondary hyperparathyroidism of chronic renal failure are often found in the diaphysis or metaphysis of long bones. The cysts of dialysis-related amyloidosis are most commonly in close proximity to a synovial joint, as in the current case.

Dialysis-related amyloidosis cysts can be found located in the scaphoid, lunate, humeral head, femoral neck, and supra-acetabular region. Cysts tend to increase in number and size as the duration of dialysis therapy increases.

Lesions are more diffuse and less circumscribed in metastatic disease compared with dialysis-related amyloidosis. Multiple myeloma can be differentiated from dialysis-related amyloidosis by urine and serum protein electrophoresis. Bone scan can detect other locations, and magnetic resonance imaging has been
and autologous iliac crest bone graft. No internal fixation was used. Dialysis was resumed 36 hours after surgery, with partial weight bearing allowed after 3 weeks and full weight bearing at 3 months. The average length of dialysis prior to surgery was 15 years. All cysts healed. In 2007, Fukunishi et al\(^{12}\) described surgical treatment of 14 hips in 12 patients. They considered 50% femoral neck involvement an indication for surgery. They described the importance of prophylactic treatment because of the high incidence of complications with internal fixation or total hip arthroplasty if a femoral neck fracture occurs. These surgeons used a variety of internal fixation methods combined with iliac crest graft. Thirteen hips were followed. All healed uneventfully and the pain resolved.

**CONCLUSION**

The authors believe it is important for clinicians to be familiar with the imaging findings of dialysis-related amyloidosis because this condition can masquerade as other bone pathology. The bone cysts of dialysis-related amyloidosis can often be successfully treated to ease pain and prevent fracture.

**REFERENCES**