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Imaging Findings in Amyloid Arthropathy of the Hip Joints: The Eyes Cannot See What the Mind Does Not Know

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Abstract

Amyloid arthropathy is a rare but serious complication in patients with chronic renal failure with a history of prolonged hemodialysis. The underlying pathophysiology is the accumulation of beta-2 microglobulin in intra- and periarticular tissues, with consequent synovial thickening and erosions. Imaging-based diagnosis of amyloid arthropathy allows prompt clinical management and better patient outcomes. In view of vague clinical presentation and uncommon incidence, the radiologist is often the first one to suspect this complication. We hereby describe the case of a 66-year-old man with gradually progressive left hip pain for the past 6 months who was diagnosed to have bilateral amyloid arthropathy and was subsequently confirmed with computed tomography (CT) guided synovial biopsy. Amyloid arthropathy should be considered in patients with hip pain who are on long-term hemodialysis and present with suggestive findings on radiograph, CT, and magnetic resonance studies.

Keywords
- amyloid arthropathy
- hip joints
- imaging findings

Case Report

A 66-year-old man presented to orthopaedic outpatient department with gradually increasing pain in his left hip joint for the past 6 months. No constitutional symptoms including fever, weight loss, and loss of appetite were reported. The patient reported history of chronic kidney disease with hemodialysis for the last 8 years. No history of trauma or any other systemic illness was reported. Physical examination revealed significant restriction in the range of movements in the hip joints, with more on the left side. Laboratory investigations showed normal leukocyte count without elevation of serum inflammatory markers including erythrocyte sedimentation rate and C-reactive protein levels. The Mantoux test (done elsewhere) was within normal limits.

Pelvic radiograph showed multiple articular surface erosions along the bilateral femoral head, more prominently on the left side with an otherwise preserved shape of the femoral heads (►**Fig. 1**).

Magnetic resonance imaging (MRI) confirmed the significant synovial thickening and hypertrophy in bilateral hip joints, more prominently on the left side (►**Fig. 2**). The thickened synovium led to marked pressure scalloping and erosions over the adjoining cortex of the bilateral femoral head, neck, and trochanteric regions and the acetabulum. The thickened synovium was conspicuously hypointense on T1- and T2-weighted MR images. Abnormal bone marrow edema was also noted in the left femoral neck, which explained the pain in the left hip at the time of presentation.

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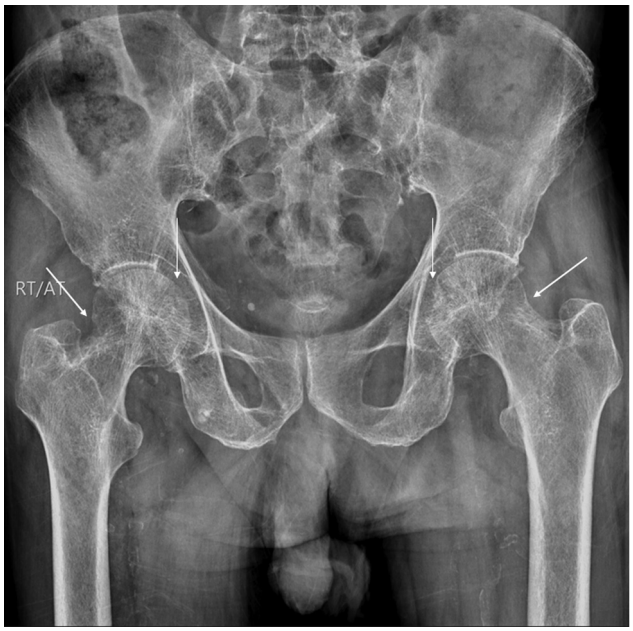

Fig. 1 A radiograph of the pelvis (frontal projection) with bilateral hip joints shows multiple articular surface erosions (*vertical arrows*) along the bilateral femoral head, more prominently on the left side. The shape of the femoral head is otherwise preserved. The bilateral femoral neck shows erosions along the superior surface (*oblique arrows*). Generalized osteopenia is also seen. Thin vascular calcification is also noted, secondary to diabetes mellitus.

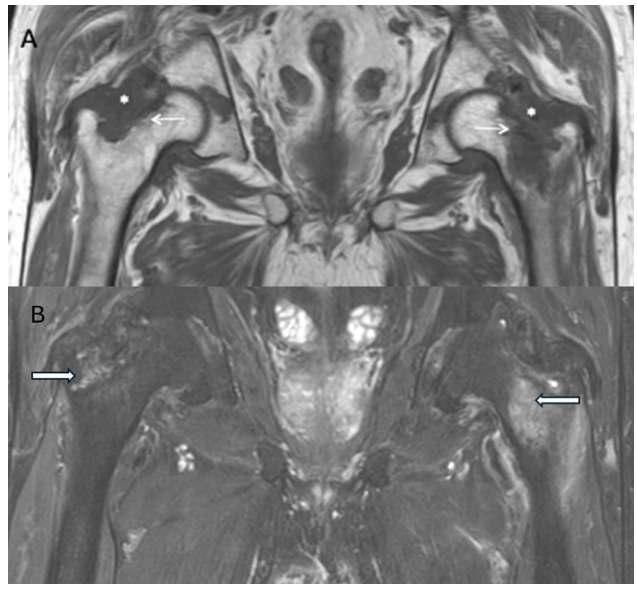

Fig. 3 Coronal (**A**) T1 turbo spin echo (TSE) and (**B**) T2 TSE fat-saturated magnetic resonance images show hypointense bilateral synovial thickening and hypertrophy (*asterisks* in **A**) in bilateral hip joints, more on the left side. The thickened synovium is causing marked pressure scalloping and erosions over the adjoining cortex of the bilateral femoral head, neck, and trochanteric regions and the acetabulum (*thin arrows* in **A**). Abnormal bone marrow edema is also noted in the adjoining part of the bilateral femoral neck and trochanteric regions (*thick arrows* in panel **B**).

In view of the clinical history of long-standing chronic kidney disease with hemodialysis, bilaterality of the disease process, and conspicuously hypointense signal intensity of the thickened synovium on T1- and T2-weighted MR images, the possibility of amyloid arthropathy of the hip joints was suspected. Computed tomography (CT) guided synovial biopsy of the left joint was performed, which again showed articular surface erosion along the bilateral femoral head along with intra-/periarticular soft tissue thickening secondary to thickened synovium in the planning CT images (►**Fig. 3**).

CT-guided synovial biopsy confirmed the diagnosis of amyloidosis based on the histopathology findings. There was red positive appearance on Congo staining and faint apple-green birefringence under polarized light on the background of fibroconnective tissue (►**Fig. 4**). No signs of infection including tuberculosis were reported on microbiology stains. No infective organisms were grown on the culture. The diagnosis of secondary amyloidosis was confirmed, and total hip arthroplasty was advised. The patient opted against surgical intervention and is presently under surveillance. Medical treatment with intravenous steroids and analgesics was started for 4 weeks. Additional screening did not reveal amyloid deposition disease in the rest of the organ systems. Nephrology consultation subsequently advised renal transplantation, which is presently awaited.

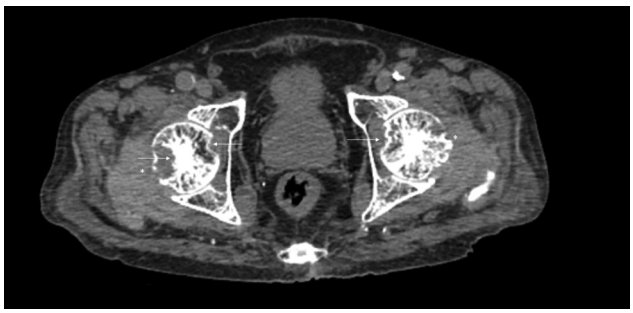

Fig. 2 Transverse noncontrast computed tomography image shows focal articular surface erosions (*white arrows*) along the bilateral femoral head, more prominently on the left side. The osseous erosions are more prominently seen along the lateral surfaces. Intra- and periarticular soft tissue thickening is secondary to thickened synovium (*asterisks*). Hyperdense attenuation of the thickened synovium is also noted.

Discussion

Amyloidosis is an acquired or hereditary condition characterized by abnormal deposition of beta-sheet fibrillar protein aggregates in the body tissues. This can be localized or systemic with range of clinical spectrum depending on the type, site, and extent of amyloid deposition.[1,2] Amyloid proteins can deposit in any organ and may accordingly cause organ dysfunction due to compressive or degenerative changes. A systematic review has reported detection of amyloid deposition during common orthopaedic surgeries, especially in the elderly patients.[3] A significant proportion of these patients showed amyloid deposition in musculoskeletal soft tissues, including ligaments, tendons, and articular cartilage.

Gejyo et al[4] reported an association between amyloidosis and hemodialysis with beta-2 microglobulin as a major component of dialysis-related amyloidosis (DRA). This

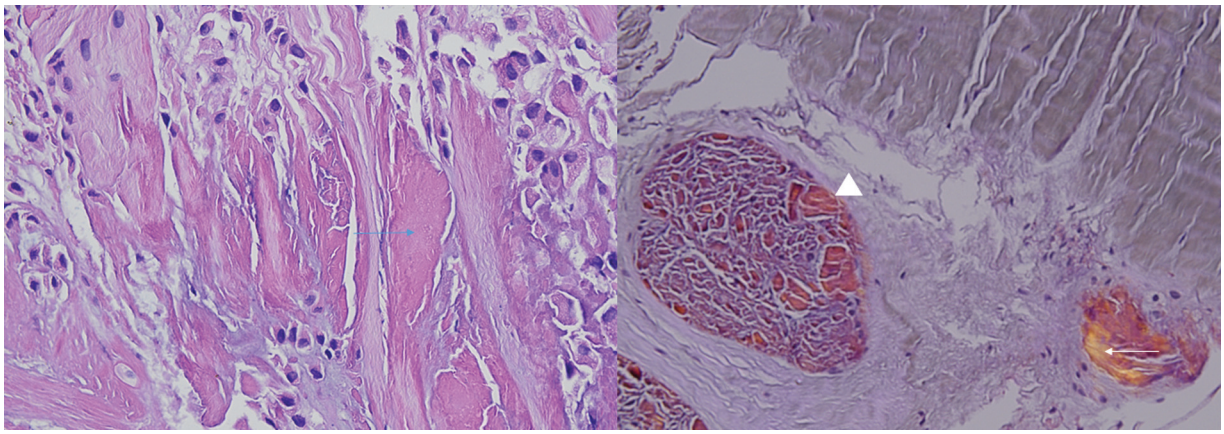

Fig. 4 Microphotograph of the left hip synovial biopsy shows predominantly fibroconnective tissue with focal areas of eosinophilic globules (left panel). These areas are red positive on Congo staining (*arrowhead*, right panel) and shows faint apple-green birefringence under polarized light (*white arrow*, right panel).

insoluble proteinaceous material is not filtered by standard hemodialysis and is difficult to remove once deposited in tissue. Associated factors, including patients age, duration of dialysis, and the type of dialysis membrane used, may also be involved.[5]

DRA predominantly involves the osteoarticular system and may present as erosive and destructive osteoarthropathies, destructive spondyloarthropathy, and carpal tunnel syndrome.[6] The hip, wrist, shoulder, knee, and spine are common sites of DRA. The osseous lesions of amyloidosis are lucent on radiographs and show variable sizes with fine sclerotic margins. The lesions are typically in periarticular/juxta-articular locations or at sites of ligamentous insertions and are frequently bilateral. The differential diagnosis of metastases, myeloma, or brown tumor rarely shows a para-articular location and should be ruled out.

On MRI, the thickened synovium in DRA shows decreased signal intensity on T1-weighted image with variable signal intensities on T2-weighted images. The hypertrophied synovium in our patient showed a hypointense signal on T1- and T2-weighted images and a hyperdense signal on CT images. The variable signal intensity is related to variable amyloid and fluid components of the lesion. Demonstration of a para-articular intraosseous lesion with a relatively low signal intensity on both T1- and T2-weighted images should raise suspicion for amyloidosis. Depending upon the clinical settings and specific findings, thickened T2 hyperintense synovium on MRI indicates synovitis and is predominantly secondary to infective or inflammatory causes. This will include tubercular arthritis, rheumatoid arthritis, osteoarthritis, or hemophilic arthropathy. Pigmented villonodular synovitis or synovial tumors may also show a hyperintense signal on T2-weighted imaging.

On the other end, thickened synovium with hypointense T2 signal on MRI may be seen in conditions that lead to fibrous tissue deposition, tissue calcification, or accumulation of blood products. Accordingly, the differential diagnosis may include pigmented villonodular synovitis, synovial chondromatosis, chronic tophaceous gout, advanced rheumatoid arthritis, amyloid arthropathy, hemophilic arthropathy, tuberculous arthritis, tenosynovial giant cell tumor, synovial hemangioma, and hemosiderotic synovitis.

Contrast-enhanced MRI helps in distinguishing between a thickened synovium and joint fluid in patients with DRA.[7] The bone lesions in DRA usually show moderate enhancement possibly related to increased vascularity and/or damage to subsynovial capillaries. DRA may also manifest as tenosynovial giant cell tumor mimic without the accompanying susceptibility artifacts on gradient echo sequences.[8]

Amyloid arthropathy often manifests as progressive bilateral polyarthritis involving the shoulder, wrist, elbow, hip, and knee joints.[9] Muscular tissue thickening in the shoulder is often termed the "shoulder pad sign." Gradually, DRA may appear similar to the chronic degenerative disease with subchondral erosions, sclerotic margins, and juxta-articular osteoporosis. Amyloid arthropathy can also be destructive with narrowing of the joint space and erosions in the absence of osteophytes. Osseous infiltration by amyloid may manifest as marrow edema, pathological fractures, or neurologic symptoms in case of spinal involvement.

Imaging-based diagnosis of DRA is feasible, which may require confirmation with synovial biopsy, as in our case. In appropriate clinical settings, radiologists may play an important role in early diagnosis of DRA and guide the clinical workup in the correct direction to avoid diagnostic delays. Conservative management with analgesics, nonsteroidal anti-inflammatory drugs, and steroids may help control local pain, while diuretic treatment may help in removing the excess sodium and fluid from the body.[10,11] Total hip arthroplasty should be considered for extensive hip involvement. Treatment with high flux membrane, hemofiltration, and immunoadsorption is also advised. Renal transplantation is offered as the definitive treatment to treat the underlying chronic kidney disease in these patients.[12]

Conclusion

Imaging-based diagnosis of amyloid arthropathy allows prompt clinical management and better patient outcomes. In view of the vague clinical presentation and uncommon

incidence, the radiologist is often the first one to suspect this complication. Amyloid arthropathy of the hips should be considered in patients with hip pain who are on long-term hemodialysis and presents with appropriate imaging findings.

Funding
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Conflict of Interest
None declared.

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