

# Non-Popliteal Synovial Rupture

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**Abstract:** The ruptured popliteal synovial cyst is a common complication of chronic knee arthritis. In contrast, non-popliteal synovial rupture is less well recognized and may present a diagnostic dilemma. We report an 81-year-old woman who presented with chest wall pain and ecchymosis. Ultrasonography of the shoulder region readily diagnosed a dissecting parasynovial cyst. She developed the unusual complication of contralateral recurrence. Literature review revealed a small but important set of non-popliteal synovial ruptures in the regions of the shoulder, elbow, wrist, spine, hip, knee, and ankle. Local swelling, inflammation, ecchymosis, and nerve impingement may mimic other conditions. Awareness of the clinical presentations and a high index of suspicion are required to avoid diagnostic confusion. Management data are limited to case reports of arthrocentesis, injection, and very rarely, surgery.

**Key Words:** synovium, cyst, rupture, shoulder

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Synovial cysts are lined by a secretory synovial membrane, filled with synovial fluid products, and may communicate with adjacent joints.<sup>1</sup> A Baker's or popliteal cyst, located in the gastrocnemio-semimembranosus bursa, is well recognized as a mass or tightness in the posterior knee associated with discomfort.<sup>2</sup> Popliteal synovial dissection may present as painless or tender calf and ankle swelling and can be mistaken for venous thrombosis. In contrast, cyst rupture most often presents with acute pain, swelling and erythema suggestive of cellulitis, or a deep space infection. Occasionally, bruising with a "crescent sign" may be seen inferior to the ipsilateral malleolus due to bloody synovial fluid dissection into this area.<sup>3</sup>

Non-popliteal synovial rupture is much less common. Synovial cysts or dissection complicated by rupture in unusual locations may pose a diagnostic dilemma. We present a case of bilateral synovial rupture of the shoulders, and review the literature to describe the clinical spectrum of non-popliteal synovial rupture.

## METHODS

A Medline search of the literature was conducted using Boolean logic combinations of the search terms "hemorrhage, hemorrhagic, non-popliteal, shoulder, rupture, ruptured synovium, synovial fluid, synovium, synovial cyst, and spontaneous," as title, text word or MeSH subject headings. Using selection criteria of relevance to either hemorrhagic shoulder or non-popliteal synovial rupture, we screened 557 titles and abstracts, yielding 28 for additional review. Further search was performed using references cited in these selections. This search yielded a total of 45 articles for

detailed analysis, of which 21 best met the earlier criteria for inclusion in this review.

## CASE REPORT

An 81-year-old woman complained of acute onset of right chest wall pain and "rash," centered over the right superior trapezius muscle and extending over the anterior and posterior chest wall. She had a long history of recurrent shoulder pain, but the present illness was distinctly different. She denied trauma or other inciting event, and she had no systemic symptoms.

Her past medical history was remarkable for severe degenerative disease of both shoulders, associated with complete rotator cuff tears, large effusions, and marked radiographic destruction of the glenohumeral joints. Arthrocentesis and injection of one or both shoulders had been performed a total of 5 times in the past. Synovial analysis revealed noninflammatory bloody fluid on 4 occasions with a mean red blood cell count (RBC) of 75,000/mL, nucleated cell count (NCC) of 421/mL of which 46% were polymorphonuclear leukocytes (PMN). She had moderate inflammation on one occasion (NCC 4850/mL, 90% PMN). She had extracellular urate crystals demonstrated in noninflammatory fluid on 2 occasions, but none after allopurinol was initiated 10 months before the current presentation.

Other medical problems included polymyalgia rheumatica, stage III chronic kidney disease, diabetes mellitus, and hyperparathyroidism. Her medications included prednisone 5 mg daily, allopurinol 100 mg 3 times weekly, and aspirin 81 mg per day.

On physical examination, her right shoulder was visibly enlarged with palpable fluid superiorly over the acromion. There was crepitation on range of motion of the shoulder, with minimal tenderness. She had extensive ecchymosis that spread both posteriorly and anteriorly on the chest wall (Fig. 1). Ultrasound demonstrated a large fluid collection over the acromion which dissected medially past the midscapular line (Figs. 2, 3). Arthrocentesis yielded 65 mL of nonclotting blood tinged fluid, with RBC of 198,990/mL, leukocyte count of 367/mL, 64% PMN, and no crystals on polarizing microscopy. Marked reduction in shoulder swelling was noted immediately after arthrocentesis. The shoulder was injected with triamcinolone acetonide, and the chest wall symptoms resolved. Magnetic resonance imaging (MRI) confirmed a large cyst above the acromion, but images did not cover the area of synovial dissection (Fig. 4).

Two weeks later, the patient presented with sudden onset of pain and ecchymosis of the left arm (Fig. 5). She had an obvious large effusion of the left shoulder that was aspirated and injected, with similar synovial fluid findings (RBC of 51,480/mL, NCC of 73/mL, 57% PMN, no crystals). After a second recurrence on the left she was referred to consider orthopedic surgery, but died of an unrelated cause before further intervention.

## LITERATURE REVIEW

Synovial enlargement with dissection or cyst formation has been reported in association with juvenile rheumatoid arthritis, reactive arthritis, septic arthritis, gout, osteoarthritis, pigmented villonodular synovitis, synovial osteochondromatosis, Lyme disease, and neuropathic arthropathy.<sup>1,2,4,5</sup> The most common sites of non-popliteal synovial cysts are near the elbows, wrists, and the fingers.<sup>1</sup> Parasynovial cysts of the ankle, tarsus, forefoot, hip, and

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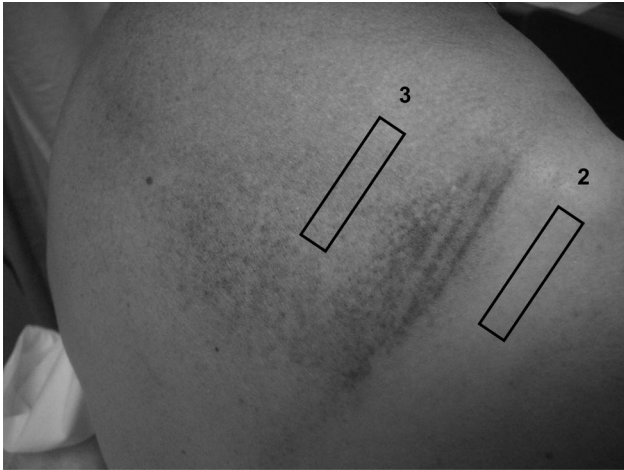
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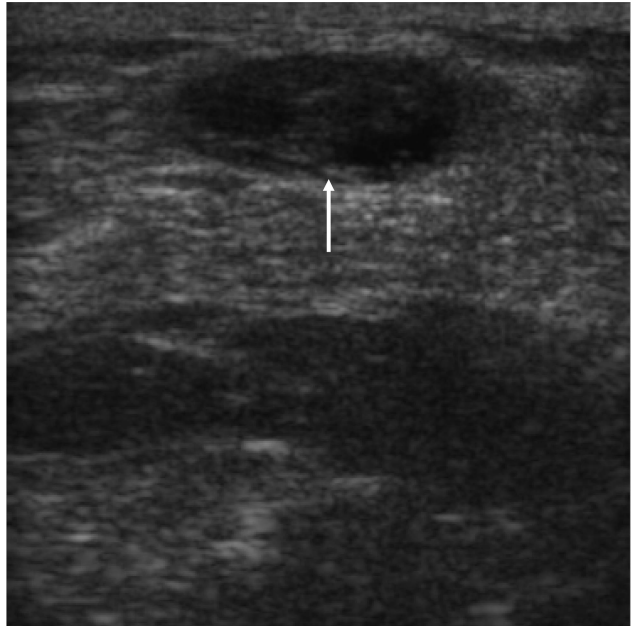
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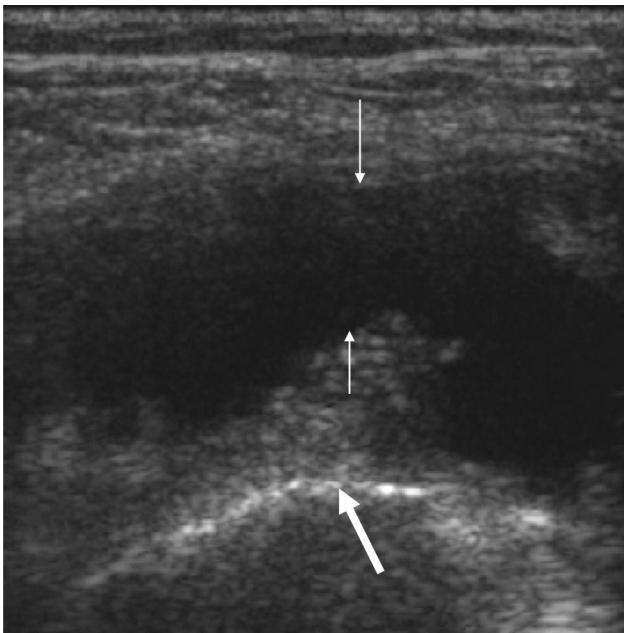
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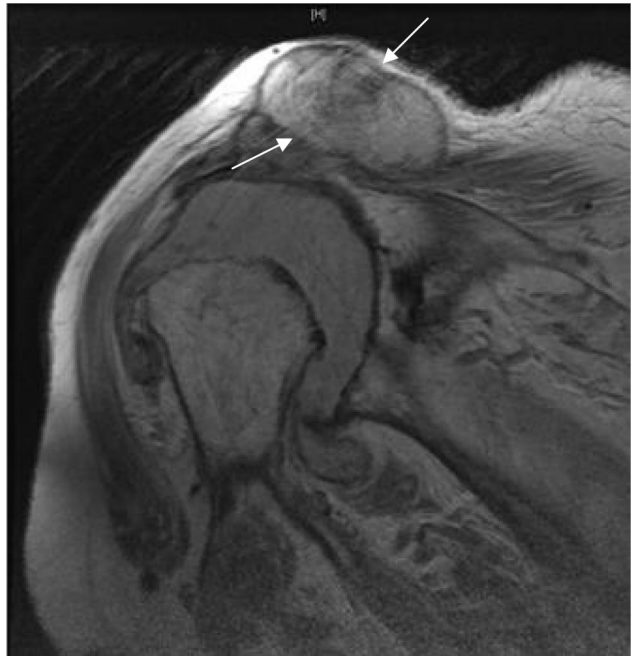
**FIGURE 1.** Right shoulder and scapula, posterior view, showing ecchymotic “crescent” sign of synovial rupture. Rectangle shows orientation of transducer for Figures 2 and 3.



**FIGURE 3.** Ultrasound image of cross section of synovial dissection (arrow) medial to right shoulder joint. For transducer orientation, see Figure 1, (45-mm linear array transducer, 10 MHz).



**FIGURE 2.** Ultrasound image of right shoulder showing irregular humeral head (thick white arrow) and large effusion (thin white arrows) extending to subcutaneous space. See Figure 1 for orientation of transducer, (45-mm linear array transducer, 10 MHz).



**FIGURE 4.** MRI of right shoulder showing destruction of humeral head and large effusion with “geyser sign” extension to subcutaneous tissue (arrows), (T2-weighted fat suppressed image).

shoulder joints have also been reported.<sup>1</sup> Ruptured non-popliteal synovial membranes are even more unusual and typically are associated with rheumatoid arthritis,<sup>1,2,6–10</sup> although the spectrum of other associations is broad.<sup>4,11–16</sup> Non-popliteal synovial rupture has been identified in the regions of the shoulder, elbow, wrist, spine, ankle, and even the knee (Table 1).<sup>4,6–11,14–17</sup>

**Shoulder**

Synovial rupture of the glenohumeral joint was first described in a 72-year-old woman with rheumatoid arthritis who presented with a swollen, painful right shoulder and subsequently developed

erythema of the anterior shoulder.<sup>11</sup> The swelling and erythema increased and appeared to gravitate toward her right anterior axillary fold. Subsequent arthrogram revealed contrast material escaping the glenohumeral joint capsule through at least 3 opening defects. The



**FIGURE 5.** Left arm crescent sign after synovial rupture.

authors concluded that the release of the synovial fluid was irritating to the affected tissues, causing swelling, induration, and inflammation of the anterior chest wall and axillary fold.

A patient with juvenile rheumatoid arthritis (JRA) suffered from recurrent bilateral rupture of the shoulder synovial membrane.<sup>4</sup> This 5-year-old male boy with systemic onset JRA developed recurrent bilateral bicipital masses that were firm, moderately tender, and complicated by linear horizontal ecchymoses above his antecubital fossa.

Similar to the second rupture in our case is the clinical presentation of a 58-year-old woman with a chronic history of rheumatoid arthritis who presented with a 1-week history of left anterior upper arm pain and swelling.<sup>6</sup> She was found to have a ruptured biceps tendon and massive rotator cuff tear on MRI. The authors postulated that the tear of the long head of the biceps tendon and its synovial sheath led to fluid from the subacromial bursa tracking down into the anterior area of the upper arm, manifesting itself as arm swelling.

Two cases of dissecting synovial cysts of the shoulder were reported as complications of chronic rotator cuff tear.<sup>13</sup> Unlike the present case, however, these did not rupture.

## Elbow

Rare cases of ruptured synovial cysts in the elbow have been identified. Six patients with rheumatoid arthritis presented with elbow swelling that extended into the forearm.<sup>7</sup> The most severe cases demonstrated forearm pitting edema with swelling extending into the hand and into the upper arm. Arthrograms in 4 patients demonstrated contrast medium leakage from the joint into the forearm.

One ruptured synovial cyst of the posterior elbow has been described.<sup>17</sup> The patient had rheumatoid arthritis and presented with erythema, swelling, induration, and limited range of motion of his left elbow. A double contrast arthrogram revealed a tear of the synovium that was just above the attachment of the posterior capsule of the olecranon. One case of radial nerve compression due to synovial rupture of a rheumatoid elbow has been reported.<sup>9</sup>

## Wrist

Synovial rupture at the wrist was reported in 3 cases, all of whom had rheumatoid arthritis.<sup>8</sup> Symptoms included recurrent forearm edema, and the confirmatory test was arthrography.

## Lumbar Spine

Epidural hematoma formation after synovial cyst rupture at the L4–L5 level has been reported.<sup>14</sup> The patient presented with a progressive history of pain, weakness, and atrophy in the right leg. MRI showed a posteromedial ovoid mass consistent with an intraspinal extradural synovial cyst. Cauda equina syndrome developed and patient proceeded with surgery, which confirmed spinal stenosis as well as a hemorrhagic ruptured right sided synovial cyst at L4–L5. Two years after surgery, the patient had no further leg pain or neurologic deficits.

## Hip

Communication between the hip joint and hip-related bursae is common, but synovial and cyst rupture are surprisingly rare.<sup>18,19</sup> Hip joint cysts and hip-related bursae might theoretically rupture under the high pressures of this weight bearing joint, however, we found only one case report of capsular rupture.<sup>12</sup> In this report, a 30-year-old man complained of months of posttraumatic low back, right buttock, and groin pain with radiation to the hip and knee. His symptoms were recalcitrant to intraarticular steroid injections, and he developed a 30-degree hip flexion contracture. Right hip arthrography demonstrated flow of contrast from the hip joint via an anterior capsular defect into the iliopsoas bursa and extended proximally under the inguinal ligament into the retrosoas space. The proximal part of the capsular rupture appeared to be directly over the right sacroiliac joint and was thought to have contributed to the patient's low back and buttock pain. Surgical tendon release and cyst removal were performed, with complete resolution of all symptoms.

## Knee

Non-popliteal synovial rupture of the knee has also been reported, although it is much less common than the ruptured Baker cyst. Rupture of the suprapatellar bursa presents with a painful ecchymotic swelling or mass, typically in the thigh and knee regions complicating trauma, rheumatoid arthritis, and gout.<sup>10,15</sup>

## Ankle

Only one case of synovial rupture of the ankle has been reported.<sup>16</sup> The presentation was that of progressive left ankle and calf pain and swelling after minor trauma.

## DISCUSSION

Synovial rupture will occur when the pressure of the synovial space exceeds the ability of the synovial membrane and supportive tissues to contain it.<sup>20</sup> Hence, the pathogenesis may involve either excessive pressure, a weakened synovium, or both. We believe our patient's primary shoulder process was severe rotator cuff tear arthropathy. In addition, she had urate crystals demonstrated in 2 noninflammatory fluid specimens, the pathogenic role of which is unclear. Her arthropathy led to secondary large effusions with consequent increased intrasynovial pressure, synovial herniation, dissection, and eventually rupture. The synovial fluid rupture resulted in her acute presentation with soft tissue inflammation and



**TABLE 1.** Case Reports of Non-Popliteal Synovial Rupture

Involved Joint	Gender	Age	Associated Diagnosis	Diagnostic Modality	Clinical Features	Reference
Shoulder	F	72	RA	Arthrogram	Painful, swollen right shoulder, erythema in right anterior shoulder increased and migrated toward anterior axillary fold.	11
Shoulder	M	5	Systemic onset JRA	Not done	Recurrent bilateral bicipital masses that resolved in less than 2 wk. Ecchymosis noted in elbow crease. Clinically diagnosed.	4
Shoulder	F	58	RA	Ultrasound and MRI	Proximal arm pain and swelling. Soft, tender swollen mass over the biceps muscles. Ruptured biceps tendon and massive rotator cuff tear.	6
Elbow	M	53	RA	Arthrogram	Pain and swelling of left forearm. Pitting edema extended to dorsum of hand, raised, erythematous area 6 cm below joint.	7
Elbow	F	65	RA	Arthrogram	Right elbow pitting edema, forearm pain, and hand swelling. Edema improved with rest.	7
Elbow	F	51	RA	Arthrogram	Finger paresthesias and pitting edema of the arm down to the wrist. Repeat arthrogram revealed synovial rupture at elbow.	7
Elbow	F	33	RA	Arthrogram	Mild swelling along the medial aspect of elbow with mild tenderness and edema.	7
Elbow	F	36	RA	Not done	Several episodes of painful and swollen elbow and forearm lasting from days to wk, clinically diagnosed synovial rupture of the elbow.	7
Elbow	F	61	RA	Arthrogram	Two wk of severe left forearm swelling which extended from the hand to the upper arm.	7
Elbow	M	56	RA	Arthrogram	Chronic synovitis followed by painful, indurated mass around the triceps and above the olecranon.	17
Elbow	M	56	RA	Arthrogram	Left forearm swelling with paresthesias in digits I–III. Electrodiagnostic evaluation consistent with radial nerve compression.	9
Wrist	N/A	N/A	RA	Arthrogram	Three cases of rheumatoid arthritis complicated by synovial rupture at the wrist, manifest by forearm swelling, confirmed by arthrogram.	8
Lumbar spine	M	68	OA	MRI	Extradural synovial cyst ruptured, causing cauda equina syndrome.	14
Knee	M	48	RA	Arthrogram	RA flare, right knee with suprapatellar synovial rupture. Diffuse pain and swelling of thigh.	10
Knee	M	47	Gout	Ultrasound	Suprapatellar synovial rupture. Severe pain, warmth, and swelling of the right thigh.	15
Ankle	F	27	Trauma	Arthrogram	Three mo of intermittent left ankle pain and swelling after minor trauma, followed by acute left ankle and calf pain, swelling.	16

RA indicates rheumatoid arthritis; JRA, juvenile rheumatoid arthritis; OA, Osteoarthritis; wk, week(s); mo, month(s).

ecchymosis, similar to the pseudocellulitis presentation of a Baker cyst rupture, but in this case involving first the right chest wall and then the left arm.

Along with the ultrasound and MRI findings, the first pattern of ecchymosis down the posterior and anterior right chest wall suggests synovial dissection from the glenohumeral joint superomedially through the torn rotator cuff, followed by subcutaneous rupture medial to the normal anatomic boundary of this joint. The subsequent pattern on the left, anteriorly over the upper arm, suggests synovial rupture directly from the anterior glenohumeral joint or its long head of biceps tenosynovial extension.

Rupture of the non-popliteal synovium is rare, but is important to consider in the appropriate clinical setting. Preceding arthritis or trauma is a risk factor shared by all cases in this review. A common theme when synovial rupture involves one of the lower extremity joints is its ability to mimic deep venous thrombosis. Therefore, when entertaining a diagnosis of lower extremity deep venous thrombosis, synovial rupture of the ankle, knee, and hip should be considered in the differential diagnosis. Suprapatellar synovial rupture may be suspected when there is swelling and ecchymosis in the thigh.

Similarly, synovial rupture in the shoulder should be considered in patients presenting with acute pain and ecchymosis along the adjacent chest wall or upper arm, especially when there is a history of synovial hypertrophy, synovitis, and large effusions. Synovial dissection may present with a mass in the axilla or upper arm. Elbow or wrist synovial rupture should be considered in patients with diffuse edema involving the forearm with or without distal neuropathy, especially in the setting of active rheumatoid arthritis.

Traditional arthrography assisted in diagnosis in older case reports. Magnetic resonance and ultrasound imaging, as demonstrated in the present report, are noninvasive modalities that may contribute to the diagnosis.

Given the rarity of non-popliteal synovial rupture, management data are limited to isolated case reports. As illustrated by the right shoulder of this patient, arthrocentesis and corticosteroid injection may provide at least temporary relief. Surgical solutions have been reported in rare instances of non-popliteal synovial rupture as earlier. For the shoulder, hemiarthroplasty was reported successful in one case of rotator cuff arthropathy associated with hemiarthrosis and lateral arm ecchymosis, but actual synovial rupture was not reported.<sup>21</sup>

### KEY POINTS

Non-popliteal synovial rupture is important to consider in the differential diagnosis of acute regional pain, swelling, and ecchymosis. Magnetic resonance and ultrasound imaging are useful diagnostic modalities.

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