Chapter 13
The Acutely Swollen/Painful Joint

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This chapter focuses on the evaluation of the adult patient with an acutely swollen, painful joint. A major concern with these patients is the possibility of infection of the joint space itself, which, untreated, can lead to permanent joint damage. Thus, the goal in the evaluation of these patients is to determine the etiology as quickly as possible.

Red Flags

The most serious cause of an acutely swollen and painful joint is a bacterial infection (septic arthritis). In addition, there are other red flag considerations:

1. *Trauma*. Rapid onset of an effusion after trauma may indicate hemarthrosis, which may be due to fracture or internal joint derangement, such as cartilage or ligament damage. These patients should all have radiographs performed.
2. *Multijoint involvement*. These patients are likely to have systemic conditions and should be evaluated appropriately.
3. *Immunocompromise*. Those patients who are immunosuppressed by disease or medications are at increased risk for joint infections and are also more likely to have fewer findings on diagnostic testing, such as blood tests and synovial fluid analysis [1]. Extra care should be taken to rule out infection in these patients.

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Approach to the Patient with an Acutely Swollen, Painful Joint

The first challenge in evaluating the patient with an acutely swollen, painful joint is to establish whether the problem is intra-articular or extra-articular. Disorders of extra-articular structures, such as bursae, tendons, extra-articular ligaments, and overlying skin, can present with swelling, erythema, and pain. These conditions are potentially less serious than intra-articular swelling and pain, which are regarded as infectious until proven otherwise.

Historical considerations include overall health status of the patient, chronic medical conditions, medications, alcohol use, recent joint surgery, and any history of trauma (particularly if it immediately preceded the onset of the complaint). In the absence of trauma, very abrupt onset (becoming severe within hours) is more characteristic of crystal deposition arthritis and septic arthritis than other inflammatory conditions [1].

Having the patient point to the precise location of the pain may help locate the source, as he or she may point directly to a tendon or bursa. The pain associated with joint pathology, on the other hand, is often more difficult for the patient to localize. Range of motion (ROM) evaluation is helpful; patients with extra-articular pathology will often have more pain with active or resisted ROM than with passive ROM, whereas those with intra-articular pathology will have pain with both active and passive ROM [1].

Joint aspiration is required in most patients with an acutely swollen, painful joint, especially if septic arthritis is suspected [1, 2]. The synovial fluid should be sent for WBC count with differential, Gram stain, and culture, as well as for evaluation for crystals. Aspiration can be quite difficult at times depending on the joint involved, and consultation may be necessary depending on the clinician's level of comfort and experience. Hemarthrosis may lead one to suspect trauma. Superimposed cellulitis is a relative contraindication to aspiration. Warfarin therapy is not a contraindication. Removal of as much synovial fluid as possible offers symptomatic relief. The details of aspiration of various joints are described elsewhere. With certain joints, particularly the hip, an effusion may be neither visible nor palpable. Blind aspiration should not be attempted; radiographically confirmed effusions can be drained with the aid of interventional radiology techniques. Table 13.1 lists synovial fluid findings in various conditions [3].

Common Clinical Presentations

Infection (Septic Arthritis)

Joint infection, also called septic arthritis, is relatively common in patients with swollen, painful joints and must be a priority consideration. Almost any infectious agent can cause septic arthritis, including fungi and viruses, but the vast majority are

Table 13.1 Synovial fluid findings in various conditions

Measure	Normal	Noninflammatory	Inflammatory	Septic	Hemorrhagic
Clarity	Transparent	Transparent	Translucent-opaque	Opaque	Bloody
Color	Clear	Yellow	Yellow to opalescent	Yellow to green	Red
Viscosity	High	High	Low	Variable	Variable
WBC/mm^3	<200	0–1,000	1,000–100,000	15,000 ≥ 100,000	200–2,000
PMNs, %	<25	<25	≥50	≥75	50–75
Culture	Negative	Negative	Negative	Often positive	Negative
Total protein g/dL	1–2	1–3	3–5	3–5	4–6
Glucose mg/dL	Nearly equal to blood	Nearly equal to blood	>25, lower than blood	<25, much lower than blood	Nearly equal to blood

Adapted from Ref. [3], UpToDate

caused by bacteria. Bacterial infections are generally referred to as gonococcal or nongonococcal, since *Neisseria gonorrhoeae* is a causative agent among young sexually active adults. Staph. and Strep. species are the most common gram-positive agents and cause up to 90 % of septic arthritis cases [4]. Gram-negative organisms are more common in older patients and in the immunocompromised.

Several risk factors for septic arthritis have been identified in recent studies. Those with the highest positive likelihood ratios (LR) were hip and knee prosthesis and skin infection (LR 15), recent joint surgery (LR 6.9), age >80 years (LR 3.5), and hip or knee prosthesis (LR 3.1) [5]. Diabetes and rheumatoid arthritis also increase the risk.

Septic arthritis typically presents as a hot, swollen, tender joint with a reduced range of motion. Fever occurs in approximately 50 % of patients with septic arthritis and does not distinguish this diagnosis from other inflammatory causes of joint pain and swelling [5]. An elevated peripheral WBC count, an elevated ESR, or an elevated CRP were found to increase the likelihood of septic arthritis minimally, so a high index of suspicion needs to be maintained.

Progressively higher WBC counts in the synovial fluid increase the likelihood of septic arthritis. In one systematic review and one meta-analysis, the likelihood ratio (LR) of septic arthritis with a synovial WBC count of <25,000/mm^3 (25×10^9/L) was 0.32 [5], the LR for a WBC count of ≥ 25,000/mm^3 was 3.2, for a WBC count > 50,000/mm^3 (50×10^9/L) the LR was 4.7, and the LR for a synovial WBC count > 100,000/mm^3 was 13.3 [6]. If 90 % or more of the cells in the synovial fluid are polymorphonuclear cells (PMNs), then the risk of septic arthritis is increased threefold (LR 3.4). Other markers in the synovial fluid, such as glucose, protein, and lactic acid, have not been found to be helpful [5, 6].

Gram staining of synovial fluid is very helpful when positive, but is not sensitive enough to rule out infection [4]. Culture results can take several days, so treatment should be instituted if infection is suspected. Blood cultures should always be

obtained when septic arthritis is suspected or diagnosed, and they can be very helpful for guiding therapy. Unfortunately, blood cultures are only positive in 10–50 % of cases [1, 7].

Prompt treatment with antibiotics along with drainage of purulent material from the joint is the mainstay of treatment [4]. With a positive gram stain, choices can be tailored early on; in the absence of this, many experts recommend broad-spectrum coverage for gram-positive and gram-negative bacteria. With the prevalence of MRSA increasing in all populations, some experts recommend coverage with vancomycin until culture results are available. There is also little evidence to guide duration of therapy. Experts recommend antibiotic treatment for 4–6 weeks for nongonococcal septic arthritis and 1–2 weeks for gonococcal arthritis [2, 7]. Successful treatment also includes removal of purulent material from the joint space either surgically or through closed needle aspiration. Consultation with a surgeon may be necessary.

Crystal Deposition Arthritis

Gout (deposition of monosodium urate crystals) and pseudogout (calcium pyrophosphate crystals) can both present with acute pain and swelling of a joint. It is a challenge to differentiate these conditions from septic arthritis, particularly if there is no prior history of crystal deposition disease. If the diagnosis is not completely clear based on history and physical findings alone, then joint should be aspirated and synovial fluid evaluated for infectious organisms and crystals. It is also important to remember that infection may coexist with crystal deposition arthritis, so the clinician's threshold to perform aspiration should be low. Risk factors for the development of gout include male sex, genetic predisposition, hypertension, metabolic syndrome/obesity, diuretic use, chronic renal disease, alcohol consumption (beer and spirits, not wine), and dietary intake of seafood, red meat, and high-purine foods [8]. Common triggers for acute gout include infection, IV contrast, dehydration, diuretic therapy, surgery, and starting or stopping allopurinol [9]

Recommendations for the diagnosis of gout were updated in 2011. The rapid development of severe pain, swelling, and tenderness that reaches its maximum within 6–12 h, especially with overlying erythema, is highly suggestive of crystal inflammation, although not specific for gout [10]. The presence or absence of elevated serum uric acid cannot be used alone to confirm or exclude the diagnosis of gout. The presence of monosodium urate crystals in synovial fluid is confirmatory [8, 10].

The European League Against Rheumatism (EULAR) guidelines state that an elevated uric acid blood level at the time of presentation and then at a follow-up visit in a patient with podagra (inflammation of first MP joint of the great toe) can be presumptively diagnosed with gout [11, 12]. Only 10 % of patients with gout are referred to rheumatology subspecialists with the vast majority being diagnosed and treated without joint aspiration [12, 13]. This, then, is a reasonable course to take in treating these patients.

Pseudogout can be very difficult to distinguish from gout by clinical evaluation; fluid analysis confirming calcium pyrophosphate crystals is needed.

Treatment of acute gout includes NSAIDs, corticosteroids, or colchicine; all have side effects and precautions that must be considered. Pseudogout is typically treated with anti-inflammatory medications.

Acute Exacerbation of Osteoarthritis

Although osteoarthritis is typically a chronic condition, acute exacerbations often occur. In one study of 500 patients, 47 % of patients had only one symptomatic joint, and 41 % of radiographically abnormal joint sites were knees [14]. Physical exam often reveals pain on range of motion as well as limited range of motion of the affected joint [15]. An effusion of the knee should be aspirated to rule out infection or hemarthrosis. The synovial fluid from osteoarthritis is usually clear and viscous with a leukocyte count less than 2×10^9/L [13]. Bloodwork is usually not helpful.

Treatment of acute exacerbations of osteoarthritis includes acetaminophen or NSAIDs if acetaminophen does not help. Rest of the joint is appropriate until the exacerbation has resolved; afterwards, an exercise program of muscle strengthening and range-of-motion exercises may reduce pain and improve physical function. The use of intra-articular corticosteroids may provide short-term relief lasting 4–8 weeks [15]. Some common nonpharmacological treatments for osteoarthritis. There is good evidence that one of the most effective, long-term treatment plans for patients with osteoarthritis is referral to the Arthritis Foundation for patient education and support.

Trauma

Trauma is an extremely common cause of the acutely swollen, painful joint. All patients with a swollen joint or joint effusion, pain, and a history of trauma need X-ray evaluation. If no history of onset can be obtained from the patient (such as a patient who is delirious, confused, unconscious, or noncommunicative), trauma should be suspected and X-rays performed. Internal derangement (cartilage or intra-articular ligament damage, in addition to fracture) should be considered if hemarthrosis is diagnosed on synovial fluid aspiration. Further management depends on the particular injury found.

In summary, all patients with an acutely swollen, painful joint require detailed evaluation to rule out a septic joint and to properly diagnose their condition(s). Those with even a moderate possibility of septic arthritis should either be treated empirically and/or require urgent consultation with a specialist; those in whom the diagnosis is clearly not infectious can be managed conservatively by the primary care provider. Close follow-up is essential for all patients. The flowchart that follows can help guide the provider through management of these patients.

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