Acute monoarthritis
diagnosis in adults

Recognition and appropriate management of an acute monoarthritis requires strategic assembly and analysis of information from the history, the examination and a few selective tests.

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Acute monoarthritis – that is, acute pain and swelling in a single joint that has been present for less than six weeks – can be the initial manifestation of many joint disorders, including polyarticular rheumatological disorders. The hallmarks for inflammatory acute arthritis are severe pain, heat and swelling, loss of function and erythema. Septic arthritis is a rapidly destructive inflammatory joint condition and must always be excluded as the cause of a single inflamed joint because, without correct management, infection can result in irreversible damage to a joint within days.

As well as the potential for long term joint damage, acute joint problems can have a significant impact on a patient's quality of life and ability to participate in normal work or social activities. The GP is generally the first doctor a patient will see, and prompt action and appropriate referral can significantly improve the outcomes. Diagnostic possibilities are influenced substantially by context, and the various monoarthropathies have characteristic presentation profiles.

Differential diagnosis

The differential diagnoses of acute monoarthritis are the following:[1-3]

- infectious arthritis – bacterial, mycobacterial, fungal, viral (Figure 1)
- crystal-induced arthritis – gout, pseudogout (Figure 2)
- trauma-induced arthritis – fracture, internal derangement (ligamentous/meniscal), haemarthrosis, post-traumatic synovitis
- other arthritis – osteoarthritis, foreign body synovitis, tumours, spondyloarthritis, sarcoidosis, amyloidosis.

The most likely causes of a true acute monoarthritis in an adult are infection, trauma or crystal-induced synovitis. Polyarticular disorders may, however, present as monoarthritis. There may be a recent history of other joint involvement, which a patient may mention only when specifically asked, or the oligo/polyarticular nature may become apparent only during examination, such as the recognition of dactylitis or other more subtle inflammatory joint changes. Common polyarticular disorders with a potential monoarticular onset include the spondyloarthropathies (that is, reactive psoriatic and enteropathic arthritis) and occasionally rheumatoid arthritis. Monoarthritis is not usually the initial manifestation of a systemic inflammatory connective tissue disease.

Infection of a joint with mycobacteria or fungi is rarer than with bacteria, and usually results in a

IN SUMMARY

- **Common causes of monoarthritis are infection, trauma and crystal-induced synovitis.**
- **Monoarthritis must be regarded as potentially septic until proven otherwise.**
- **Synovial fluid examination is the most important investigation.**
- **Polyarticular conditions can present initially with a single inflamed joint.**
- **Contextual information and extra-articular features often provide clues to the underlying diagnosis.**

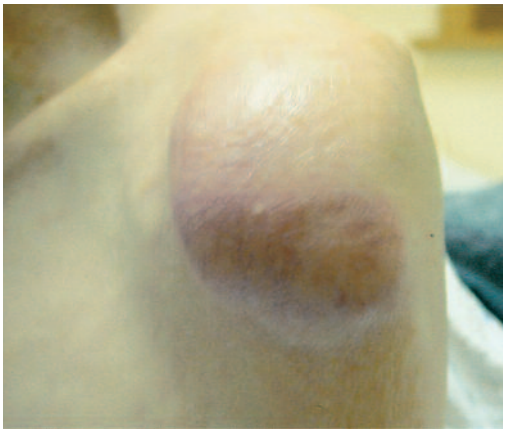

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Figure 1. Septic arthritis of the shoulder, showing characteristic joint distension and overlying erythema.

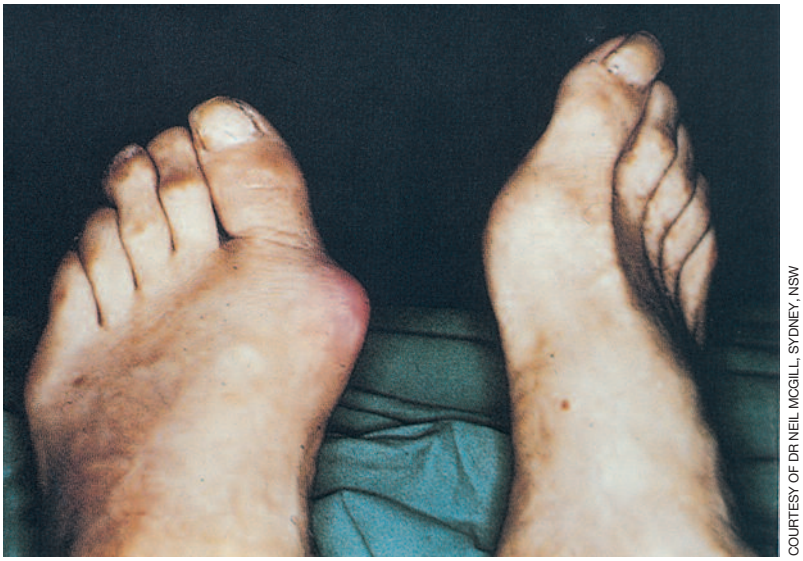

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Figure 2. Typical gout of the big toe. The redness, heat and swelling of the first metatarsophalangeal joint commenced abruptly.

chronic arthritis. Viral joint infection is rarely monoarticular. Only acute septic monoarticular arthritis caused by bacteria is discussed here.

Other causes, such as synovitis due to a foreign body, pigmented villonodular synovitis and infiltrative disorders (sarcoid or amyloid), are less common and usually diagnosed when further investigations are performed for assessment of a chronic monoarthritis. Occasionally metastases or primary tumours can present with acute joint inflammation. Again, these are uncommon, but should be considered when a patient has a history of cancer elsewhere, and basic tests are unrewarding.

Extra-articular features often aid in the diagnosis. For example:

- patients with psoriatic arthritis may have psoriasis (hairline, natal cleft, umbilicus, extensor surfaces) and nail changes (pitting, ridging, onycholysis)
- those with reactive arthritis may have rash (keratoderma blennorrhagium), urethritis/dysuria and conjunctivitis (painful eyes, blurred vision)
- those with gout may have tophi (olecranon bursa, hands, feet, ear helix)
- those with disseminated gonococcal infection may have rash (pustular lesions), migratory arthritis and tendonitis.

History and examination

A thorough history and examination are important in firstly confirming that the problem is arthritis and that it is limited to a single joint,[2] and secondly in determining a possible aetiology. The presentation profiles of the main arthropathies are summarised in the box on pages 38 and 39, and important points regarding history and examination in Table 1. Clues to diagnosis and potential pitfalls are listed in the box on page 40.

Investigations

Joint aspiration and synovial fluid analysis

The most important initial investigation in a patient with an acute monoarthritis is joint aspiration and analysis of the aspirated synovial fluid. This enables diagnosis of infection, crystal-induced arthritis and haemarthrosis. The aspiration should be performed using an aseptic, 'no touch' technique under local anaesthetic, and has a low complication rate (less than 1 in 10,000 risk of infection and bleeding). Ultrasound-guided (or fluoroscopy-guided) aspiration may be necessary for deeper joints (such as the hip) and difficult joints (such as the metacarpophalangeal joint), and a larger needle (18 gauge) is often required for successful aspiration in the presence of haemarthrosis. Concurrent aspirin use is not a contraindication to aspiration. If a fracture is suspected, the joint should be imaged before aspiration because theoretically there is an increased risk of osteomyelitis with aspiration

continued

Presentation profiles of acute monoathropathies

Infectious arthritis

Diagnosis	Risk factors	Age	Gender	Time to presentation	Predisposed joints	Associated features
Nongonococcal bacterial infection	Diabetes mellitus, IV drug use, alcoholism, immuno - suppression/corticosteroid use, rheumatoid arthritis/joint destruction, age > 80 years, penetrating injury	Any age	Either	Hours to days, may be later	Large joints (knee 50%),[4] finger joints	Pneumonia, urinary sepsis, skin infection in 50% of cases,[4] fever in 80%
Disseminated gonococcal infection	Sexually active, past history of gonococcal infections, certain occupations, recent travel	Mostly 20-40 years; but all ages	Females > males	Hours to days, 1-21 days after sexual encounter, menstruation	Hands, ankles, wrists, knees	Pustular rash, urethritis/cervicitis, migratory arthritis, fever, tenosynovitis

Diagnosis	Risk factors	Age	Gender	Time to presentation	Predisposed joints	Associated features
Gout (monosodium urate)	Previous gout; diuretic, alcohol, aspirin use; purine diet; recent medical illness; recent surgical trauma; obesity; renal impairment	Male: peak 40-50 years Female: >60 years	Males > females	Hours to days	First MTP* joint (>50%), midfoot, ankle, knee, Heberden's nodes (elderly women)[5]	Tophi
Pseudogout (calcium pyrophosphate)	Acute illness, joint insults/ osteoarthritis, advanced age, haemachromatosis	Peak 65+ years (<55 years suggests metabolic cause)	Females > males	Hours to days	Knees, wrists, shoulders, hips	Chondrocalcinosis knee, triangular fibrocartilage at wrist
Calcium hydroxyapatite	Advanced age	70+ years	Females	Hours to days	Shoulder (may be bilateral asynchronously, includes periarthritis), knees, hips	

*MTP = metatarsophalangeal.

Mycobacterial or fungal joint infections are rarer and usually give a chronic arthritis; viral

of a fractured joint.

Generally arthrocentesis can be safely performed in anticoagulated patients with an INR below 2.5 and should be undertaken if septic arthritis suspected. In a patient who is over-anticoagulated, consider reversing the anticoagulation with vitamin K or fresh frozen plasma (depending on the urgency of the procedure and the underlying indication for anticoagulation).

Synovial fluid analysis

The macroscopic appearance of the synovial fluid at the time of aspiration will provide immediate clues. Whereas normal or noninflammatory fluid is clear, inflamed or infected fluid will be cloudy because of its increased cellular content. All the aspirated fluid should be sent for examination, although only 2 mL is required for Gram stain, culture, cell count (including differential leucocyte count) and crystal analysis.[3] The sample for these tests should be sent in a sterile specimen container. If there is sufficient fluid, it is useful to place some in an

Trauma-induced arthritis

Diagnosis	Risk factors	Time to presentation
Fracture through joint	Trauma	Seconds to minutes
Internal derangement	Trauma, osteoporosis	Minutes to hours
Haemarthrosis	Anticoagulation, bleeding diathesis, fracture, ligamentous rupture	Hours to days
Post-traumatic synovitis	Past history of joint trauma or periarticular fracture, psoriasis (Koebner phenomenon)	Days to weeks

Spondyloarthritis

Diagnosis	Age	Gender	Time to presentation	Predisposed joints	Family history	Past history	Extra-articular features
Reactive spondyloarthritis	20-40 years	Male > female	Days to weeks	Lower limb	Seronegative arthritis	Precipitating gastro- or genitourinary infection	Keratoderma, balanitis, dactylitis, urethritis, tenosynovitis, mouth ulcers, ocular inflammation
Psoriatic spondyloarthritis	Common 35-50 years	Either, possibly male > female	Days to weeks	Large and small joints	Seronegative arthritis, psoriatic arthritis, psoriasis	Psoriasis†	Psoriasis, dactylitis, nail changes, conjunctivitis, iritis
Enteropathic spondyloarthritis	All ages	Male = female	Days to weeks	Knee, ankle, also upper limb and small joints	Seronegative arthritis, inflammatory bowel disease	Inflammatory bowel disease	Flare of bowel disease, pyoderma gangranosum, erythema nodosum, aphthous stomatitis, anterior uveitis

†Check occult sites – i.e. scalp, umbilicus, natal cleft.

EDTA tube to allow more accurate analysis of the white cell count and also into blood culture bottles to aid in diagnosis of septic arthritis.

Ideally, the synovial fluid should be analysed within a few hours because a potential fall in the white cell count, reduction in the number of calcium pyrophosphate crystals or an increase in difficulty of detection of monosodium urate crystals can occur *ex vivo* over time.[6] Use of a blood culture bottle (where there is a high volume of inoculum in a high volume of medium) is likely to increase the chances of a positive synovial fluid culture, particularly if the fluid will not be analysed for a number of hours.

Interpretation of results

Macroscopic examination of the synovial fluid is particularly important in a few conditions:

- in haemarthrosis, the fluid is uniformly bloody and can have a yellow-brown (xanthochromic) supernatant (in contrast to a traumatic aspirate, which usually has streaks of clotted blood[2])

Table 1. Acute monoarthritis: factors to note in diagnosis

Time to presentation
- seconds to minutes to hours – fracture or internal derangement (ligamentous/meniscal injury)
- hours to days – crystal-induced arthritis or haemarthrosis
- days to weeks – seronegative arthritis, indolent infection (fungal/mycobacterial), potential tumour or another infiltrative process

Precipitating factors
- recent or concurrent infections
- trauma
- recent arthroscopic or operative management of a joint

Age
- young adults – spondyloarthritis, trauma, disseminated gonococcal infection
- older adults – crystal-induced arthritis, infection

Concurrent medications
- anticoagulants
- immunosuppressants

Comorbidities and past history

Systemic/extra-articular features

Articular versus periarticular involvement
- pain on movement can be a pointer to diagnosis
  - articular disorders: painful limitation of movement in all planes
  - periarticular inflammation: limitation of movement in a single plane, or local tenderness distinct from joint itself

Signs of inflammation
- exquisitely tender joints +/– erythema are suggestive of sepsis, gout or psoriatic arthritis

Predisposed joint(s)
- fat droplets raise the suspicion of a fracture
- grossly purulent synovial fluid is consistent with infection (but can also occur in psoriatic arthritis and other inflammatory conditions).

The number of white cells and the percentage of polymorphonuclear leucocytes helps differentiate between inflammatory and noninflammatory joint conditions (Table 2), although there is considerable overlap of categories. In most series, 10 to 20% of cases of clinically diagnosed bacterial arthritis are not confirmed on synovial fluid analysis.[4]

Prior antibiotic treatment increases the risk of false negative results for Gram staining and culture. Whenever possible, a synovial fluid sample (or, if this is impractical, a blood sample) should be taken for culture before antibiotic therapy is started.

All synovial fluid should be examined using polarised microscopy for monosodium urate crystals and calcium pyrophosphate crystals.[7] Monosodium urate crystals will be seen as needle-shaped negatively birefringent crystals (Figure 3), and calcium pyrophosphate crystals as rhomboid or rod-shaped weakly positively birefringent crystals. Articular cartilage debris is birefringent. There is a large variation between reported sensitivity, specificity and reliability of diagnosis of an acute crystal arthritis on synovial fluid examination.[8] Reported sensitivities are 90% for monosodium urate crystals and 70% for calcium pyrophosphate crystals.[9] Both the concentration of the crystals within the fluid and the experience of the observers are important factors in making a correct diagnosis. It is important to remember that gout and pseudogout can coexist with infection.

Contraindications to aspiration

There are a number of instances when joint aspiration is contraindicated or may not be needed. These include patients

Acute monoarthritis: clues to diagnosis and potential pitfalls

- Haemarthrosis can occur while the INR is still within the therapeutic range.
- Acute monoarthritis in an anticoagulated patient must always raise the possibility of a haemarthrosis, particularly in the weight bearing or glenohumeral joints.
- In patients with recurrent haemarthrosis due to haemophilia, expert haematologist advice should be sought before aspiration (as the patient will require coagulation factors).
- Minimal trauma may cause an articular fracture in an osteoporotic patient.
- Trauma may also precipitate flares of crystal-induced arthritis.
- Patients who are immunosuppressed may have a more indolent presentation of septic arthritis with mild pain/swelling – maintain a high index of suspicion in these patients.
- The presence or absence of fever can be misleading. Temperature can be normal in patients with septic arthritis (20% are afebrile) and increased in those with a a crystal-induced arthritis or other inflammatory processes.
- About 10 to 20% of cases of septic arthritis have an oligoarticular presentation,[6] and the diagnosis is not necessarily excluded upon finding a second or third involved joint.
- Infection in intravenous drug users often occurs in atypical sites such as the sternoclavicular, costochondral, shoulder, vertebral or sacroiliac joints.
- Polyarticular conditions can present with a monoarticular onset. Therefore, a careful history of previous joint involvement and recognition of extra-articular features will aid in the diagnosis. The diagnosis will often become apparent over time.

who have the following:

- classic first metatarsophalangeal gout – consider treating initially and then reviewing in one to two days if no response to treatment
- infection overlying a joint targeted for aspiration – image to see if there is an associated effusion, and if so, refer for urgent specialist advice
- extensive psoriasis over a joint targeted for aspiration – seek specialist advice because there is increased risk of iatrogenic infection if a needle is to be placed through a plaque since plaques have the potential to be colonised with *Staphylococcus aureus*
- a prosthetic joint – refer the patient to the orthopaedic unit; urgent referral is necessary if there is concern regarding a prosthetic joint infection.

Radiology

Plain films of an acutely inflamed joint may reveal unsuspected underlying pathologies, including fracture, osteomyelitis, avascular necrosis or a tumour. In the setting of acute septic arthritis, plain films will generally show only soft tissue swelling but will provide an invaluable baseline for later comparison. It generally takes 10 to 14 days for destructive changes of septic arthritis to become apparent. Plain films are indicated in the setting of trauma. If initial imaging is normal and there remains a suspicion of a fracture, re-imaging seven to 10 days later (when there may be callus formation or abnormal alignment) is warranted.

Blood tests

Blood test results are usually nonspecific. Inflammatory markers (erythrocyte sedimentation rate, C-reactive protein) support the diagnosis of an infective or inflammatory condition. A complete blood picture may show elevated white cells, but a normal count does not exclude infection. Coagulation studies are recommended in patients on warfarin or in whom a bleeding disorder is suspected.

Blood cultures will be positive in about 50% of patients with nongonococcal septic arthritis[4,10] (the samples should be taken before patients start taking any antibiotics). In patients with disseminated gonococcal infection, blood cultures will be positive in only 5 to 10% of cases and investigations should be performed on a broader set of samples, including a midstream urine sample, and urethral, anal, cervical, pharyngeal and skin lesion swabs (Table 3).[10] As synovial fluid Gram stains are positive in fewer than 25% of cases of disseminated gonococcal infection and cultures are positive in only 25 to 70%, confirmation of the diagnosis based on synovial fluid alone can be difficult.

Table 2. Analysis of synovial fluid[3]

Fluid type	Macroscopic appearance	White cell count (cells/mL)	Polymorphonuclear leukocytes (%)
Normal	Clear, viscous, pale yellow	0-200	<10%
Non-inflammatory	Clear to slightly turbid	200-2000	<20%
Inflammatory	Slightly turbid	2000-50,000	20-70%
Septic/pyarthrosis	Turbid to purulent	> 50,000	>70%

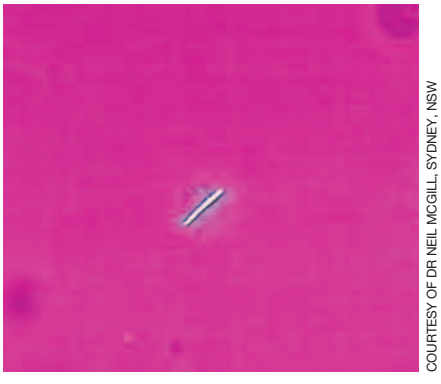

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Figure 3. A urate crystal engulfed by a leucocyte, viewed under polarised microscopy.

Plasma urate can be normal in patients with acute attacks of gout and elevated in asymptomatic patients. In the setting of acute gout, the plasma urate will generally be in the upper normal range or above. Exceptions include recent medical events or introduced treatments that lower blood urate.

Autoimmune screens such as rheumatoid factor and antinuclear antibody are rarely helpful in the acute setting[8] and should not be ordered routinely in a patient with an acute monoarthritis with no symptoms suggestive of an inflammatory connective tissue disorder.

Treatment

Treatment will vary depending on the diagnosis. General guidelines include therapeutic aspiration of large tense effusions, which will provide pain relief and

Table 3. Culture positivity in disseminated gonococcal infection[10]

Specimen site	Positive (gonococcal) culture
Genitourinary	80%
Synovial fluid	25-70%
Rectum	20%
Pharynx	10%
Blood	5-10%
Skin	Rare

also reduce potential damage resulting from increased pressure within the joint capsule. Rest, ice, simple analgesia (such as paracetamol) and gentle mobilisation will help traumatic (nonfracture) monoarthritis. If there is concern regarding acute internal derangement, then further imaging is warranted. Nonseptic inflammatory conditions can be treated with intra-articular corticosteroids and NSAIDs.

If there are persisting symptoms and the diagnosis remains unclear, then re-aspiration (in one or two days) is reasonable. Percutaneous or arthroscopic lavage may be helpful, especially in patients with septic arthritis. Lavage should be avoided if a communication between the joint and skin (a sinus) is present.

When to refer

Urgent specialist referral is required with proven or presumptive septic arthritis. Urgent review is also warranted with suspected acute internal derangement secondary to trauma.

Patients should be referred for outpatient review if there is an ongoing, undiagnosed monoarthritis or if there are features suggestive of a systemic rheumatological cause such as a psoriatic arthritis. Considering the adverse outcomes that can accrue from delay in appropriate management of septic arthritis, it is best to err on the side of caution and refer the patient if in doubt.

Conclusion

A patient presenting to the GP with an acute monoarthritis requires a systematic review and simple investigations, of which synovial fluid analysis is the most important. Common causes of monoarthritis include infection, trauma and crystal-induced arthritis, although polyarticular rheumatological disorders can initially present as a monoarthritis. Septic arthritis must always be excluded as the cause of a single inflamed joint. MT

References

1. Baker DG, Schumacher HR. Acute monoarthritis. N Engl J Med 1993; 329: 1013-1020.
2. Cibere J. Rheumatology: 4. Acute monoarthritis. CMAJ 2000; 162: 1577-1583.
3. Spencer RT. Arthrocentesis and synovial fluid analysis. In: West SG, ed. Rheumatology secrets. 2nd ed. Philadelphia: Hanley and Belfus; 2002. p. 63-66.
4. Goldenberg DL. Septic arthritis. Lancet 1998; 351: 197-202.
5. Edwards NL. Gout. (Section B. Clinical and laboratory features). In Klippel JH, Stone JH, Crofford L, eds. Primer on the rheumatic diseases. 11th ed. Atlanta: Arthritis Foundation; 1997. p. 234-239.
6. Kerolus G, Clayburne G, Schumacher HR Jr. Is it mandatory to examine synovial fluids promptly after arthrocentesis? Arthritis Rheum 1989; 32: 271-278.
7. Dieppe P, Swan A. Identification of crystals in synovial fluid. Ann Rheum Dis 1999; 58: 261-263.
8. Freed JF, Nies KM, Boyer RS, Louie JS. Acute monoarticular arthritis. A diagnostic approach. JAMA 1980; 243: 2314-2316.
9. Janson RW. Gout. In: West SG, ed. Rheumatology secrets. 2nd ed. Philadelphia: Hanley and Belfus; 2002. p. 325-332.
10. Gilliland WR. Bacterial septic arthritis. In: West SG, ed. Rheumatology secrets. 2nd ed. Philadelphia: Hanley and Belfus; 2002. p. 281-289.

DECLARATION OF INTEREST: None.

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