

SEPTIC ARTHRITIS



*“Snow Storm: Hannibal and his Army Crossing the Alps”, oil on canvas, J. M. W. Turner,
Tate Gallery, London.*

“Never before, while the City itself was still safe, had there been such excitement and panic within its walls. I shall not attempt to describe it, nor will I weaken the reality by going into details... it was not wound upon wound but multiplied disaster that was now announced.

For according to the reports two consular armies and two consuls were lost; there was no longer any Roman camp, any general, any single soldier in existence; Apulia, Samnium, almost the whole of Italy lay at Hannibal’s feet. Certainly there is no other nation that would not have succumbed beneath such a weight of calamity...”

*Livy,
On the Roman defeat at Cannae in 216 B.C,
The History of Rome Bk 22, 1st century A.D*

One day in 1810, Turner took Fawkes' son for a walk on the Yorkshire Moors as a storm brewed. The two of them sketch away. Turner puts his pencil down.

"There Hawky", he says, "in two years you'll see this and it'll be called "Hannibal crossing the Alps".

So a scrawl over the Yorkshire Moors turns into a no-holds-barred Alpine cataclysm. A simultaneous blizzard, and a shaft of sickly sun. Hannibal's army is the victim as it clammers its painful way over the Alpine passes. Stragglers picked off by scary mountain men while a sucking vortex hovers over the scene like some gigantic malevolent bird of prey.

Turner does something tremendous with the storm over the Yorkshire Moors. It's not just scenic weather, it's a cosmic reckoning.

Hannibal is a hit. People crowded round it so densely, the gents couldn't elbow their way in to see it.

But why did this picture pull in the crowds? Not because it was a scene from ancient history, but because everybody knew it was also a modern painting, a contemporary story. The comeuppance handed out to another arrogant invader who crossed the Alps in search of glory.

The archenemy. Napoleon.

In a crushing put-down, Turner shrinks the mighty commander to a puny, almost comical, figure in the remote background. Atop an elephant that looks more like a dung beetle.

Simon Schama, "The Power of Art", BBC Television, 2010.

The battle of Cannae was one of the most famous and decisive battles in history. It was fought, in 216 B.C during the second Punic War, between the two superpowers of the ancient world, Carthage and Rome. Carthage was led by one of history's greatest generals, Hannibal Barca, who had stunningly led an immense army from Africa, across the straits of Gibraltar, through Spain, over the mountains of the Alps, and into the heartland of Italy itself. Despite the ordeals of terrible storms encountered in the crossing of the Alps, Hannibal's army had descended onto the Tuscan plain largely intact. Terrified civilian populations in the north of Italy fled en masse before Hannibal's army which included numerous elephants, that seemed like incredible monsters to many civilians who had never before seen such animals, adding to the mystique and subsequent legend of the fearsome invaders. The size of Hannibal's army, even allowing for the usual exaggerations of ancient sources, has been estimated at around 60,000 in total. Just as the tension that had been rising for years in the Nineteenth century between Great Britain and Germany over world hegemony had led to the outbreak of the First World War, so too had tension been steadily building between Carthage and the rapidly expanding Roman empire. The stakes would be of the highest possible order, nothing short of the unchallenged domination of the known "civilized world". Panic gripped Rome at the approach of Hannibal, who had already defeated two Roman armies sent against him, at the battles of Trebia in 218 BC

and of Lake Trasimene in 217 BC. In response to this critical situation the Roman senate managed to raise an astounding 90,000 troops to meet Hannibal in battle. To lead this immense army, the largest in history, would be no less than the two Consuls of the republic for that year, Gaius Terentius Varro and Lucius Aemilius Paullus. The subsequent battle at Cannae would be fought on an unprecedented scale.

Although Rome was led by its two most powerful citizens, they were not, unlike Hannibal, professional generals and herein lay a fatal weakness in the greatest army Rome had ever assembled. The battle took place on the 2nd of August. The two armies faced off against each other near the Aufidus River, not far from Cannae. The Roman legions would fight the battle as it had always previously fought battles, by direct frontal assault, crushing the enemy by overwhelming force, determination and sheer endurance. But Hannibal would be more subtle. Not only brute force but cunning and careful strategy would be employed. As he was outnumbered sheer force and attrition would have decided in favour of Rome. But Hannibal was brilliant in his strategy, masterful in his planning. The bulk of the Roman strength lay in its centre. Hannibal concentrated his on the flanks, weakening his own centre. To entice the Romans, he opened the battle by advancing his centre towards them, the “challenge” of which provoked an explosive response from the Roman centre, unused to not taking the initiative in battle. Thousands of Carthaginians were quickly cut down. Their centre began to give way. The legions, sensing an unexpectedly easy victory surged forward. Hannibal responded by a swift - but supremely controlled - “retreat”. The rapidly rising Roman hubris, sensing an easy breakthrough, resulted in an almost uncontrollable blood lust, which saw them pursue the retreating Carthaginian centre at an ever frenetic rate. Their tight formations began to break up into a barely controllable mob in pursuit of the “fleeing” enemy. As they reached deeply into the Carthaginian centre, Hannibal grasped his window of opportunity and unleashed his cavalry flanks to each side of the now undisciplined Roman mass. A mass which the consuls seemed to have lost control of.

One of the great tenets of warfare is that “God is on the side of the big battalions”. This alone should have assured a Roman victory. There are however some more subtle tenets of warfare, a prime example of which includes, “that to be completely surrounded is not good!” As the Carthaginian center melted away Hannibal’s powerful cavalry streamed in from the sides like comets from the heavens, and enclosed the bulk of the Roman army. Furious attacks then came from three sides throwing the Romans into complete confusion. As they turned to face the threat from the rear, the decimated but still functional Carthaginian centre regrouped, and counter attacked again from the front, completing a huge encirclement of the legions. The loosened discipline of the legions now turned to blind panic as uncoordinated groups attempted to desperately hack their way out of the Carthaginian trap. But it was too late, the trap had already been sprung. Hannibal by this time had lost an estimated ten per cent of his forces, but this would be little compared to the appalling slaughter of the Romans that followed. Ancient sources vary in their estimates of Roman dead. Livy wrote, “...It is said that 45,500 foot soldiers and 2,700 horsemen were slain in almost equal proportion of citizens and allies”. Polybius thought the figure was far higher, more like 70,000! Either way such concentrated slaughter in battle on this kind of scale would not be seen again until the industrialized killing of the First World War. Rome for the first time in over 500 years, was on its knees.

The news of the defeat at Cannae was met with incredulous silence broken only by muted gasps by the Roman senate, most of whom had lost relatives in the battle. The Consul Lucius Aemilius Paullus himself had been killed, (the other Consul, Varro, being one of the few to have escaped, but was now completely discredited). All Italy now submitted to Hannibal. But history records that Rome remained magnificently defiant. It would survive the calamity of Cannae! The reason for this lay partly in Roman manpower and partly in its supreme engineering. Rome was protected by magnificent walls. As brilliant a general as Hannibal was, he lacked the technology or the knowledge of siege warfare. The Romans without an army to oppose Hannibal simply locked themselves up within their walls. Hannibal was never able to breach them. For the next 14 long years, Hannibal virtually ruled Italy, while the citizens of Rome were tenuously supplied by their Mediterranean fleet. Hannibal's army over the years lost its strength and will to continue with the ongoing stalemate. By continuing small but constant attacks the Romans were able to wear Hannibal down by sheer weight of the manpower at their disposal. Eventually they would defeat a shadow of his original army at the battle of Zama in 202 B.C, and Hannibal would retire back to Carthage.

The battle of Cannae became an icon for the use of careful strategy in war as opposed to sheer overwhelming strength of numbers. The battle has been studied by generals throughout history, right up to General Norman Schwarzkopf (a great admirer of Hannibal) in the First Gulf War of 1991. Hannibal passed into legend, if not as the ultimate conqueror of Rome, then at least as its temporary subduer. He used mighty beasts in his army and as Turner depicted, even overcame nature itself in his crossing of the Alps in the midst of a snowstorm. Hannibal taught countless future military strategists that there is a time for retreat and there is a time for attack, and the timing of these will be crucial. At Cannae he chose an "ignominious" retreat of his centre, but this only to enable the setting of an deadly trap. Only when the time was right - he attacked with devastating results for Rome. In battle the Romans were nothing if not quick learners of harsh lessons. Much chastened they completely changed their strategy against Hannibal - they patiently bided their time until the time was completely right, 14 years later - at the battle of Zama in 202 B.C. Two generations after this, Rome would finally defeat Carthage in 146 B.C in the Third Punic War, under, Scipio Africanus the Younger, the grandson of the consul Lucius Aemilius Paullus, who was killed at Cannae. The Romans had long memories. The Carthaginian Empire was erased from the face of the Earth, and disappears from the historical record after this time. But Hannibal had taught Rome the meaning of fear. It was said that the old Roman republic had ever only feared two people, Hannibal, and Cleopatra.

When we are confronted with patients who present with probable septic arthritis, we need keep in mind the tactics of the great Carthaginian general. There will be a time to withdraw and a time to attack! And we must be careful to choose the right time. Initially we must avoid the temptation of an all out direct assault by giving IV antibiotics before samples have been taken and joint washout has occurred. On the other hand, if the patient is at significant life threatening risk, antibiotics must then become the most urgent priority - and the attack must occur without undue delay - it will all be a matter of careful strategic timing!

SEPTIC ARTHRITIS

Introduction

Septic arthritis refers to infection in a joint; it is usually caused by **bacteria** but can on occasions be caused by fungi or mycobacteria.

This is an important condition, as delay or inadequate treatment can lead to permanent joint damage and disability.

In all suspected cases there should be urgent consultation with the Orthopedic Unit.

Antibiotics are generally withheld in the first instance, as it is desirable to collect material for microbiological examination prior to their administration, unless there is an associated potentially life-threatening condition, in which case timely antibiotics must take preference.

Pathophysiology

Sites

In adults, the commonest joint involved is the knee joint.

In children the commonest joint involved is the hip joint

Organisms

1. **Staphylococcus aureus, (including MRSA)** is the commonest cause.
2. Streptococci
3. Streptococcus pneumoniae

Less commonly:

4. Neisseria gonorrhoeae, in sexually active adults.
5. Pseudomonas and other gram negative organisms:
 - Septic arthritis due to gram-negative bacilli is generally observed in the setting of trauma, intravenous drug users, neonates, elderly, and in association with underlying immunosuppression.

Mycobacterial and **fungal arthritis** are much less common than bacterial arthritis; they occur more frequently in the context of HIV. An **indolent monoarthritis** is often the only symptom, and synovial membrane histopathology and culture are frequently required to establish the diagnosis.

Predisposing factors:

Predisposing factors include:

1. Joint prostheses
2. IV drug use.
3. Trauma:
 - Particularly penetrating into a joint space.
 - Recent joint surgery.
4. Intra-articular injection of steroids.
5. Hematogenous spread from another site such as:
 - Adjacent tissues, (skin).
 - Infected heart valves:
 - ♥ In some cases, bacterial arthritis is the **presenting sign of infective endocarditis.**

This is most likely to occur in patients who use injection drugs.

Endocarditis should also be suspected when septic arthritis due to **Staphylococcus aureus, enterococci, or streptococci** occurs in a patient *without an obvious predisposing cause.*
6. Patients with chronic diseases affecting the joints:

Bacteremia is more likely to localize in a joint with pre-existing arthritis, particularly if associated with synovitis, particularly in cases of:

 - SLE
 - Rheumatoid arthritis
7. Immunological depression in general, including:
 - HIV
 - Immunosuppressive drugs
 - Diabetes

- Alcoholism.
8. Age extremes:
- Neonates
 - Age > 80 years.

Combinations of these independent risk factors substantially increase the overall risk.

Complications

Complications include:

1. Rapid joint destruction in cases of bacterial septic arthritis, especially if not recognized early.
2. Osteomyelitis of adjacent bone.
3. Septicemia.

Clinical Features

1. There may be systemic “constitutional” disturbance, but absence of these does not rule out the diagnosis.
 - Fever:
 - ♥ Older adult patients with septic arthritis are less likely to present with fever.
 - Nausea/ anorexia
 - Myalgias
 - Rigors
2. Pain:

This is:

 - Acute in onset.
 - Usually severe
 - Exacerbated by any movement:
 - ♥ Restricted movements (active or passive) may be seen.

Note however that a moveable joint does *not* exclude septic arthritis, (this in fact is one of the “28 golden ID Rules”!)

3. Antalgic gait or an inability to weight bear when joints of the lower limb are involved.
4. Evidence of an inflamed joint:
 - Warm
 - Severe tenderness, especially along joint lines.
 - Swelling / joint effusion *may* be seen:
 - ♥ In the **hip joint**, the leg may be held in flexion and external rotation, usually *without* evidence of warmth or swelling or erythema.
 - Erythematous.
 - ♥ Note however that this is *uncommon*. This is more characteristic of overlying skin cellulitis or bursitis, (**see separate guidelines for bursitis**).
5. Children:
 - In infants or young children **refusal to use a limb** or **to weight bear** may be the presenting complaint.
6. There may be evidence of an associated skin, urinary tract, or respiratory infection, which should provide a clue to the likely infecting organism.
7. Polyarticular involvement:
 - Most cases involve one joint only, however oligoarticular or polyarticular infection can occasionally occur, with involvement of 2-3 joints.

Polyarticular septic arthritis is most likely to occur in patients with rheumatoid arthritis or other systemic connective tissue disease and in patients with overwhelming sepsis.

Investigations

Blood tests:

1. FBE:
 - Elevated WCC

2. CRP:
 - The sensitivity of C-reactive protein level rate) in septic arthritis has been estimated to be around 92 %.
3. U&Es/glucose
4. Blood cultures must be taken **prior** to the administration of any antibiotics.

Plain Radiography:

Findings may be **normal**.

Look for soft tissue swelling around the joint, widening of the joint space, and displacement of tissue planes.

In later stages of progression, look for bony erosions and joint space narrowing.

Plain x-rays may also be useful in ruling out alternative diagnoses, (such as slipped upper femoral epiphysis, fractures or tumors).

Ultrasound:

This study is sensitive in detecting joint effusions generated by septic arthritis.

Ultrasound may help to differentiate septic arthritis from other conditions such as soft tissue abscesses or tenosynovitis.

It is also useful in some cases for guiding joint aspiration, especially of the hip.

Bone scan:

This study may be helpful to differentiate osteomyelitis from septic arthritis.

CT/MRI:

These modalities may sometimes be useful for imaging less accessible joints, such as the hip or sacroiliac joints).

Joint aspiration

This is the *definitive* investigation.

The **knee joint** is the most readily aspirated joint and may be done in the ED under **strict aseptic conditions**, (see separate document).

If synovial fluid cannot be readily obtained with closed needle aspiration, the joint may be aspirated under the guidance of:

- Computed tomography (CT)
- Fluoroscopy
- Ultrasound

Certain joints, such as the **hip** or **sacroiliac** joint, are difficult to access and may require **surgical arthrotomy** for diagnostic aspiration.

In general terms:

Diagnosis / fluid type	Macroscopic appearance	WCC ($10^6/L$)	% Polymorphs
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	Turbid to purulent	> 50,000	> 70 %

It should be noted however, that there is considerable overlap and this table only provides a rough guide; 10-20% of clinically diagnosed bacterial arthritis is not confirmed on synovial fluid analysis.²

The likelihood of septic arthritis increases with rising synovial fluid leukocyte count, especially above 50,000 ($10^6/L$).

There should be close liaison with the pathology laboratory, regarding any specific sample collecting kits, as well as communication concerning the urgency of investigation.

Arthroscopic joint washout

This may also be an option on occasions, when clinical suspicion is high, and there is no significant delay to theater.

Direct arthroscopic washout and tissue biopsy sampling represents the ideal modality for investigation, (which will also enable initial treatment via the washout).

Management

1. Analgesia, as required:

- Pain is often severe and opioids may be required.

2. Antibiotics:

The exact timing of the administration of antibiotics in cases of suspected septic arthritis, as for cases of suspected osteomyelitis, can be problematic. It is important to obtain a joint aspirate for micro and culture testing before antibiotics are commenced.

It is also important not to delay treatment for any longer than is necessary.

The knee joint is readily aspirated in adults in most cases, but other joints much less so. Where the joint is not easily aspiratable or in children antibiotics should be withheld until orthopedic review has occurred.

In certain cases empiric antibiotics may need to be given even before an aspirate has been taken. Examples include:

- The patient appears very unwell, (septic shock)
- The patient has significant underlying immunocompromise, (such as **febrile neutropenia** or recent chemotherapy)
- There is a suspicion of meningococcus infection that is disseminated.

Empiric antibiotic therapy:

Following the collection of microbiological samples, in general terms use:

- **Flucloxacillin.**
- **Vancomycin:**
 - ♥ For those at risk of MRSA (e.g. recently hospitalised, certain community groups at risk of MRSA).
- **Cefotaxime:**

Should be **added** for children less than 5 years not immunized against *Haemophilus Influenzae type B*, or if gram negative sepsis is suspected.

For patients allergic to penicillin, **clindamycin** or **lincomycin** or vancomycin may be used.

IV antibiotic treatment will be required for **at least 14 days** in uncomplicated cases, and oral antibiotics continued for **4-6 weeks**.

See latest Antibiotic Therapeutic Guidelines for full prescribing details.

Expert Infectious Diseases Specialist consultation should be sought in any cases of uncertainty.

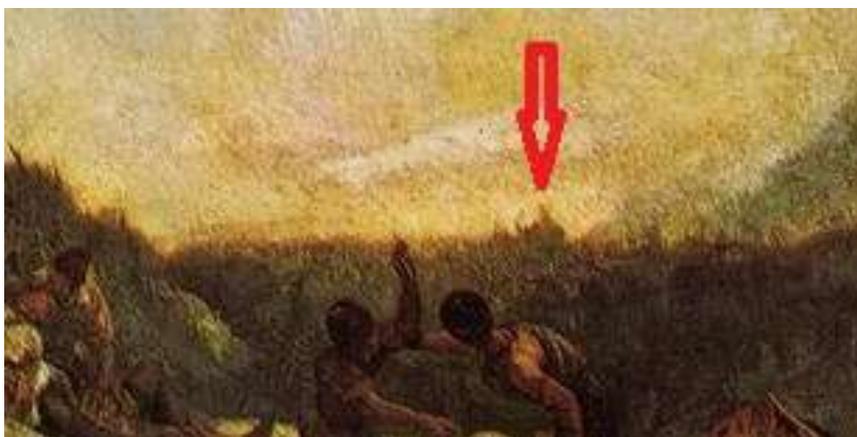
3. Surgical drainage:

- **Surgical drainage, debridement and washout are the cornerstones of treatment of septic arthritis.**
- Joint washout facilitates diffusion of antibiotic into the joint and may also protect the articular surface. Often this can be done **arthroscopically**.
- Sequestra, dead bone or foreign material require surgical removal in chronic infection, or in acute infection which fails to resolve.



Hannibal Barca counting the rings of Roman soldiers killed at the Battle of Cannae (216 BC), in marble, Sébastien Slodtz, 1704. Musée du Louvre.

In Slodtz's marble masterpiece we see the victorious Carthaginian general Hannibal, holding a captured Roman standard upside down (a poignant symbol of Roman defeat), crushing the Imperial Eagle beneath it. To his left is a great urn containing thousands of gold, silver and bronze rings taken from the elite of the Roman dead.



Turner's depiction of Hannibal

References

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