SELF ASSESSMENT IN TRAUMA & ORTHOPAEDICS II

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Case 1

As a Regimental Medical Officer to an Infantry Battalion you are seeing your first patient of the day. The soldier concerned has recently joined the unit and during platoon PT has 'gone over on his ankle'. Following appropriate assessment in the local Emergency Department, he has been given a compression bandage and some anti-inflammatories. His platoon sergeant is keen that you see him in order that he is 'fit for the JNCO cadre' starting the following week.

Describe the incidence and mechanism of ankle sprain.

Ankle injuries are a common reason for attendance at the Emergency Department and account for 10% of sporting injuries overall. Of such injuries to the ankle, 80% are sprains and it has been reported that in the United Kingdom these injuries are seen in Emergency departments at a rate of 5.27/1000 person years [1]. Ankle sprains occur in a common anatomical pattern with the foot generally held in plantar flexion, supination and inversion with 90% of injury affecting the lateral ligamentous complex. This injury pattern is most commonly seen in sporting activities involving jumping, sidestepping and is obviously exacerbated by movement over uneven terrain at speed or in poor light.

Describe the applied anatomy of the ankle with regard to stability of the lateral aspect of the ankle joint.

The lateral aspect of the ankle joint is supported by both static and dynamic restraints. Static support is derived from the bones and ligaments with more dynamic joint support derived from the peroneal tendons. The bony architecture of the mortice contributes around 30% of the inherent stability of the joint with the soft tissues (both dynamic and static) accounting for 70%. It is important to note that the most stable position of the talus within the ankle mortice is during full dorsiflexion, whilst in plantar flexion (as described above, a significant element of the position of the foot during ankle sprain) the narrowest part of the talus is engaged within the mortice and hence this is the position of **least** bony stability.

Lateral Ligaments

The **anterior talofibular ligament (ATFL)**, **calcaneofibular ligament (CFL)**, and **posterior talofibular ligament (PTFL)** all contribute to alleviate anterior drawer stress in the non-axially loaded ankle, as well as adduction stresses (Figure 1) in the plantar flexed, neutral, and dorsi flexed ankle/subtalar complex.

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Figure 1. Talar tilting during radiographic screening.

The ligaments are not as bulky or as strong laterally as they are medially.

The ATFL runs anteriorly from the anterior margin of the fibula to the lateral talus just in front of the articular surface. This ligament is intracapsular, is a condensation of capsular fibres and is the main restraining ligament of the ankle. The CFL is a strong band of collagen that originates on the inferior surface of the tip of the fibula and extends posteriorly and inferiorly until it attaches to a tubercle on the calcaneus; however, its true anatomic orientation is variable. The PTFL runs from the posterior surface of the lateral malleolus to the posterior aspect of the talus just lateral to the groove for the flexor hallucis longus tendon. The ATFL is the most commonly injured ligament during ankle sprain [2] and may be injured in isolation or in combination with the other ligaments making up the lateral ligamentous complex.

Describe the classification, immediate and continuing management of the serviceman with ankle sprain.

A number of classification systems have been described for ankle sprain and there have been numerous modifications of these [3]. A summary can be seen in Box 1.

It is important to ensure that these injuries are managed robustly due to their potential physical and career morbidity and efficiently due to their high incidence within this population. It has been shown that acute examination has a low sensitivity and specificity and hence delayed (5-6 days later) assessment is of value [4]. These patients should therefore be brought back for further assessment.

It is important to reassess the mechanism of the insult to the joint, especially with regard to index or recurrent injury, prior intervention and associated prior or current lower limb injury. A consideration of the differential diagnoses in this situation is important and assessment of the peroneal tendons, Achilles tendon, proximal fibula and base of fifth metatarsal is useful in light of missed injuries in the acute stage. A low threshold for radiographs of the standing foot, ankle and knee in two planes is essential if any concerns arise out of the delayed assessment.

Grade I A 'mild' ankle sprain involving a stretch of the ligaments, no macroscopic tear, little swelling or tenderness. Minimal functional impairment is seen with these injuries and joint instability does not feature.

Grade II 'Moderate' sprains associated with partial tears of the lateral ligamentous complex, most commonly seen with ATFL insult. Point tenderness, especially over the distribution of the ATFL, localised swelling and bruising may feature. Some ligamentous instability may be evident.

Grade III 'Severe' sprains, associated with complete ligament rupture (most commonly a combination of ATF & CFL). Marked, widespread swelling and bruising may feature, ankle function is minimal and the ankle is found to be unstable.

Box 1. Grading of ankle sprain.

During delayed assessment, an anterior drawer test may be performed by stabilizing the distal tibia anteriorly with one hand and pulling the slightly plantar flexed foot forward with the other hand cupped behind the heel. A tear of the ATFL is associated with a greater than 5mm anterior translation. Similarly a combined CFL and ATFL injury can be assessed when performing a talar tilt by stabilizing the distal tibia with one hand and inverting the talus and calcaneus as a single entity with the other hand. Again, greater than 5mm movement with a soft endpoint is suggestive of a combined injury. A positive anterior drawer test has been shown to have a high specificity and moderate sensitivity and inter-observer agreement for ligament rupture [4].

Treatment of acute ankle sprains involves a phased functional management:

- Phase I Rest, Ice, Compression and Elevation (RICE). Commence range of movement exercises and Achilles tendon stretching. Anti-inflammatories, unless contra-indicated, and protected weight bearing with crutches are also included in early care.
- Phase II A short period of immobilization (not in plaster cast) and protection. Bracing allows for an element of support and the ability to rehabilitate the ankle and return to training in a graded fashion [5].
- Phase III Active range of movement exercises, weight bearing, proprioceptive re-education and peroneal muscle strengthening.

Although there is evidence to suggest in the acute stage that early surgical intervention may lead to lower long term instability [6,7], overall systematic meta-analyses have concluded that the evidence base is weak [8] and that acute surgical intervention does not convincingly confer improved prognosis compared with the above non-operative strategy.

It can be seen that these injuries need to be comprehensively addressed. Repeated evaluation and assessment of progress is important and early, close liaison with the rehabilitation services is essential. Recovery period from an ankle sprain may be lengthy and servicemen need to be appropriately protected to allow for ultimate return to full fitness. The attitude of 'strap the boot up tight and crack on' may result in considerable late complications in terms of degenerate disease and career ending instability and pain.

Case 2

A retired Brigadier is your last patient of the day. Whilst discussing his anti-hypertensive prescription, he wonders if you could advise him on how best to proceed with his 'dodgy ankle'. He has spent some time on the internet whilst waiting for referral to a specialist and is confused with the management options for ankle arthritis. Looking at his notes you can see that he is 64, relatively fit and well and has had a number of 'knocks to his ankle' including a fracture at some point as a junior officer. He has had imaging, is awaiting referral to a foot & ankle surgeon and has advanced osteoarthritis at the ankle joint.

What is the aetiology of ankle arthritis?

Idiopathic arthritis of the ankle is uncommon compared with the hip or knee and has rates of around nine times lower than these larger joints. Post-traumatic arthritis is the most common cause of ankle degenerative disease. Other lesser causes include chronic ligamentous instability, sepsis, inflammatory arthritis, crystalline and neuropathic arthropathy.

Post-traumatic arthritis

This causes over 50% of cases of ankle arthritis. The degree of arthritis correlates with fracture type, degree of cartilage injury and the level of incongruity of the articular surfaces. Arthritis follows 14% of all malleolar fractures, with Weber C and tri-malleolar fractures having rates of around 30%. The maintenance of fibular length and anatomical reduction of the posterior malleolar fragment improve outcome.

Syndesmotic injury and especially those not recognised intra-operatively are associated with increased rates of arthritis. This is apparent when it is remembered that an increase in syndesmotic widening of >1mm will increase peak contact cartilage pressures by 50%. Talar fractures, although much less common than those discussed above are responsible for a disproportionately high level of post-traumatic arthritis. If fractured these lesions have a high rate of avascular necrosis due to the tenuous blood supply and high proportion of bone to cartilage ratio. Interestingly osteochondral lesions of the talus may cause considerable discomfort, but do not typically lead to severe arthritis [9].

The Biology of Articular Cartilage

The ankle bears the highest load per surface area of any joint in the body, bearing around 5 times body weight on walking. This load passes through a surface area of only 350mm^2 although despite this disproportionate load bearing area compared with the more proximal joints, the thickness of the cartilage is only 1 – 1.7mm. In order to cope with the application of such high loads the ankle relies on its strict biomechanical congruency and uniform cartilage and if this relationship is lost either through loss of congruency or decreasing joint space the pressures rise rapidly leading to a speedy onset of arthritis.

How could you manage his early diagnostic work up?

As with the larger joints, a complete history is essential to the diagnosis of ankle disease. Points to address include:

- Age, occupation, previous and current mobility
- Past sporting activities
- Past medical and surgical history with special regard to peripheral vascular disease, thromboembolism and diabetes
- Past or concurrent inflammatory conditions
- Current medications and tobacco use
- Previous treatments including lifestyle modification, orthotic use, injection and operative procedures

Ankle arthritis commonly presents with pain and decreased joint motion, primarily related to the anterior aspect of the joint. The nature of pain should be further investigated in relation to:

- Weight bearing
- Walking – especially on uneven ground
- Resting
- Stiffness and swelling
- Morning or 'start up' pain
- Ability to sleep

Examination
A complete examination should include gait analysis, inspection, palpation, neurovascular evaluation, active and passive range of movement, strength testing and assessment of ligamentous stability.

Imaging
Standard weight-bearing AP, lateral and mortice view plain x rays are required. Further imaging including CT or MRI scanning may be required in cases that present atypically.

What are the treatment options available to him?

Diagnostic Injections
These are useful when doubts exist regarding the origin of the patient's pain. Evaluation of the impact of instillation of local anaesthesia under aseptic technique and using fluoroscopic control is valuable in establishing ankle joint involvement and eliminating subtalar and talo-navicular disease as causes of pain.

Non-operative Measures
When the clinician is faced with a patient for whom anaesthesia is risky or if a patient is reluctant to consider the extent of post-operative immobilization for instance following fusion surgery; the non-surgical options become extremely valuable.

As with all degenerative joint disease, simple lifestyle changes and improved analgesia and anti-inflammatory provision may be all that is required for a number of patients. Exercise modification and weight loss may also be of considerable benefit. Ambulatory aids and bracing/orthotics must be considered. These measures although not providing a cure, will offer an element of pain control and may result in surgical intervention becoming delayed or not required at all. 'Nutraceuticals' such as glucosamine and chondroitin are being increasingly used by patients presenting with osteoarthritis. Although the evidence base on their use is in its infancy [10] and the majority of the work has been carried out in knee arthritis, there are early suggestions that they may have a beneficial role in ankle degeneration.

Orthotics
An orthotic is an externally applied device used to modify the structural or functional characteristics of the neuromusculoskeletal system. These devices may be sub-divided into those which are pre-fabricated 'off the shelf' and those which are custom made.

With regard to supporting the arthritic ankle, bracing with orthotics is a valuable adjunct in both a diagnostic and definitive management scenario. Options include simple measures as adjusting footwear, lightweight splints and custom made ankle and foot orthoses.

It is important to establish what it is exactly that you would like your prescribed orthosis to achieve prior to discussion with the orthotic team. Bracing a joint that exhibits pain during movement only has a good chance of gaining a more tolerable symptom profile than a similar brace in an ankle causing rest pain. The ankle may be braced by an Aircast device, affording a decreased range of movement, controlling the subtalar joint whilst affording increased proprioception and decreased instability. Alternatively, a rocker in the shoe may be used to decrease the bending moment on the joint during the gait cycle.

These are valuable measures that may provide the symptom relief required and delay or negate the need for surgical intervention altogether.

Surgical Options
The decision to proceed to surgical intervention is made following discussion with the patient regarding the presumed benefits of operative and non-operative measures and takes into account both the clinicians skill base and the patient's wishes.

Cheilectomy
Anterior ankle joint debridement is an option particularly in the early stages of degenerative disease and also in those with impingement type symptoms at an earlier age. Osteophytes may be visualised on the anterior aspect of the distal tibia and the dorsal aspect of the talus. The most important feature is that this procedure should be reserved for the young or minimally degenerate joint eg isolated anterior disease.

Arthrodesis
Fusion of the ankle remains the gold standard for the treatment of advanced degenerative joint disease that has not responded to conservative measures [9]. The goal of fusion surgery is to provide a stable, painless plantigrade ankle. It is essential that prior to embarking on fusion surgery that the clinician is certain that the symptom profile is resultant from ankle disease. The subtalar complex must be examined and imaged and if any doubt exists, selective injection is recommended. The theoretical basis of fusion is simple in that it requires a large bed of bleeding cancellous bone across which interfragmentary compression is maintained by a form of internal fixation.

The alteration in the biomechanics of the lower limb following fusion surgery are important and it is essential that these are communicated to patients. Whilst successful fusion will result in a painless ankle joint, the other foot joints, knee, hip and lower back are all recruited into absorbing increased stresses and may suffer accelerated degeneration as a result.

Approach to the joint may be either arthroscopic, open via trans-fibular or anterior incision or mini-arthrotomy. The choice of approach is determined by a combination of surgical experience, associated deformity and pre-existing scarring.

With regard to internal fixation, options include plates and screws, Steinmann pins and cannulated compression screws. Another option is to use external fixation in the guise of an ilizarov frame. This method has been described both for primary and salvage ankle fusion but as with the other methods, there is no level one evidence to compare modern external to internal ankle arthrodesis

Overall, it is seen that arthroscopic ankle fusion is associated with a faster fusion rate, less intraoperative blood loss and a shorter hospital stay [9]. As techniques improve the minimally invasive approach of arthroscopic fusion with its demonstrated high fusion rates with minimal complications [11] is becoming more widely used. It is increasingly recommended for those ankles at the more moderate end of the degenerative spectrum and indeed a number of studies reflect this. There is no level one evidence regarding either screw placement or comparison of arthroscopic or open fixation.

Complications of arthrodesis are primarily non-union, mal-union and infection. The rate of non-union is generally less than 10% although rates of up to 40% are reported. The rate of revision of arthrodesis is 9% and the majority of these cases (65%) are revised for non-union [12]. Risk factors identified with non-union are smoking, non-compliance with non-weight bearing and diabetes. Non-union may present predictably on imaging or with the patient complaining of persisting pain. It is important in the non-united fusion that an infective source is ruled out and this must be borne in mind during investigation of these patients.

Ankle Arthroplasty

Vying for contention with arthrodesis as the gold standard treatment for advanced ankle joint degeneration is the ankle replacement. Initially described and trialled in the 1970's, early results in the 1980's were encouraging, however with poor long term success of many implants [13] the use of and interest in arthroplasty for ankle arthritis waned.

With the evolution of implant design and the persisting desire for the benefits of retained ankle motion and hence improved gait dynamics associated with replacement versus fusion, total ankle replacement is still an option. More recently with improved implant design, results are encouraging however authors advise caution. Survival rates of the implants of 93% (5 years) and 80% (10 years) [14] have been reported and although these are increasingly acceptable, there is still a gulf between the longevity of these implants and the standard survival for hip and knee prostheses. We await long term follow up studies and there is to date no Randomized Controlled Trial comparing arthroplasty to arthrodesis.

All things considered with the new implant design, opting for Total Ankle Arthroplasty is essentially an acceptance of the possible complications with the aim to maximise the increased mobility which is impossible with a fusion.

Case 3

As an F2 in the Emergency Department of a local MDHU you encounter a 20 year old right hand dominant craftsman who fell whilst snowboarding. He complains of right wrist pain and currently is immobilised in a light weight splint. His radiographs are available for your review (Figure 2)

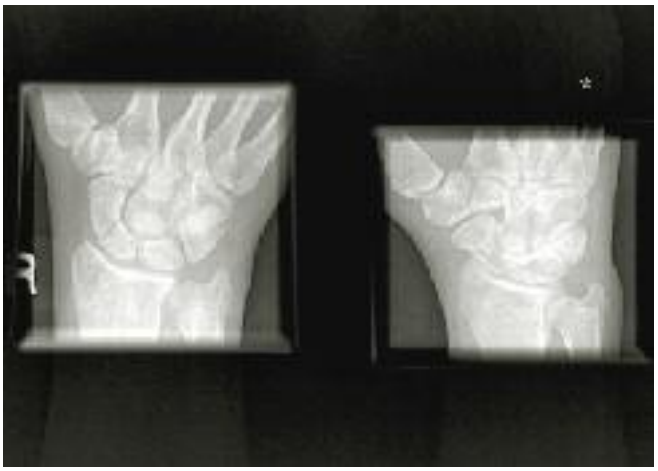

Figure 2. X-rays of the right wrist of the patient described in Scenario 3

Discuss the nature of the insult to the wrist, making reference to established fracture classification systems.

The scaphoid is the most commonly fractured carpal bone, accounting for 70% of carpal fractures and 11% of hand fractures. They generally result from a fall onto an outstretched hand forcing the wrist into dorsiflexion greater than 95° and greater than 10° of radial deviation. Scaphoid injury is often overlooked which when seen in the light of the significant morbidity associated with avascular necrosis and malunion of the scaphoid in terms of wrist instability and early arthritis, demonstrates the need for vigilance in diagnosis and early management.

Patients with scaphoid fracture commonly present with "wrist pain". There may be fullness in the anatomical snuff box resultant from effusion and pain on palpation in this region. Axial compression of the thumb may cause an exacerbation of pain at the wrist in the presence of a fracture. Diagnosis is augmented by radiographs of the wrist, allowing evaluation of the distal radius and scaphoid as well as focussed "scaphoid views".

The scaphoid may be described as having a proximal and distal pole, a tubercle and a waist. Around 80% of the bone is covered with articular cartilage and the scaphoid acts as an anchor for a number of wrist ligaments. Blood supply is derived from the scaphoid branches of the radial artery entering through the dorsal ridge. As the proximal pole of the bone is supplied from essentially the distal end in a retrograde manner, its blood supply is most tenuous. As the proximal pole thus relies on fracture healing for perfusion it is at risk of avascular necrosis following injury, especially with fracture displacement.

Classification of scaphoid fracture most simply and commonly is by the anatomical site of the fracture. In adults around 70% of these fractures occur in the waist region. Other classification systems include the Herbert Classification [15] in which fractures are termed A to D dependent on the location and stability of the fracture:

Type A: Stable acute fractures
Type B: Unstable acute fractures
Type C: Delayed union
Type D Established non-union

The type B fractures are most likely to go on to avascular necrosis, especially those involving the proximal pole.

Apart from the location of the fracture, displacement of the fragments is important. Criteria for classifying a fracture as displaced include 1mm displacement on any radiographic view, an angular displacement of greater than 10° or fracture comminution.

Discuss the management of scaphoid fractures, making reference to immobilisation and further investigation.

Whilst identifying the fracture, a full history regarding the injury and previous insults to the hand and wrist must be elicited. Hand dominance, occupation and sporting activities must be noted. Systemic enquiry is performed to identify concerns with fracture and wound healing. Non-union at the scaphoid, which ranges between 5-25%, has been shown to be related to smoking as well as fracture location and configuration. When considering management of the more common waist fractures as with this example, it is of paramount importance to establish the degree if any of fracture displacement.

Non-displaced waist fractures have been shown to have a high union rate [16] when treated with immobilization alone in a below elbow cast with the thumb left free [17] and the wrist in slight dorsiflexion for 8 weeks. Traditional concerns with prolonged immobilization with regard to decreased grip strength, stiffness and delayed return to work have been recently shown to be less of an issue than previously thought.

Advantages of surgical intervention however in this group are the ability to not immobilize the arm post-operatively and allowing an earlier return to work, sport [18] and military duty [19]. Although no consensus exists, a recommended approach to these fractures is immobilization in a below elbow cast with clinical and radiographic review at 8 weeks. Fractures with concern over healing may be further investigated with computed tomography and /or MRI and considered for fixation with or without bone grafting at this stage.

Discuss the options for management and the rationale for the options available for the definitive care of these fractures

Displaced or unstable fractures, such as in this case, elicit less debate than non-displaced fractures. Operative intervention is recommended, generally with percutaneous screw fixation (Figure 3).

Figure 3. Radiograph of a right wrist after screw fixation of a displaced scaphoid waist fracture.

The pitfall patient is one with wrist tenderness, a good mechanism and clinical suspicion of fracture, but with normal x rays. A review of the literature demonstrates that of those patients seen with a suspected scaphoid fracture, around half will have no scaphoid insult. Sensitivity of radiographs in identifying scaphoid fracture is variously reported between 60-80%. Scaphoid fracture is hence seen in about 20% of patients with negative x rays [20]. In reality the prudent approach is to put them in plaster as described above for 2 weeks, bring them back to clinic and further evaluate their symptom profile and radiographs. To aid in the diagnosis of a patient with a history and examination suggestive of fracture in the face of apparently negative radiographs, Magnetic Resonance Imaging may be utilised. It has been shown that early MRI scanning of these patients, with films reported by radiographers, has a high sensitivity of fracture detection, thus preventing unnecessary immobilisation in many cases.

Case 4

In your sick parade, you are asked to see a 22 year old single male corporal with a painful knee. He cannot recall injuring himself, however he has been drinking heavily recently and so is unsure. He has recently returned from spending his post-tour leave in Bangkok.

Detail your management of the painful, swollen knee in this setting.

As with any individual presenting with an acutely painful joint, a prompt assessment of the patient and awareness of the differential diagnoses with a low threshold for emergency referral is essential. This soldier has septic arthritis until proven otherwise.

A thorough history is taken with regard to:

- Timing, onset and nature of the symptom profile
- Involvement of other joints
- Extra-articular, systemic symptoms especially with regard to the genitourinary, gastrointestinal and ophthalmic systems
- Previous articular symptoms and prior or concurrent injury to the joint including sepsis and gout
- Presence of fever
- History of a rash
- Foreign travel
- Recent sexual intercourse
- Intravenous drug misuse
- History of coagulopathy
- Prescribed and illicit drug use

Your differential diagnosis should include:

- Septic arthritis
- Crystalline arthropathy
- Reiter's Disease
- Spontaneous haemarthrosis
- Lyme disease
- Deep venous thrombosis
- Referred pain from the hip, abdomen or genitourinary system

On examination you should assess the patient with regard to general health, nutritional state and baseline observations are taken. A 'septic screen' should be applied to the examination with especial regard to the respiratory, cardiovascular, gastrointestinal and genitourinary systems. Capillary blood glucose is taken and urine is dipped for basic screening. It is important to note that all of this is done concurrent to examining the joints. It is essential that an overall appreciation is obtained in order not to miss vital information affecting the diagnosis. Brief assessment should be made of all the joints with regard to range of movement and swelling in order to distinguish between a mono and poly arthropathy.

With regard to the affected knee the 'look, feel and move' approach will allow appreciation of the nature of disability and soft tissue condition. The joint should be inspected always in comparison with the other (unaffected) side for skin changes, in particular erythema and skin lesions, both new and old. It is important to remember the extent of the bursae around the knee and hence scars or punctures around the distal femur and proximal tibia should be considered as potentially breaching the joint. The posterior of the knee must also be visualised. The attitude of the joint should be noted with regard to how the patient is lying / standing / holding on to the joint.

Swelling of the joint with regard to effusion can be visualised and felt on examination. At this instance, the temperature of the skin surrounding the knee may be compared to the other side. Localisation of painful focus to the extensor mechanism, joint lines or ligament distribution is of less relevance in the atraumatic, swollen knee as in these cases, more global pain of poor localisation is usually found. With regard to movement, it is as mentioned above, vital to see how the patient holds the knee at rest. The acute septic joint - which is the main focus of your differential in this instance – is associated with severe pain at even the slightest movement of the joint and the patient will frequently hold the joint in fixed flexion and will not allow you to move it. Any movement possible in terms of flexion and extension is noted.

Following your brief history and examination it transpired that this individual has had numerous dubious sexual encounters heavily under the influence of alcohol whilst abroad. He noticed some burning when he passed water some days ago but this has now settled. He has a family history of gout he thinks but denies any previous or current joint problems. He takes no medication. He has felt 'hot & shaky' and has vomited a couple of times. His back and his wrists have been aching and he thinks his wrists were swollen last week when he noticed a rash on his arms and legs. He is pyrexial, tachycardic and will not let you move his knee at all, which has an obvious effusion. You refer him to hospital. As the on call orthopaedic ST2 you are asked to see this patient who the RMO has correctly referred in with a working diagnosis of septic arthritis.

Outline your initial management

Having availed yourself of the history, obtained repeat observations and examined the patient, you agree with the presumed diagnosis. You obtain radiographs of the knee in two

planes, send urine for analysis and obtain blood samples to assess Full blood count, ESR, CRP and urate levels although it must be borne in mind that reliance on hyperuricaemia as a diagnostic entity in mono-arthritis is not recommended. Blood culture samples may be taken at this instance also. If concern exists regarding dehydration or coagulation status, these tests may be complemented with renal profile, liver function tests and clotting profile. Based on clinical findings and augmented by blood test results, aspiration of the joint is the next step in the diagnostic pathway. The nature of the fluid aspirated should be noted, sent for an urgent Gram stain, synovial white cell count and assessed for crystalline content.

It is important to understand that the laboratory tests for septic arthritis should not be relied upon in isolation to rule out a septic joint. Various studies have identified the sensitivity of gram stain as being between 40 -60%, however understandably is has a specificity of 100%. Similar figures are quoted for C Reactive protein which has been shown to have a greater sensitivity and specificity than Erythrocyte Sedimentation Rate. It is also important to remember that gram stain remarking on crystals present, does not exclude septic arthritis as sepsis and gout can present concurrently. These tests are diagnostic adjuncts and should be seen in the context of the history and examination findings.

The CRP is 172 mg/L, WBC is 14x10⁹ cells /L and the Gram stain is reported as negative for organisms although many white blood cells seen with scanty crystals. His repeat temperature is 38.7°c and his heart rate is 102bpm. His chest is clear and his abdomen is soft and pain free. Upper respiratory tract is similarly unremarkable.

Describe your further actions

This soldier is clearly unwell and is mounting a systemic inflammatory response to an infective focus. Although the gram stain may be negative for organisms, the clinical findings warrant emergency washout of the joint for which he should proceed urgently, under general anaesthesia, in an operating theatre. These cases must be washed out formally by a surgeon experienced in arthroscopy, with copious lavage. The most likely infective agent here is Neisseria gonorrhoeae.

Case 5

As the regimental medical officer, you are asked to see a 21 year old soldier who has recently returned from a winter sports adventure training expedition. She is in a brace and has the copy of a scan report detailing "a rupture of her ACL". She plays inter-service level rugby and is a keen alpine downhill skier. She has many well-informed questions.

What do the cruciate ligaments do?

The cruciate ligaments are two strong intracapsular (although extrasynovial) ligaments that cross each other within the knee joint cavity. They are named according to the position of their tibial attachments relative to each other and form the main bond between the femur and the tibia. Through mechanoreceptors within the ligament, they also provide proprioceptive feedback regarding knee tension to the central nervous system.

The anterior cruciate ligament (ACL) is attached to the anterior intercondylar region of the tibia, just medial to the anterior horn of the lateral meniscus. It passes backwards, upwards and laterally to attach to the posterior part of the medial surface of the lateral femoral condyle. It is composed of Type I collagen fibres, and its primary role is preventing anterior translation of the tibia on the femur although it does have a role in controlling varus and valgus (bending) forces around the joint. The ligament is actually composed of two bundles. The anteromedial bundle has been shown to lengthen during knee flexion and the posterolateral bundle is in maximum tension during full extension. It is important to note that due to the principle of isometry, one part of the ACL is taught throughout all knee movements in order to provide support throughout the functional range. At around 30° of flexion of the knee, the ACL is contributing almost 90 % of stability to the knee.

Figure 4. Magnetic Resonance Imaging of a knee with multiple ligament insult.

Rupture of the ACL requires a tremendous amount of force. The normal loading of the ligament in daily activity accounts for only around a quarter of its failure capacity. The two common biomechanical mechanisms of rupture described are a valgus force to the flexed knee with the leg in external rotation and knee hyperextension with the leg internally rotated. ACL ruptures are seen primarily in sporting injuries, and in particular in those sports involving jumping, twisting, 'cutting' or rapid changes in velocity. Skiing and rugby are both associated with anterior cruciate ligament rupture with soft tissue knee injuries accounting for up to a third of injuries sustained in these sports.

It must be remembered that the ACL is seldom injured in isolation and most commonly the medial meniscus is torn during an acute ligament rupture and this may have implications when considering management options. As a female the injury profile of ligament rupture is different to that seen with male athletes. The literature reveals that in many sports the rate of ACL rupture in greater for females than for males competing in the same activities [21]. Studies have shown that the rate of rupture is related to the menstrual cycle with recently published work demonstrating an increased risk of rupture during the ovulatory phase [22]. Other postulated reasons for the disparity in rupture rates between the sexes include features such as differing hamstring flexibility and laxity, as well as differences in the intercondylar notch orientation.

Does she need an operation?

In discussion of the management options available, as with all injuries, attention must be given to both operative and non-operative methods of treatment. The decision regarding which treatment path to follow is largely related to the individual's activity level and the risk of further injury to the knee and later degeneration of the joint if the activity is maintained with an

unstable knee. It is important to establish early that ligament rupture, especially when associated with concurrent meniscal damage is a significant injury and degeneration of the articular structures of the joint will occur in the future at a rate greater than the uninjured knee [23,24].

When advising a patient on the risks and benefits of ACL reconstruction it can therefore be seen that there are no absolute indications for best management. It should be made clear that injury to the ligament is serious and has significant implications for the long term function of the knee joint regardless of treatment choice. Opting for surgical intervention in no way guarantees a disease free joint and remaining ACL deficient also may have little if any impact on the basic activities of daily living.

It is important to appreciate the contribution of meniscal insult to the overall outcome. It is well known that meniscal injury may occur at the time of ACL rupture [25] and studies have shown correlations between meniscal damage and subsequent degenerative change in the joint [26].

The key factor -as with all aspects of practicing good medicine, is to take a thorough history and examination and have a low threshold for further investigation of suspected meniscal lesions. Magnetic Resonance Imaging to augment equivocal clinical findings and subsequent early arthroscopic meniscal repair is the ideal, with subsequent protective bracing and weight bearing, physiotherapy and further discussion regarding ACL reconstruction as appropriate.

The main feature to focus on in this case is two-fold. Firstly, with the level of activity that this patient pursues and a desire to return to pre-injury sporting level, surgical reconstruction of the stability of the joint by is the preferred option, on the understanding that the risks of long term damage to the joint are not obviated by surgery. Secondly and of paramount importance is compliance with physiotherapy. Both pre and post operative physiotherapy are essential to the success of the procedure. Rehabilitation of the joint is central to regaining function.

Can she continue sport and her job after surgery?

With regard to administration of the service individual following surgery, down grading P7L for three months, P3 for three months and consideration for P2 at the six month point if functionally normal. Consideration of return to skiing and contact sports at nine months to one year post reconstruction is realistic. These time frames however should be seen as an informative guide and are influenced heavily by an individual case basis with regard to progress with rehabilitation. In the same context, civilian individuals with a normally functioning knee eighteen months following reconstruction may be considered for a service career.

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