ORTHOPAEDICS

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INTRODUCTION

The term "orthopaedic" comes from a Greek root and refers to the curing or correction of deformities in children. It has come to be associated with all treatment for afflictions of the musculo-skeletal system. Orthopaedic surgeons are responsible for the management of patients from birth to the grave. There is a huge diversity of work performed by orthopaedic surgeons in the United Kingdom.

In general terms orthopaedic surgeons are responsible for the management of bone and soft tissue injury and for the management of orthopaedic disease both acute and chronic.

Many clinical negligence claims are directed against orthopaedic surgeons. This is because in general patients submit themselves for orthopaedic surgery for painful and disabling conditions but not with life threatening conditions. Patients may succumb to the effects of multiple trauma but cases of multiple trauma occur only very infrequently. Similarly the number of patients who present with potentially life threatening malignant disease is also very low. Many people however, suffer from relatively minor non-life threatening injuries and the expectation of a return to normal function is very high. Similarly patients presenting with non-fatal painful conditions of their joints expect to be able to return to all the activities they pursued before the condition developed. Unfortunately return to normal function cannot always be guaranteed and this often provokes a feeling of dissatisfaction.

Amongst all UK Independent sector surgical claims settled over the last 13 years, approximately 21% have related to orthopaedic procedures, and a similar proportion to obstetrics/gynaecology and plastic/reconstructive surgery respectively.

Approximately 16% of the orthopaedic claims result from spinal surgery. An almost equal number result from lower limb surgery. A further 13% (not counted in the lower limb figure) relate to total hip replacement.

In general terms there are three main areas in orthopaedic surgery which provoke claims for clinical negligence. These relate to errors of diagnosis, errors of treatment, and errors relating to consent. In general, trauma surgery and elective (non-trauma) surgery should be regarded as separate specialties.

TRAUMA

General

Patients suffering from trauma generally present initially to accident and emergency departments. For their initial assessment they are seen not by orthopaedic surgeons but by specialists in accident and emergency medicine. They are referred secondarily for orthopaedic care. The initial examination, assessment and diagnosis at the outset are therefore out of the control of the orthopaedic team.

Fractures

Errors of diagnosis

In most cases the diagnosis of a fracture is simple and straightforward. Patients typically present with a history of trauma and they complain of pain. Clinical examination reveals swelling of the part. There may or may not be a deformity, and clinical examination demonstrates local bony tenderness. There may be crepitus (a grating sensation) on movement of the limb. It is often relatively straight forward for the accident and emergency doctor to isolate the area of potential fracture and to arrange for the appropriate x-ray. In many cases, however, the diagnosis is less clear. The clinical signs of fracture may be equivocal and the x-rays may be difficult to read.

Unfortunately doctors in accident and emergency departments tend to be inexperienced. They have often not been qualified very long and they have very little clinical experience upon which to rely. Accident and emergency doctors need to understand the limitations of their own experience. The corner stones of good treatment and diagnosis are the taking and recording of an adequate history, and an appropriate and well recorded clinical examination**.**

The history should include a description of the events causing the injury and an analysis of whether the injury was high or low velocity. The examination should record the appearance of the limb, the presence or absence of swelling and deformity, and the presence or absence of local point bony tenderness. The doctor should also adequately examine and record whether the neurological function of the limb is intact and if the limb has adequate blood supply. The doctor should also record the x-ray appearances. If there is any doubt in the mind of the accident and emergency officer about the diagnosis, a further opinion should be sought, either from his supervisor, from a radiologist or from an appropriately qualified orthopaedic surgeon.

A typical example of an injury which may be difficult to diagnose is a fracture of the scaphoid bone.

Scaphoid fractures

The scaphoid is a small bone in the wrist. It lies at the base of the thumb and articulates proximally with the radius and distally with two other carpal bones, the trapezium and the trapezoid. It is frequently injured and has a relatively poor blood supply, particularly to the part adjacent to the radius.

Fractures of the scaphoid usually occur as a result of a fall on the outstretched hand. The fall may often be thought of by the patient as a very minor injury and the pain caused by the fall may be ignored. Many patients with fractured scaphoids do not present for several months.

When examined, patients with scaphoid fractures typically have tenderness in the area known as the anatomical snuff box which lies on the radial side of the wrist. The anatomical snuff box is bounded by the tendons which radiate towards the thumb. Tenderness in the anatomical snuff box is highly suggestive of a fractured scaphoid. Tenderness over the tubercle of the scaphoid situated on the front of the wrist may also be found in cases of scaphoid fracture.

Unfortunately, not all patients with injuries to the scaphoid present with the typical signs. Tenderness may be diffuse and by no means localised. The degree of tenderness may be extremely mild.

This can result in the patient being reassured that they have merely suffered a sprain, and therefore being offered no diagnostic test.

There is a standard series of x-rays to visualise the scaphoid bone. Signs of scaphoid fracture however can be extremely subtle, and fractures may either be missed or thought to exist when in fact the x-ray is normal.

Patients may therefore be under-treated if the fracture is not recognised, or they may be over-treated for a non-existent fracture. Both scenarios have the potential to cause frustration for the patient.

Problems are compounded by the variable natural history of scaphoid fractures. Undisplaced scaphoid fractures will in the majority of cases heal by immobilisation in plaster although immobilisation may in some cases be necessary for up to 12 weeks and occasionally longer. Displaced scaphoid fractures heal with less certainty. Inevitably therefore, some fractures of the scaphoid fail to heal as expected, thus prompting the need for surgical intervention. Surgical intervention usually involves some form of internal fixation together with a bone graft. Even then predicting the eventual outcome can be very difficult. The literature indicates that the outcome for an undisplaced scaphoid fracture is usually satisfactory provided the diagnosis is made within four weeks of the injury. It is not therefore necessary to immobilise every suspected scaphoid fracture in a plaster cast. It is however, important that accident and emergency officers recognise the possibility of a scaphoid fracture even if the x-ray findings are equivocal. There should therefore be an appropriate safety net, and all patients

with suspected scaphoid fractures should be asked to return either to an accident and emergency review clinic or to a fracture clinic for clinical assessment and if necessary repeat x-ray. If repeat x-rays remain equivocal, further diagnostic tests should be undertaken in the form of either a radio isotope bone scan, CT, or an MRI scan.

Other fractures

Other fractures which can be difficult to diagnose include those of other wrist bones and the equivalent bones in the ankle. Fractures of the vertebrae are often extremely difficult to diagnose radiologically, particularly by inexperienced practitioners. Odontoid peg fractures of the second cervical vertebra and potentially unstable fractures of the spine not associated with spinal cord injury are frequently under-diagnosed at the outset. If there is any doubt at all about these injuries the involvement of more experienced practitioners is essential. Fractures at the ends of long bones in the epiphyseal and metaphyseal areas can also be difficult to diagnose both clinically and radiologically.

Soft Tissue Injury

Soft tissue injuries include any injuries to parts of the musculo-skeletal system not including bones. They comprise ligament injuries to joints, including dislocations, tendon injuries to the hand and feet, and soft tissue contusions.

Tendon injury

Missed tendon injuries –particularly in the hand - are a fertile source of clinical negligence claims. Flexor tendons can be injured as a result of open wounds, but closed injuries to flexor tendons can also occur in some cases. A typical example occurs amongst rugby players. A player grabs the jersey of an opponent in his clenched fist. His hand is prised away and he suffers a forced extension injury to a flexed digit. This can cause rupture of one of the long flexor tendons where it attaches to the bone. Early treatment for this type of injury will result in near normal function in most cases. If the injury is missed, however, the outcome of treatment is far less certain and residual disability is quite common. Once again the taking and recording of an adequate history, the recording of an adequate examination and a second opinion if necessary are essential if the injury is not to be overlooked.

Open injuries to the flexor tendons are more common. Injuries from knives or glass are the most frequent causes of flexor tendon damage. Unfortunately, flexor tendon injuries often occur late at night and alcohol may be a barrier to clinical assessment. Once again the accident and emergency officer should have the possibility of flexor tendon injury high on his list of diagnostic possibilities.

In some cases, however, injuries to flexor tendons can be incomplete: in other words the tendon is not completely severed. Function at the outset may appear to be relatively normal. This should not lull the doctor into a false sense of security.

A tendon which is lacerated through 80 or 90% of its thickness may eventually give way altogether, making surgical treatment far more complicated. Early referral to the hand specialist is therefore essential if normal function is to be preserved.

Referral to the surgeon does not occur until the patient has been clinically assessed by the accident and emergency doctor. If the injury is missed by the accident and emergency doctor there is not very much that the specialist surgeon can do about it other than advise and treat the patient accordingly. There is, however, a safety net for accident and emergency doctors in that all hospitals with accident and emergency departments have fracture clinics where patients can be seen within a few hours of the injury. In the overwhelming majority of cases if the injury is diagnosed within a relatively short period of time, no harm will follow. If the patient is discharged, then of course the safety net is missed and permanent damage may ensue. The concept of the safety net is therefore very important in minimising the risk of missed diagnosis and neglected care.

Penetrating injuries

Penetrating injuries from glass or other sharp objects are extremely common. There is an ever present risk of damage to deeper structures, (for example tendons and nerves) particularly if the penetrating injury has been to the hand. Patients with such injuries are often seen late at night and patients are often under the influence of alcohol. In the majority of instances glass will be seen on an x-ray as the density of glass is greater than the density of soft tissue. An x-ray should therefore always be taken in cases of glass injury. If there is any doubt at all about the severity of the injury or the diagnosis the patient should be asked to return within 24 hours for further assessment.

Cat and dog bites carry a high risk of infection. The same is true of human bites. These usually occur during fights when the clenched fist is in contact with a tooth resulting in an injury to the knuckle. These injuries require careful surgical treatment with cleaning and appropriate antibiotics.

Errors of management: fractures

Fractures may be either open or closed. An open fracture is a fracture with an associated wound such that the fracture at some time has been exposed to the external environment. The main complication of open fractures is infection. Infection in the early stages may be from gas gangrene or tetanus organisms and in the later stages from other bacteria such as staphylococci.

Patients with open fractures should have their tetanus immunisation checked, and they should immediately receive prophylactic antibiotics. Surgical treatment of open fractures involves the excision of the margins of the wound and wound debridement. All potentially infected and contaminated tissue is removed. The fracture is then reduced and stabilised.

It was once taught that to place internal fixation devices into an open wound was to invite infection. It is now believed that achieving stable fixation of a fracture reduces the risk of infection. The immediate priority however is the management of the wound.

Open fractures are classified by Gustilo into three grades.

(i) Gustilo I: There is a small clean puncture wound through which the bone has penetrated.
(ii) Gustilo II: The wound is more than 1 cm in length but there is no skin flap and not very much soft tissue damage. The fracture is not severely comminuted.
(iii) Gustilo III
    (a) There is extensive soft tissue damage but the bone can be adequately covered with soft tissue.
    (b) The fracture cannot be covered with soft tissue and there is also periosteal stripping and severe comminution of the fracture.
    (c) The above with vascular or neurological damage superimposed.

The higher the Gustilo grade, the greater the amount of energy which has been expended on the limb, and the graver the prognosis. The incidence of complications is far higher in high energy injuries than in low energy injuries. Infection, nerve injury, vascular injury, delayed union, non-union, joint stiffness, leg length inequality, and residual deformity are therefore more likely following Grade III open injuries than following Grade I injuries.

Management of these fractures must be very precise, and it is recommended that they should be managed jointly by orthopaedic and plastic surgeons. Plastic surgical care of the soft tissue by wound dedridement skin grafting and flap coverage converts the fracture into a closed injury and will reduce the risk of infection. Coverage of the wound should be carried out expeditiously and should have been completed ideally within 5 days. The orthopaedic surgeon can therefore deal with the fracture by using the most appropriate method of fixation - be that with a frame, nail or plate.

In general, fractures can be managed operatively or non-operatively. Non-operative management of fractures usually involves the application of an external splint of some kind - a plaster, a fibre-glass “plaster” or a splint. Non-operative management is usually reserved either (a) for fractures which are not displaced; or (b) for fractures which are displaced but which can be reduced into an anatomical position or are relatively stable (i.e. they are likely to remain in place once the plaster has been applied). Operative surgery, on the other hand, is used to maintain the reduction of a displaced fracture or to permit an early return to function.

Non-operative management is not free of risk. On the contrary some of the most serious complications of fracture management can arise when surgery is not the treatment of choice.

Compartment syndrome

This is a condition characterised by the presence of pain usually greater than can be explained on the basis of the original injury. The involved part, which might be the arm or leg, becomes swollen and there is often an associated colour change. Initially the affected part becomes either red or blue. There is associated paraesthesiae (altered sensation), and movements become limited. Pain elicited by passively stretching the affected muscles is a very suggestive physical sign.

Compartment syndrome is caused by swelling in the soft tissue envelope in which the muscles are contained. At the outset the swelling is caused by oedema and haematoma caused by the trauma. As the pressure in the muscle envelope rises, venous return is impeded. and this affects the normal oxygenation process of the muscles. The muscles thus become ischaemic, and this further compounds the swelling. Compartment syndrome is an emergency condition. If untreated the ischaemic muscles will die and this may result in virtually irreversible contractures of the digits - so called Volkmann's ischaemic contracture.

Initially the condition is diagnosed clinically. The diagnosis may be confirmed by measurement of the pressures within the compartment. Treatment is by fasciotomy –surgical division of the envelope surrounding the muscles. This alleviates the swelling, restores normal venous return and reverses the ischaemic process. Unfortunately, because of the swelling the fasciotomy wound tends to gape. This can make eventual wound closure difficult to achieve other than by the use of skin grafts. The ultimate cosmetic appearance can be quite poor.

Compartment syndrome can be a complication either of operative or non-operative management of fractures. It may also be a complication of elective surgical procedures. The fact that compartment syndrome occurs is not an indication that the treatment has been less than optimal. The condition should however be diagnosed as early as possible to avoid ischaemic contracture and long term disability.

Reflex sympathetic dystrophy or chronic regional pain syndrome

Reflex sympathetic dystrophy (or Sudek's atrophy as it is sometimes known) may be a complication of operative treatment, but may also be a complication of the injury itself. It may follow fracture or soft tissue injury. It can be a complication of elective orthopaedic surgery. The patient complains of pain. There is often associated swelling and colour disturbance of the limb. Neurological function may also be altered: there may be paraesthesiae. The affected joints become stiff. It is not an immediate complication of trauma but tends to occur during the healing phases. It is a difficult condition to treat. The mainstay of treatment is an

early recognition of the condition and physiotherapy. Referral to pain management specialists may be useful.

The condition is often construed by the patient as an indication that the treatment has fallen below a satisfactory standard. Claimants need to be reassured that this is not the case and it is a natural complication of the fracture. Indeed the condition may occur not as a consequence of fracture but as a result of a soft tissue injury. The stimulus to the onset of reflex sympathetic dystrophy is a painful episode - not necessarily a fracture.

Problems of fracture union

The objective of an operation to reduce and internally fix a fracture is to effect adequate fracture reduction (i.e. the bone should be put back into as normal anatomical alignment as can reasonably be achieved), and fixation (so that the fixation will not fail - i.e. the plate and screws will not break and the fracture will unite).

This is often difficult to achieve. For example, displaced fractures of the radius and ulna must be perfectly reduced to permit normal rotational movement of the forearm. Even if anatomical reduction is achieved rotation can sometimes be affected. Cross union can occur between the two bones such that they become effectively welded together preventing normal rotation. Very minor degrees of mal-reduction are normally tolerated but significant degrees of mal-reduction can be a cause of great concern and initiate a clinical negligence claim. The humerus, for example is very tolerant of both shortening and of angular and rotational misalignment due to the wide range of movement of the shoulder which can compensate for these things. The tibia is less tolerant of rotational or angular misalignment or shortening.

The outcome of fracture management can be difficult to predict. Bone is a biological tissue and is subject to its own laws. Fracture healing can be delayed for a number of reasons. Smoking, for instance, influences fracture healing adversely. There may have been significant periosteal stripping of the bone or damage to the vascular supply to the bone. Notwithstanding appropriate fracture management, delayed healing or even non-union can sometimes occur. These must be recognised by the orthopaedic surgeon and dealt with correctly.

Neuro-vascular injury

Per-operative damage to a peripheral nerve during fracture surgery is fortunately an infrequent occurrence. When it occurs, it can be very serious. Damage to the radial nerve during an operation to plate the shaft of the humerus will result in very profound disability for the patient. There will be a lack of wrist extension, thumb extension and abduction and finger extension. Damage may occur to the posterior interosseous nerve during operations to fix fractures of the proximal radius, the median and ulnar nerves can be damaged during surgery on the radius

and ulna; and damage can occur to the common peroneal nerve during operations on the knee and proximal fibula. These are just examples.

Nerves can be injured in a variety of ways. They can be stretched or cut. Simple stretching injuries to peripheral nerves are known as neurapraxia. There is temporary cessation of nerve function but eventual recovery is complete. If a nerve is stretched irreversibly or cut there is no chance of spontaneous recovery. Referral to a peripheral nerve specialist is then required. Specialist investigation by means of electro-myography is necessary to help determine the prognosis. Further surgery is almost always necessary with either a direct surgical procedure on the nerve itself, or reconstruction by means of tendon transfers.

ELECTIVE ORTHOPAEDICS

Errors of Diagnosis

The range of elective orthopaedic procedures is enormous. There are now orthopaedic practitioners practising in the sub-specialist areas of paediatric orthopaedic surgery, spinal surgery, rheumatoid arthritis surgery, joint replacement, sports medicine, upper limb surgery, hand surgery, foot and ankle surgery and bone tumours.

Diagnostic dilemmas in orthopaedic surgery are relatively infrequent. The clinical diagnosis is made on the basis of history, clinical examination and special investigations. Special investigations include plain x-rays, CT scans, MRI scans and radio-isotope bone scans. Haematological testing is also important if the patient is suspected of having an inflammatory condition, infection, tumour or metabolic condition.

Developmental Dysplasia of the Hip (Congenital Dislocation)

The incidence of developmental dysplasia of the hip is between 5 and 20 per 1000 live births. There may be a genetic pre-disposition to the condition. Girls are nine times more likely to be affected than boys. 60% of affected children are first born infants. There may be hormonal factors and intra-uterine mal-position: for example breach position with extended legs may favour hip dislocation. The socket of the hip joint may be poorly formed (acetabular dysplasia).

All infants should be tested at birth for hip instability. Unstable hips are further examined by means of an ultra sound test. If the hip is unstable and there is an abnormality on the ultra sound scan the hips are supported in splints with the hips flexed and abducted. Nevertheless, despite adequate screening programmes, some children do present late with congenital dislocation.

The diagnostic tests for instability include Barlow's test, in which the examiner attempts to push the head of the femur posteriorly out of the socket of the hip joint and Ortolani's test - a manoeuvre to reduce a recently dislocated hip. If

positive, the examiner feels a clunk as the hip pops back into place. After age 2 this test is no longer useful, as the soft tissues around the hip have started to contract, thus preventing the hip from reducing. Late signs of dislocation include leg length inequality, asymmetrical thigh skin creases and abnormal gait.

The long term implications of a missed or untreated hip dislocation are very serious - leg length inequality and the potential for the early onset of hip arthritis.

Tumours

Benign tumours of the musculo-skeletal system are relatively more common than malignant tumours and seldom cause difficulty of identification or treatment.

Malignant tumours are far less common. An orthopaedic surgeon in general practice might see a malignant tumour perhaps once or twice each year. It is for this reason that the treatment of malignant bone tumours is centralised to specific orthopaedic centres.

Patients with suspected malignant bone tumours need careful diagnostic work up. Plain radiographs, MRI scans, bone scans and CT scans are indicated. Eventually, tissue diagnosis is necessary and this can be performed by means of fine needle aspiration or by an open incision and biopsy. Incisions need to be carefully planned to avoid seeding malignant tissues outside the treatment area. Ideally the complete diagnostic work up should be performed by the surgeon eventually responsible for providing treatment. Surgery should not be contemplated on either benign or malignant bone tumours unless there is a clearly identified radiological abnormality.

It must also be remembered that if bone is removed this may weaken the skeleton and necessitate prophylactic internal fixation to prevent subsequent fracture.

Back Conditions

Chronic neck and back pain is a frequent cause for orthopaedic referral. In the overwhelming majority of patients with neck and back pain the cause is relatively simple to identify and relatively simple to treat. Unexplained pain needs very careful investigation to avoid missing serious pathology.

Occasionally spinal pain can be a manifestation of more sinister pathology such as a tumour. Careful history-taking to identify, for example, night pain, loss of appetite or weight loss is essential. Pathology in the sacroiliac joints (for example tumour or infection) may present in many ways. Patient may present with back pain with or without sciatic radiation, abdominal pain or groin pain.

All patients presenting with back pain should undergo thorough neurological examination to assess whether there is compression of a nerve root. This may be caused by a prolapsed inter-vertebral disc, disc degeneration, infection or tumour.

Prompt recognition of neurological damage is necessary if irreversible damage is not to occur.

The spinal cord terminates at the level of the first lumbar vertebra. Below this level the lumbar and sacral nerve roots are contained within the spinal column as the cauda equina. Damage to the cauda equina can occur as a result of surgery on the lumbar spine, disc prolapse (frequently central), trauma, tumours of the lumbar spine and infection. It is a most serious event which can result in permanent neurological loss, manifested by paralysis, sensory loss and loss of bladder bowel, and sexual function. Patients present with bi-lateral (or, occasionally unilateral) leg pain, motor weakness, altered sensation in the buttocks and perineum, and paralysis of bowel and bladder. Pressure on the cauda equina must be alleviated quickly if permanent loss of neurological function is to be avoided. Careful monitoring of the patient's neurological status is essential so that if the condition does develop, appropriate treatment can be instigated.

Bone and Joint Infection

Primary bone infections (osteomyelitis) usually occur in children. Primary bone infection is very rarely encountered in adults although occasionally chronic infection (Brodie's abscess) is encountered. Infection can complicate the management of fractures.

Sepsis in joints is also usually only encountered in children. In adults, primary joint sepsis is usually caused by an underlying medical condition such as diabetes mellitus or rheumatoid arthritis. The diagnosis is in the majority of cases relatively straight forward as is the treatment. Both bone and joint infection can occur in patients with immunological compromise. Joint infection is common in intra-venous drug users.

Patients with soft tissue infections such as cellulitis frequently find their way into orthopaedic wards. Cellulitis is caused by strains of streptococci. Streptococci are normally sensitive to penicillin and respond quickly to treatment with intravenous antibiotics. There are, however, strains of streptococci which can cause very rapid and fulminating septicaemia resulting in shock and multi-organ failure. Necrotising fasciitis is one example of this. Prompt investigation with full blood count, erythrocyte sedimentation rate (ESR), C-reactive protein, urea and electrolyte estimation to determine the status of the kidneys, and blood cultures are essential. Treatment is by means of intravenous antibiotics. There must be careful monitoring of blood pressure, pulse, respiration rate, and urine output with appropriate fluid replacement and resuscitation if the patient requires it. Help and support may be needed from microbiologists to determine the correct antibiotic regime, anaesthetists if the patient requires intensive care, or physicians if the patient displays signs of organ failure.

Errors of treatment in elective orthopaedics

All surgical procedures can potentially be complicated by infection, respiratory difficulty such as atelectasis, deep vein thrombosis and pulmonary embolism. Patients need to be warned of these risks as part of the consent process.

There are, however, specific complications common to many patients undergoing orthopaedic surgery. These include the complications of diathermy and tourniquet application.

Diathermy

Diathermy is used in surgery to control bleeding. There are various types of diathermy, determined by the type of current used. The main complication is burning caused by poorly insulated diathermy leads. Diathermy can also cause the ignition and explosion of inflammable liquids used during the operation, such as the alcohol used to sterilise the operative field.

Tourniquets

Tourniquets are used widely in orthopaedic surgery to provide a bloodless field. A tourniquet can remain inflated at the correct pressure for as long as two hours, but it is normal not to leave it inflated for longer than this except in exceptional circumstances. If the tourniquet is inflated to the wrong pressure or if it is left in place for too long, ischaemic complications can result. These can include nerve injury and muscle ischaemia resulting in compartment syndrome. The tourniquet equipment requires regular maintenance to ensure that the pressures are correctly calibrated. The use of a tourniquet is contra-indicated in cases of vascular compromise sickle cell disease and other specific indications.

Complications of total joint replacement

Infection

Infection is the great enemy of successful joint replacement. Prophylactic antibiotics, ultra clean air operating theatres and special operating suits can help reduce the risk. Nevertheless some patients develop infection. This can be very serious and even life threatening. All patients undergoing joint replacement should receive antibiotics at the time of induction of anaesthesia and for between 24 and 36 hours post-operatively. Infecting organisms include gram negative staphylococci and, most seriously, antibiotic resistant staphylococci. The proportion of infected joints is less than 1%.

Treatment for infection is by antibiotics and surgery. Revision of the joint replacement is often needed and this can be done in either one or two stages.

Deep vein thrombosis and pulmonary embolism

The incidence of deep vein thrombosis in the veins of the leg below the knee after hip and knee joint replacement is between 40 and 60%. The sequelae of thrombosis in the lower leg are not especially serious, although venous ulceration can occur, rarely, as part of the so-called "post-phlebitic"syndrome. More serious are clots within the veins of the thigh and pelvis which can break off and result in pulmonary embolism.

Chemical prophylaxis to minimise the risk of deep vein thrombosis is widely employed by surgeons in the United Kingdom, but there is no wide-spread agreement about whether chemo-prophylaxis is indicated and which drugs should be used. The incidence of fatal pulmonary embolism is approximately 1%, and this is not affected by prophylactic treatment. Moreover complications can arise from anticoagulation. The most serious is bleeding. There are no national guidelines dealing with this issue. The British Orthopaedic Association, in a pamphlet distributed to members of the Association stated:

> *"There is no good evidence to suggest that the use of chemical prophylaxis reduces either overall mortality or pulmonary embolus. Furthermore in contemporary practice total hip replacement should be regarded as "moderate" risk for death from pulmonary embolism. Chemical prophylaxis may reduce the risk of non-fatal pulmonary embolism but rigorous scientific evidence is not available."*

Adjunctive means of reducing the risk of venous thrombosis include mechanical methods such as anti-thrombotic stockings, and foot pumps to maintain venous blood flow through the legs during surgery.

Leg length inequality

It is very difficult for the surgeon to ensure equal leg length following total hip replacement. The surgeon relies on specialised equipment for the implantation of the joint but there is no fool proof method of ensuring equal leg length at the end of the procedure. A leg length discrepancy of 1 cm is usually well tolerated and does not cause any particular functional problems. Discrepancies of more than 2 cms will, however, cause problems with gait, functional problems and sometimes back pain.

Nerve injury

Damage to the sciatic nerve can occasionally occur during hip surgery. Post-operatively the patient is aware of altered sensation in the leg and of weakness of the ankle and foot. There may be a foot drop. The nerve may be physically damaged. It may, for example, be cut or stretched by the use of retractors. Cement may leak from around the cup and burn the nerve. The nerve may also find itself physically distorted by prominent cement at the back of the hip joint. In many cases, despite careful investigation, it is impossible to identify the cause of the damage.

The prognosis for sciatic nerve injury is variable. Recovery may or may not occur. The patient may be left with permanent foot drop and permanent loss of sensation. This can be very disturbing and necessitate the use of appliances.

The common peroneal nerve winds round the neck of the fibula on the lateral aspect of the knee joint. It is very vulnerable to the effect of traction during knee replacement surgery, and the patient may wake up after the operation with weakness of ankle extension and eversion and sensory disturbance affecting the foot. The prognosis for the injury is similar for the prognosis for sciatic injury following hip replacement. Recovery may or may not occur.

Dislocation

Post operative dislocation occurs in a very small minority of patients following total hip arthroplasty. In the majority of these once the hip has been reduced there is no further problem. Recurrent dislocation can however occur, and this can cause a great deal of difficulty and anxiety both for the patient and for the surgeon. It may result from poor positioning of the components or by using a prosthesis of incorrect size. In many cases of dislocation, however, it is difficult radiologically to identify the cause. Treatment for recurrent dislocation is usually by means of a revision procedure.

Peri –operative fracture

Fracture of the shaft of the femur is a complication of total hip replacement in both primary and revision cases. The femur can fracture as the hip is dislocated to expose the diseased joint, as well as during reaming and at the time of relocation of the joint. It occurs more often in osteo-porotic bone than in normal bone. Fracture of the femoral shaft does not preclude satisfactory joint replacement, but additional steps may be necessary during the surgery to strengthen the bone. Internal fixation and sometimes bone grafting may be required A fracture will almost certainly delay recovery.

The tibial plateau can fracture during knee replacement. This generally happens during preparation of the bone for the stem of the tibial component, although the femoral condyles can also fracture if the bone is osteoporotic - particularly if the patient has rheumatoid arthritis. Fractures should be recognised at the time they occur. If necessary they should be supported with suitable internal fixation.

Arterial injury

The popliteal artery is a direct posterior relation to the knee joint and may be injured during knee replacement. It may be cut during resection of the tibial plateau or as the menisci are removed from the back of the knee joint. Damage to the popliteal artery may not be immediately manifest as the majority of knee replacements are undertaken in a bloodless field using a tourniquet. The pre-operative vascular status of the leg should be known and carefully checked post-operatively. Popliteal artery injury can cause pain and, sometimes, neurological injury. Examination may reveal colour changes in the limb, loss of sensation,

weakness in the muscles distally, loss of peripheral pulsation and peripheral vascular failure (manifested by a drop in blood pressure and increase in pulse rate, with poor peripheral perfusion). If recognised peri-operatively, a vascular surgeon should assess the damage and carry out the necessary remedial surgery. If not recognised until after the operation has been finished, the vascular surgeon should give an opinion. Early recognition of the problem is essential if permanent damage is to be avoided.

Compartment syndrome

The physical signs of compartment syndrome are described above. The condition must be diagnosed early and treated by fasciotomy if permanent damage is to be avoided.

Complications of arthroscopy

Most soft tissue and ligament disorders of the knee are managed arthroscopically. Arthroscopy is increasingly common for disorders of the shoulder, elbow, wrist and ankle. The advantages of arthroscopic techniques are that surgery can be performed as a day procedure; the surgery can be performed through very small incisions; post operative recovery is quicker than if open surgery is performed.

Endoscopic procedures, however, are not without risk. Some of the risks are as follows:

Broken instruments

Instruments used in arthroscopic surgery have small cutting ends and are manufactured to fine tolerances. Breakage can occur, and may result in metal being retained within the joint. The surgeon should recognise what has happened and should take active steps to remove any retained fragments.

Operations on the wrong joint

The joint should be marked pre-operatively to prevent this from happening.

Infection

The incidence of this is extremely low - probably less than 0.01%. There is no clear indication for the use of prophylactic antibiotics. It is incumbent on the surgeon to recognise the problem and treat it in the most expeditious manner with the appropriate medication and, if necessary by surgery with washing out of the joint.

Nerve injury

This can occur following arthroscopic procedures. The damage can be very severe. The nerves around the elbow seem particularly at risk - especially the ulnar nerve on the medial side. The brachial plexus can be injured during arthroscopic procedures on the shoulder.

Complications of shoulder surgery

The most frequently encountered complication of shoulder operations is damage to the brachial plexus.

The brachial plexus is the group of nerves running from the neck and into the arm. The nerve roots from C5 to T1 form a complicated network between the neck and upper arm. The nerves run into the arm in fairly close proximity to the shoulder joint. Any open operation on the shoulder exposes components of the brachial plexus to potential damage. Patients suffering brachial plexus damage may present with several types of neurological injury, including muscle weakness in the arm, forearm, wrist or hand, and sensory disturbance. The prognosis for such injuries can be poor. Permanent disability can result.

Complications of wrist and hand surgery

Specific risks inherent in wrist and hand surgery include nerve injury, tendon injury and stiffness. In particular, surgery on the fingers often results in stiffness. Nerves can be damaged during hand surgery, resulting in areas of numbness or muscle paralysis. Reflex sympathetic dystrophy is an ever present danger.

Complications of foot surgery

Pain and disability from disorders of the feet is very common. Deformities of the feet, bunions hammer toes and arthritic conditions are often an indication for surgery. Common problems causing anxiety for patients after foot surgery include persistent pain (particularly after operations to correct deformity of the great toe), persistent deformity, the wrong choice of operation to correct deformity, and post operative infection.

Hallux valgus can affect people throughout their lives. The condition often presents in adolescence. The choice of operation depends upon the degree of deformity, the patient's age and the presence of osteo-arthritis. The surgical choices include corrective osteotomy of the 1st metatarsal, fusion of the 1st metatarso-phalangeal joint, or Keller's procedure (which creates a false joint in the region of the 1st metatarso- phalangeal joint). Patient expectation may be greater than the operation can deliver. Management of those expectations is important. With increasing age there can be transfer of weight bearing from the 1st metatarsal onto the lesser metatarsals: this can be compounded by the wrong choice of operation. This must be made clear at the outset.

Osteo-arthritis of the great toe (hallux rigidus) can be treated surgically by fusion of the joint, by excision arthroplasty, or by the insertion of an artificial joint. Less severe pain can be treated by removal of the osteophytic rim from the margins of the joint. This can help to restore movement and delay the need for more radical surgery. Fusion of the joint involves the use of some form of internal fixation such as a screw. In time this may cause problems and need to be removed.

OBTAINING PATIENT CONSENT

Appropriately informed consent is a corner stone of good surgical practice. There are several important elements to the informed consent discussion.

First, the surgeon should explain the condition in easily comprehensible terms. Simple drawings and diagrams can help the patient to understand. Information booklets are helpful. The process should start in the out-patient clinic and should be continued throughout attendances at the pre-assessment unit. Information can be provided both by the surgeon and by trained nursing staff. The majority of information however, particularly relating to the operation should be given by the operating surgeon or by a surgeon trained in the procedure. It should not be left to a junior doctor untrained in the procedure. The patient needs to know why treatment is necessary and what might happen if the treatment is not provided.

Second, the available treatment options should be discussed, together with the risks and benefits of each.

Third, patients need to understand the post-operative regime. They need to know, for example, if they will require the removal of sutures or the application of plaster. They need to know if physiotherapy or occupational therapy might be necessary, and when, if ever, they can expect to return to normal function. They need to understand what functional restrictions might eventually be necessary. The long-term outlook and prognosis needs to be carefully discussed. So does the possibility and nature of future treatment. In relation to the contemplated surgery, patients need to know what might happen if the procedure is less straight forward than hoped.

Fourth, the specific complications of the procedure should be discussed fully, together with the implications of those complications for prognosis.

It is therefore important that the consent process involves careful planning of the procedure by the surgeon. The surgeon should understand what potential pitfalls might be encountered and communicate this understanding to the patient.

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