Long bone fractures are commonly seen in patients following significant trauma such as road traffic accidents or during extreme sports. There are six long bones in the body which are considered in four units:

1. Humerus
2. Radius and Ulna
3. Femur
4. Tibia and Fibula

The tibia is the most commonly fractured long bone. These injuries are most commonly seen in individuals under the age of 40 with teenage males having the highest incidence.

Initial Management
The initial management of a patient with a long bone fracture is according to ATLS® principles. Once the patient has been appropriately stabilised then attention can be turned to the fracture.

Pain relief is a big problem in long bone fractures and the patient will often arrive in the emergency department wearing a vacuum splint. These splints are material bags filled with polystyrene balls with a valve attached. They are wrapped around the injured limb and then a vacuum pump is used to suck out all the air making them go rigid. This usually makes the patient much more comfortable and reduces the risk of neurovascular injury during the patients’ transfer. Another advantage of these splints is that they allow the limb to be x-rayed with a minimum of artifact as shown in the x-ray below.

The next step in management is to manipulate the fracture into as anatomic position as possible and hold the reduction in a plaster of paris (POP). When a POP has been applied it should be moulded to the fracture. In the tibia care must be taken to get the correct rotation. In the lower limb it is critical that the ankle joint is immobilised at ninety degrees. The immobilisation is often be left with the ankle in equinus (with the toes pointing at the floor) when performed by an inexperienced doctor. This is not acceptable as if the fracture is to be treated conservatively the ankle will become stiff in this position and this can be very difficult to resolve after the plaster is removed. The following x-ray shows a fracture of the tibia and fibula which has been immobilised in a POP.

This reduction would not be acceptable as a position for conservative management due to the degree of persisting deformity.

Conservative Management
If a good position is obtained on initial reduction conservative management can be considered. It may also be considered in patients who are too unwell to undergo surgery. The x-ray below shows a transverse tibial fracture which has been manipulated into a good position which will allow ongoing conservative management with close follow-up.

A transverse fracture is a good candidate for conservative management as the fracture is stable on axial loading and will not displace in the way a spiral or oblique fracture would.
Surgical Management
If the decision has been made to operatively manage the patient there are three main methods of surgical treatment.

Open Reduction and Internal Fixation
The first option is to fix the fracture with a plate and screws. This has the advantage of allowing accurate reduction of the fracture and the ability to place one or more lag screws across the fracture site allowing for interfragmentary compression. It is also very useful for fractures close to either the knee or ankle joint (metaphyseal fractures) where a pre-contoured plate can allow for more rigid fixation.

The disadvantage of plating is that it requires a large surgical incision and significant disruption of the soft tissues. This can be detrimental to fracture healing leading to a higher risk of non-union.

In the following example the lag screws can be seen as dots in the middle of the tibia on the AP view and the screws can clearly be seen on the lateral view. The fracture itself is barely visible indicating that an excellent reduction has been achieved.

Intramedullary Nailing
The second option is to use an intramedullary nail to bridge the fracture site. This is an excellent choice for midshaft fractures and has the advantage that the surgical incisions are very small. It does not cause any soft tissue disturbance at the fracture site itself which is beneficial in terms of fracture healing.

The above post-operative x-rays were taken 6 months after a distal third tibial fracture was managed with a tibial nail. The fracture has healed though there is some degree of malunion.

One of the problems with tibial nailing is that the closer to the metaphysis of the bone the fracture is, the harder it becomes to obtain a good reduction.

External Fixation
The third option is to use an external fixation device. This is commonly used in high energy injuries where there is a significant degree of soft tissue damage which precludes a safe surgical incision being made. They are also commonly used in open fractures where there is contamination at the fracture site.

The following image shows an external fixator spanning a comminuted wrist fracture. The pins can be seen going through the skin attaching to the brackets which are in turn connected to the rods.

The x-ray below shows the internal position of the pins seen in the previous photograph.

One disadvantage of external fixators is that it is difficult to gain any compression at the fracture site and at the same time the construct is very rigid. This can lead to non-union. Another disadvantage is that the pins give a point of communication from the outside world to the bone and this often leads to pin site infection which in turn can cause osteomyelitis. This essentially creates a new ‘injury’ which then needs to be treated.

Stress Fractures
Stress fractures occur as a result of repetitive loading of a weightbearing bone where each load is below the breaking point of the bone but cumulatively the loading leads to the development of an incomplete crack in the bone. It is commonly seen in athletes and military recruits. It can also occur under normal loading conditions when the bone is weakened by diseases such as osteoporosis or Paget’s disease. The most commonly affected long bone is the tibia though it is also seen in the femur and occasionally the upper limb.

Patients usually have an insidious onset of pain with no specific history of trauma. The pain is usually exercise related and improves with rest. Diagnosis can be difficult. The initial investigation is x-ray. This will not show a fracture until up to one month following the fracture occurring. Sometimes the only sign on x-ray will be the presence of a periosteal reaction indicating bone healing.

The x-ray below shows a stress fracture on the anterior cortex of the tibia in a patient with Paget’s disease (see the later section on Paget’s disease).

Where x-rays are normal but a stress fracture is still suspected, MRI or Technetium-99m bone scanning are the investigations of choice.

Patients who have a stress fracture should be advised to rest the affected limb. This may require a plaster or for the patient to be non-weight bearing. The length of resting time varies but a period of 4 - 6 weeks followed by a gradual return to activity is usually sufficient. Stress fractures must be followed up as they can go on to non-union and surgical intervention may then be necessary.

Further Reading
Basic Musculoskeletal Radiology (Second Edition) : A Brief Introduction to Musculoskeletal Radiology for Medical Students and Junior Doctors. Chapter : Long Bone Fractures