دعمارنجم

Treatment of open fractures

Rapid general assessment is the first step and any life threatening conditions are addressed.

Steps to be dealt with fractures

1. wound is first carefully inspected;
2. Any gross contamination is removed.
3. Dressing with a saline-soaked
4. The patient is given antibiotics, usually co-amoxiclav or cefuroxime.
5. The limb is then splinted until surgery.
6. The limb circulation and distal neurological status will need checking repeatedly.

Gustilo's classification of open fractures

Type 1 – The wound is usually a small, clean puncture little soft-tissue damage with no crushing and the fracture is not comminuted (a low-energy fracture).

Type II – The wound is more than 1 cm long, but there is no skin flap, not much soft-tissue, no comminution (also a low- to moderate-energy fracture).

Type III – There is a large laceration, extensive damage to skin and underlying soft tissue

- ***type III A*** the fractured bone can be adequately covered by soft tissue despite the laceration.
- ***type III B*** there is extensive periosteal stripping and fracture cover is not possible without use of local or distant flaps.
- ***type III C*** if there is an arterial injury that needs to be repaired, regardless of the amount of other soft-tissue damage.

PRINCIPLES OF TREATMENT

• Antibiotic prophylaxis.
• Urgent wound and fracture debridement.
• Stabilization of the fracture.
• Early definitive wound cover.

Antibiotic prophylaxis

In most cases co-amoxiclav or cefuroxime (or clindamycin if penicillin allergy is an issue) is given as soon as possible, often in the Accident and Emergency department.

Debridement

The operation aims to render the wound free of foreign material and of dead tissue, leaving a clean surgical field and tissues with a good blood supply throughout.

steps

1. ***Wound excision*** The wound margins are excised, but only enough to leave healthy skin edges.
2. ***Wound extension*** safest extensions are to follow the line of fasciotomy incisions; these avoid damaging important perforator vessels that can be used to raise skin flaps for eventual fracture cover.
3. ***Delivery of the fracture*** the fracture surfaces will be exposed through the wound without any additional damage to the soft tissues.
4. ***Removal of devitalized tissue*** Devitalized tissue(muscle, bone ,soft tissue) provides a nutrient medium for bacteria. Dead muscle can be mushy consistency, its failure to contract when stimulated and its failure to bleed when cut.
5. ***Wound cleansing*** wash with copious quantities of saline (6–12 L), Adding antibiotics or antiseptics to the solution has no added benefit.
6. ***Nerves and tendons*** best to leave cut nerves and tendons alone to later.

Stabilization of the fracture

internal or external fixation may be appropriate depending on the individual characteristics of the fracture and wound. If wound cover is delayed, then external fixation is safer.

Wound cover

Suture a small, uncontaminated wound, provided this can be done without tension. In the more severe grades of injury, immediate fracture stabilization and wound cover using split-skin grafts, local or distant flaps is ideal, It should be done by 48–72 hours, and not later than 5 days.

Complications of fractures.

Early complications

Local

- Vascular injury causing haemorrhage, internal or external
- Visceral injury causing damage to structures such as the brain, lung or bladder
- Damage to surrounding tissue, nerves or skin
- Haemarthrosis
- Compartment syndrome (or Volkmann's ischemia)
- Wound Infection - more common for open fractures
- Gas gangrene

Systemic

- Fat embolism
- Shock
- Thrombo embolism (pulmonary or venous)

- Exacerbation of underlying diseases such as diabetes or coronary artery disease (CAD)
- Pneumonia

Late complications of fractures

Local

- Delayed union
- Nonunion
- Malunion
- Joint stiffness
- Muscules contractures
- Myositis ossificans
- Avascular necrosis
- Algodystrophy (or Sudeck's atrophy)
- Osteomyelitis
- Growth disturbance or deformity
- Nerve compression
- Osteoarthritis

Systemic

- Tetanus, septicemia
- Fear of mobilizing

Early complications

Vascular injury

The circulation is then reassessed repeatedly over the next half hour. If there is no improvement, the vessels must be explored by operation a cut vessel can be sutured, or a vein graft may replace a segment.

Nerve injury

Nerve injury is particularly common with fractures of the humerus or injuries around the elbow or the knee.

Closed nerve injuries
the nerve is seldom severed, and spontaneous recovery should be awaited – it occurs in90 per cent within 4 months. If recovery has not occurred by the expected time, and if nerve conduction studies and EMG fail to show evidence of recovery, the nerve should be explored.

Open nerve injuries
With open fractures the nerve injury is more likely to be complete. In these cases the nerve should be explored at the time of debridement and repaired at the time or at wound closure.

Acute nerve compression
Complaints of numbness or paraesthesia in the distribution of the nerves should be taken seriously and the patient monitored closely; if there is no improvement within 48 hours of fracture reduction or splitting of bandages around the splint, the nerve should be explored and decompressed.

Compartment syndrome

Fractures of the arm or leg can give rise to severe ischemia. Bleeding, edema or inflammation (infection) may increase the pressure within one of the osseofascial compartments; there is reduced capillary flow, which results in muscle ischaemia, further oedema, still greater pressure and yet more profound ischemia, after 12 hours or less, in necrosis of nerve and muscle within the compartment. Nerve is capable of regeneration but muscle, once infarcted, can never recover and is replaced by inelastic fibrous tissue. (*Volkmann's ischaemic contracture*) A similar cascade of events may be caused by swelling of a limb inside a tight plaster cast.

The classic features of ischaemia are the five Ps:
• Pain
• Paraesthesia
• Pallor
• Paralysis
• Pulselessness.

Treatment

(elevating the limb causes a further decrease in end capillary pressure and aggravates the muscle ischaemia). Casts, bandages and dressings must be completely removed. If three or more signs are present, the diagnosis is almost certain. If the clinical signs are ‘soft’, the limb should be examined at 30-minute intervals and if there is no improvement within 2 hours of splitting the dressings, fasciotomy should be performed. Muscle will be dead after 4–6 hours of total ischemia –there is no time to lose!

Haemarthrosis

The joint is swollen and tense and the patient resists any attempt at moving it. The blood should be aspirated before dealing with the fracture.

Gas gangrene

Clostridium welchii infection These are anaerobic organisms that can survive and multiply only in tissues with low oxygen tension. Clinical features appear within 24 hours of the injury: the patient complains of intense pain and swelling around the wound and a brownish discharge may be seen; gas formation is usually not very marked. There is little or no pyrexia but the pulse rate is increased and a characteristic smell becomes evident.

Treatment
General measures, such as fluid replacement and intravenous antibiotics, are started immediately. Hyperbaric oxygen has been used as a means of limiting the spread of gangrene. However, the mainstay of treatment removal of all dead tissue. In advanced cases, amputation may be essential.

PLASTER AND PRESSURE SORES

Plaster sores occur where skin presses directly onto bone. They should be prevented by padding the bony points and by molding the wet plaster.

Late complications

Delayed union

Factors causing delayed union

BIOLOGICAL

1. *Inadequate blood supply* tearing of both the periosteum and interruption of the intramedullary blood supply.
2. *Severe soft tissue damage* (1) reducing the effectiveness of muscle splintage; (2) damaging the local blood supply and (3) diminishing or eliminating the osteogenic input from mesenchymal stem cells within muscle.
3. *Periosteal stripping* during internal fixation

BIOMECHANICAL

1. *Imperfect splintage* excessive movement at the fracture site will delay ossification in the callus.
2. *Over-rigid fixation* rigid fixation delays rather than promotes fracture union.
3. *Infection* bone lysis, necrosis and pus formation, but implants which are used to hold the fracture tend to loosen.

PATIENT RELATED

• Immense
• Immoderate
• Immovable
• Impossible.

Clinical features Tenderness, on stress pain may be acute. On x-ray, the fracture line remains.

Treatment

CONSERVATIVE

(1) to eliminate any possible cause of delayed union and (2) Immobilization (whether by cast or by internal fixation)

OPERATIVE

If delayed for more than 6 months and there is no sign of callus formation, internal fixation and bone grafting are indicated.

Nonunion

Two type on *X-ray*

1. *hypertrophic non-union* osteogenesis is still active but not quite capable of bridging the gap.
2. *atrophic non-union* osteogenesis seems to have ceased.

Causes

four problem of non-union, *CASS*:
1. *Contact* – Was there sufficient contact between the fragments*?*
2. *Alignment* – Was the fracture adequately aligned, to reduce shear*?*
3. *Stability* – Was the fracture held with sufficient stability*?*
4. *Stimulation* – Was the fracture sufficiently 'stimulated'? (e.g. by encouraging weight bearing).

There are, of course, also biological and patient related reasons that may lead to non-union: (1) poor soft tissues (2) local infection; (3) associated drug abuse, anti-inflammatory or cytotoxic immunosuppressant medication and (4) non-compliance on the part of the patient.

Treatment

CONSERVATIVE

Non-union is occasionally symptomless, functional bracing may be sufficient to induce union

OPERATIVE

With hypertrophic non-union and in the absence of deformity, very rigid fixation alone (internal or external) may lead to union. With atrophic non-union, excised and bone grafts are packed around the fracture.

Malunion

When the fragments join in an unsatisfactory position (unacceptable angulation, rotation or shortening)

Treatment

re-manipulation or correction by osteotomy and fixation.

Avascular necrosis

It develop ischaemia and bone necrosis after injury can occur in
(1) the head of the femur(after fracture of the femoral neck or dislocation of the hip);
(2) the proximal part of the scaphoid (after fracture through its waist);
(3) the lunate (following dislocation) and
(4) the body of the talus (after fracture of its neck).

Treatment

femoral head an arthroplasty , scaphoid or talus arthrodesis of the wrist or ankle is sometimes needed.

Growth disturbance

In children, damage to the physis may lead to abnormal or arrested growth.

Myositis ossificans

Heterotopic ossification in the muscles sometimes occurs after an injury, particularly dislocation of the elbow or a blow to the brachialis, deltoid or quadriceps. It is thought to be due to muscle damage,

Clinical features

Soon after the injury, complains of pain; there is local swelling and soft-tissue tenderness. X-ray is normal but a bone scan may show increased activity. Over the next 2–3 weeks the pain gradually subsides, but joint movement is limited; x-ray may show fluffy calcification in the soft tissues. By 8 weeks the bony mass is easily palpable and is clearly defined in the x-ray.

Treatment

Exercises aggravate the condition. The joint should be rested in the position of function until pain subsides; gentle active movements are then begun. when the condition has stabilized excise the bony mass ,NSAID gives to help prevent a recurrence.

Tendons lesion

Tendinitis may affect the tibialis posterior tendon following medial malleolar fractures.
Rupture of the extensor pollicis longus tendon may occur 6–12 weeks after a fracture of the lower radius.

Nerve compression

Common sites are:
(1) the ulnar nerve, due to a valgus elbow following a malunited lateral condyle or supracondylar fracture;
(2) the median nerve, following injuries around the wrist and
(3) the posterior tibial nerve, following fractures around the ankl.

Treatment

is by early decompression of the nerve; in the case of the ulnar nerve this may require anterior transposition.

Muscules contractures

Following arterial injury or compartment syndrome, the patient may develop ischaemic contractures of the muscles (*Volkmann's ischaemic contracture*). thus the patient presents with deformity and stiffness, but numbness is inconstant. The sites most commonly affected are the forearm and hand, leg and foot.

Treatment

Operations correction of ischemia and compartment syndrome.

Joint stiffness

commonly occurs in the knee, elbow, shoulder. is due to oedema and fibrosis of the capsule, ligaments and muscles around the joint, or adhesions of the soft tissues to each other or to the underlying bone. These worse by prolonged immobilization

Treatment

is prevention – by exercises that keep the joints mobile from the outset. If a joint has to be splinted, make sure that it is held in the 'position of safety'

Osteoarthritis

A fracture involving a joint may severely damage the articular cartilage and give rise to post-traumatic osteoarthritis within a period of months. Even if the cartilage heals, irregularity of the joint surface maycause localized stress and so predispose to secondary osteoarthritis years later.

Treatment :intra-articular osteotomies and re-positioning of the fragment may help.

Complex regional pain syndrome ,Algodystrophy (Sudeck's atrophy)

painful osteoporosis of the extremities occurs after fractures that this advanced atrophic disorder is the late stage of a post-traumatic

Two types of CRPS are recognized:
• Type 1 –a reflex sympathetic dystrophy that develops after an injurious or noxious event.
• Type 2 – causalgia that develops after a nerve injury.

Clinical features
there is local swelling, redness and warmth, as well as tenderness and moderate stiffness of the nearby joints. skin becomes pale and atrophic,with time may develop fixed deformities. X-rays characteristically show patchy rarefaction of the bone.

Treatment

Elevation and active exercises are important after all injuries, but in CRPS they are essential. anti-inflammatory amitriptyline, carbamazepine and gabapentin may help.