Goals of Open Fracture Management

- Prevention of Infection
- Fracture Healing
- Restoration of Limb Function
Fracture Stabilisation

- POP / Splintage
- External fixation
  - Temporary
  - Definitive
- Internal fixation
  - IM Nail
  - AO
Debridement

• Literal Translation - “Unbridling”
An incision to release purulent contents of wounds

• Wound Excision – popularised in WW1
Objective

Elimination of the culture medium in which infection can occur and creation of an environment favourable for healing
Principles

• Extension of wound to identify the zone of injury and to decompress viable tissue affected by injury

• Removal of foreign material

• Removal of non-viable tissue

• Reduce bacterial contamination
Debridement

- Wound excision
- Irrigation
- Dressing
Factors affecting the extent of Wound Excision

- Volume of dead/contaminated tissue
- Volume of viable but ischaemic tissue
- Accessibility of the injured tissue
- Structures injured
Wounds

- Blunt
- Large
- Ballistic
- Small
Ballistic Limb Trauma

- **Missile**
  - Bullets
  - Fragments

- **Blast/Explosive**
Missile wounds

- Kinetic Energy $\frac{1}{2}mv^2$

- Energy Transfer
  - Low
  - High
Figure 1.1 (a) Diagram of the track made by the bullet of a modern assault rifle on entering a soap block at a range of 20 to 50 metres. All bullets produce variations on this depending on calibre, velocity and construction. The inset box indicates the individual small track of one fragment should the bullet disrupt. (b) Projected graph showing the extent to which the kinetic energy of the bullet is released to the tissues along the track.
RPG Shrapnel Wound
Washout and Debridement
After Debridement
Upper Limb Shrapnel Injury
Application of Exfix
Debridement

- It is Difficult
- It is not Quick
- It may be Bloody
Surgical Dilemma

• Too Little - Potential for infection and further debridement needed

• Too much - Potential for increased functional impairment
Avoid a dogmatic approach as this will lead to inadequate treatment for large wounds and excessive excision in smaller ones.
Operative Technique

- Plan wound extensions which are generally longitudinal except when crossing a joint.

- Skin - as little as possible
  - 1-2mm around the edge of the wound

- Subcutaneous fat can be generously excised
Operative Technique

- Muscle

- 4Cs (Scully 1956)
  - Colour, Consistency, Capillarity, Contractility

- 1cm³ bites until viable tissue
Bone

• No such criteria exist

• Soft tissue attachments

• Bleeding from the bone

• Laser Doppler Flowmetry to assess perfusion of fracture fragments

  Hobbs & Watkins 2001
Operative Technique

- Cortical fragments free from soft tissue attachments should be removed

- Bone ends seen, irrigated and debrided

- Bone loss may be apparent, but better removed and reconstructed than left and infected
Irrigation

• Flushes blood and debris away

• Floats unseen fascia, fat, muscle and bone fragments into view

• Reduces the bacterial count

• Solution to pollution is dilution
  - Yes but how, what and when is it delivered?
Irrigation

- Drip set / bowl
- Bulb syringe
- Low pressure pulsatile lavage
- High pressure pulsatile lavage
Irrigation

- HPPL effective in soft tissues  
  Rodeheaver et al 1976

- HPPL effect on bone is less certain
  - damage at the fracture site and delayed fracture healing  
    Dirschl et al 1998
  - damage to bone and intramedullary seeding of bacteria  
    Bhandari et al 1998
Irrigation

• LPPL less bone damage and equally effective within three hours but not at six.
  Bhandari, Schemitsch et al 1999

• LPPL with 1% soap solution effective up to 6 hours and less damaging to bone than Povidone-iodine and Chlorhexidine solutions.
  Bhandari, Schemitsch et al 2001
Dressing

- Bulky dry dressing
- Fluffed gauze, velband/wool, crepe
“In the present retrospective, multicenter study of children with Gustilo and Anderson type-I, II, and III open fractures, the rates of acute infection were similar regardless of whether surgery was performed within six hours after the injury or at least seven hours after the injury.”

Remember

- Debridement is paramount

- Antibiotics do not reach dead tissue!
Any Questions