Manipulation and immobilization of Colles' fractures

Indications

Closed reduction and immobilization within a plaster cast remains an acceptable treatment for the majority of distal radial fractures. In order to gain satisfactory results, it is important to carefully select which patients to manage in this manner.

In general, Colles' fractures, or those showing a combination of dorsal angulation, dorsal shift and radial shift following a fracture in osteopenic bone in patients over 50 years of age, are amenable to this type of management.

Patient factors to consider should include hand dominance, employment, functional demand and patient expectations. Injury factors to consider include displacement, articular involvement and comminution. Together these injury factors give an idea as to the relative stability of the injury, and therefore its tendency to redisplace following reduction. Choosing to manage non-operatively a dominant hand displaced comminuted intra-articular fracture in a young patient with moderate functional demand and high expectations is unlikely to meet with success.

Planning

Having selected the patient, a careful analysis of the injury pattern must be made before attempting reduction. The Colles' fracture typically shows a combination of dorsal angulation, dorsal shift and radial shift. In addition they also tend to be impacted. These are the deformities one must reverse in order to achieve as anatomical a reduction as possible. Before manipulation, one must prepare the equipment necessary to immobilize the fracture. This includes:

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- Plaster of Paris (PoP), 6 or 8 inches wide, six sheets thick, with a section removed to accommodate the thumb
- Lukewarm water in a bucket large enough to submerge the entire PoP bandage
- Cotton wool bandage
- 6-inch crepe bandage
- Adhesive tape.

Anaesthesia

Having analysed the deformity, one must then decide on the type of anaesthesia to administer. Three main types are available in the accident and emergency department:

1. Local anaesthesia with a haematoma block
2. Regional anaesthesia with a Bier's block
3. Sedation and analgesia.

The choice of anaesthesia may be dictated by local protocols. However, each has its own advantages and disadvantages.

Haematoma block

Equipment:

- Sterile gloves
- Betadine skin prep
- Sterile gauze swabs
- 10 ml syringe and 20 gauge needle
- 10 ml of sterile 1% lignocaine
- Sterile cotton wool.

Technique: Informed written consent is obtained from the patient. Sterile gloves are donned. The forearm is cleaned with betadine-soaked gauze swabs. The syringe is filled with 10 ml of 1% lignocaine. The dorsum of the wrist is gently palpated to locate the fracture.

The needle, mounted on the syringe, is then introduced percutaneously at 90° to the skin into the fracture site. Once the fracture site has been penetrated a flashback of blood will be seen in the barrel of the needle. Further aspiration should yield little more blood, differentiating the fracture site from a blood vessel. Once the operator is happy that the tip of the needle lies within the fracture site, 8–10 ml of lignocaine is injected. The needle is then withdrawn, and the injection site covered with sterile cotton wool until bleeding has ceased. Adequate analgesia is achieved in 2–5 minutes, when gentle manipulation of the fracture site is relatively painless.

Bier's block

Equipment:

- Bier's block machine (double-cuff tourniquet)
- 18 or 20 gauge intravenous (IV) cannula
- 1% prilocaine – no other local anaesthetic should be used
- 0.9% saline for dilution of prilocaine
- Oxygen with mask
- Pulse oximeter
- Electrocardiographic (ECG) monitor
- Defibrillator, advanced life support (ALS) equipment and drugs.

Technique: Contraindications to the use of a Bier's block include: hypertension (systolic blood pressure >200 mmHg), sickle cell anaemia, children younger than 16 years of age, peripheral vascular disease, infection of the limb, fracture to the ipsilateral humerus, or compartment syndrome. When using a Biers block, it is essential that two doctors are present: one to apply the block and monitor the patient, and another to manipulate the fracture. The patient should preferably be starved.

Informed written consent is obtained. The patient's baseline blood pressure and heart rate are recorded. The correct volume of prilocaine is prepared. The 1% prilocaine is diluted with an equal volume of 0.9% saline to produce a 0.5% solution. The dose of prilocaine is 3 mg/kg, so for a 70 kg patient this translates to 42 ml. The gas pressure in the cylinders supplying the tourniquets is checked before starting.

The cannula is inserted into a suitable hand vein on the side to be anaesthetized. The tourniquets are applied to the upper arm on the affected side. The arm is elevated for 2 minutes to exsanguinate. The cuffs are then inflated to 100 mmHg above systolic pressure. The prilocaine is then injected through the IV cannula. The patient should be monitored throughout the period of anaesthesia for evidence of toxicity. The signs to look out for are circumoral tingling, confusion, seizures, bradycardia and hypotension. The tourniquets should remain inflated for a minimum of 20 minutes following injection. The cannula is removed before discharge.

Sedation and analgesia

Equipment:

- 18 or 20 gauge IV cannula
- Morphine 5 mg in labelled syringe
- Midazolam 10 mg in labelled syringe
- Oxygen and mask
- 20 ml of 0.9% saline in labelled syringe
- Pulse oximeter
- ECG monitoring
- Defibrillator, ALS equipment and drugs.

Technique: The patient should be starved. Informed written consent is obtained. Baseline observations are recorded. ECG and pulse oximeter monitoring are established. Oxygen is provided. The cannula is inserted into the contralateral arm. Morphine 5 mg is given by slow IV injection. Five minutes are allowed to pass for the morphine to take effect. The midazolam is then given by slow IV injection. An initial dose of 1.5 mg is provided. Further boluses are then titrated to effect, allowing 1–2 minutes to pass between injections. Saline flushes are administered between doses.

Adequate sedation is achieved once the eyelids begin to droop. Further doses can be administered once manipulation has been attempted if sedation is inadequate. The total dose of midazolam necessary is usually 3.5–7.5 mg; in the elderly 3.5 mg should be the maximum dose provided. Monitoring is continued throughout the recovery period, and the patient is not discharged until able to eat and drink. The patient must be accompanied home.

Advantages and disadvantages

A haematoma block is relatively quick and easy to carry out. However, the quality of analgesia is variable. No muscle relaxation is achieved, making manipulation more difficult. A theoretical risk of osteomyelitis also exists.

A Bier's block produces excellent analgesia and muscle relaxation, but involves specialized equipment and requires the presence of two doctors. There is also a risk of toxicity associated with the use of large volumes of prilocaine, especially if the cuffs fail or are let down too early.

Sedation and analgesia also produces good analgesia and muscle relaxation. The amnesic effects of midazolam are useful. However, there is a risk of producing too deep a sedation, leading to airway compromise. Careful monitoring is required throughout.

Kendall et al (1997) have shown that Bier's block is superior to haematoma block in terms of the reduction that can be achieved.

Manipulation

Figure 1 shows the typical radiographic appearances of a Colles' fracture. There is dorsal angulation of the distal fragment, together with dorsal and radial shift. These are the deformities that must be reversed in order to achieve an adequate reduction.

Having ensured adequate analgesia by any of the methods described above, and having prepared the necessary equipment for immobilization in plaster, one can attempt to manipulate the fracture. Before manipulation, a stockingette bandage with a hole cut out for the thumb can be rolled up to the elbow.

Manipulation requires the use of an assistant to apply countertraction at the elbow. With the proximal forearm thus immobilized, one begins by applying in-line traction to the fracture. The dorsal deformity is then accentuated to aid with disimpaction. With traction maintained, the distal fragment is then flexed into a reduced position. Pressure is then applied to the radial aspect of the fragment with the heel of the hand to correct the radial shift. The fracture is now reduced, and is maintained in this position by flexing the wrist and pronating the forearm (Charnley, 1999).

The stockingette is now rolled down to cover the forearm, pulling the thumb through its hole. Cotton wool bandage is applied, paying particular care to providing adequate padding over possible pressure areas such as the ulna styloid. The stockingette and wool should cover the forearm from elbow to proximal interphalangeal joints of the fingers. The radial PoP slab is now applied. The ends of the stockingette and wool are rolled back to cover the ends of the plaster, and the crepe bandage is applied. Adhesive tape is used to secure the end of the crepe bandage. At this point moulding can be applied. Pressure is applied to the volar aspect of the wrist, followed by proximal pressure over the dorsum of the forearm and distal pressure over the dorsum of the proximal metacarpals. The wrist is immobilized in a position of slight flexion and ulnar deviation.

Figure 1. Typical radiological appearances of a Colles' fracture.

Post-manipulation

Once the patient has recovered from the anaesthetic, check radiographs must be obtained and the adequacy of reduction assessed. A broad arm sling can then be provided and the patient discharged with an appointment to return to fracture clinic for assessment 1 week later. At this appointment the injury will be re-X-rayed to ensure that reduction has been maintained. If the reduction is maintained the backslab is completed to a full cast. In the event of reduction being lost, it may be necessary to remanipulate the fracture with or without the addition of percutaneous wires to increase stability. BJHM

Conflict of interest: none.

Charnley J (1999) *The Closed Treatment of Common Fractures.* Colt Books, Cambridge

Kendall JM, Allen P, Younge P, Meek SM, McCabe SE (1997) Haematoma block or Bier's block for Colles' fracture reduction in the accident and emergency department – which is best? *J Accid Emerg Med* **14:** 352–6

KEY POINTS

- The majority of distal radial fractures are amenable to non-operative treatment.
- Patient selection is the key to ensuring success.
- A number of anaesthetic options are available, each with its own advantages and disadvantages.
- Careful follow-up is vital to ensure maintenance of reduction and recovery of function.