SECTION 5

PROCEDURES

SECTION 5

PROCEDURES (continued)

WHY?
Splinting a fracture serves several purposes:

- Prevention of further damage to soft tissues especially muscle, bone, nerves and blood vessels.
- Relief of pain.
- Reduction of blood loss.
- Protection of both patient and injury prior to definitive treatment.

A FRACTURE IS A MAJOR SOFT TISSUE INJURY WITH AN ASSOCIATED BROKEN BONE.

WHEN?
The primary survey and resuscitation take priority. Open fractures may need to be treated as part of circulation to arrest haemorrhage.

Other fractures should be identified during the secondary survey and the need for reduction and splinting assessed.

Open fractures should be dressed and, where possible, photographed before application of the splint. This will allow others to assess the nature of the injury without disturbing the dressing and splint.

The neurovascular status of the limb distal to the fracture must be assessed and recorded before and after any procedure. If there is any vascular compromise, reduction should take place as soon as possible.

HOW?
The method of splinting will depend on the equipment available. Liverpool Hospital options include:

Upper arm and forearm	Box splint Plaster slab
Hands	Plaster slab
Femur	Thomas splint Saeger splint Donway splint Denham / Steinman pin on traction
Lower leg or Foot	Box splint Plaster slab
Pelvis	Sheet, if appropriate External fixateur Lower limb traction, if appropriate (vertical displacement)

Donway Splint

WHY?
Spinal immobilisation aims to prevent any new damage to the spinal cord during treatment and transfer.

WHEN?
Immobilisation of the cervical spine should occur as part of the assessment of airway in the primary survey.

A basic idea of peripheral neurological function may be gained whilst assessing D during the primary survey, but a full assessment should be made during the secondary survey.

In the pre-hospital environment the patient should be put on a spinal board for transfer to hospital. As the patient is log-rolled for this the opportunity of examining the back should not be missed.

HOW?
The cervical spine is immobilised either by manual in-line stabilisation or by 3-point immobilisation.

This uses:
- A hard cervical collar.
- Blocks either side of the head.
- Tape or straps over the forehead and chin.

Apply all of these to patients where there is a high index of suspicion of c-spine injury.

This should remain in place until the cervical spine is cleared. For most other patients, a hard cervical collar is sufficient.

Beware the confused or uncooperative patient – apply what measures the patient will tolerate but do not use the equipment as a restraint. This also applies to children.

Spinal boards are uncomfortable for the patient at best and often painful. In the elderly or unconscious patient pressure sores may form within two hours. On arrival in hospital the spinal board should be removed when the log-roll is performed. The hospital trolley will provide adequate support to the supine patient but care must be taken during any movement of the patient.

When the patient arrives and is transferred to the trauma bed, log roll the patient OFF the spine board. This will:

- **improve x-ray quality**
- **allow FAST**
- **decrease pressure sore formation.**

VENOUS CUTDOWN

INDICATIONS

Venous cutdown is only indicated when more rapid and less invasive venous access is not obtained. Options include cannulation of the femoral vein or neck veins and intraosseous infusion in children and adults. Subclavian and internal jugular lines are not normally feasible in the resuscitation room in trauma patients.

TECHNICAL ASPECTS

The most commonly used vein for venous cutdown is the greater saphenous vein at the ankle. It is located, in the adult, at a point approximately 2 cm anterior and superior to the medial malleolus. Also used is the antecubital medial basilic vein located 2.5 cm lateral to the medial epicondyle of the humerus at the flexion crease of the elbow. The limb selected should be immobilised and a tourniquet applied proximal to the site.

1. Following antiseptic preparation and draping of the selected area, local anaesthetic is injected over the vein.
2. A 2.5 cm full thickness transverse skin incision is made.
3. The vein is identified by blunt dissection with a curved haemostat and freed for a distance of approximately 2 cm from its bed.
4. The distal vein is ligated, leaving the suture in place for traction.

5. A tie is passed proximally around the vein.

6. A small transverse venotomy is made and dilated with a closed haemostat.

7. A plastic cannula is inserted through the venotomy and the proximal tie used to secure the vein and cannula. Alternatively, a cannula with an introducing needle can be used in the usual manner but under direct vision. A venotomy is unnecessary in this situation. In this way a guidewire can be threaded through a small cannula, and a large bore rapid infusion device placed over it. A primed fluid giving set is connected.

8. The incision can then be closed with interrupted sutures.

9. A sterile dressing is applied.

EQUIPMENT

- 14 gauge cannula or 7.5 Fr rapid infusion cannula.
- Venous cutdown tray (retractor, haemostats, forceps).
- Scalpel (#10).
- 3-0 absorbable suture.
- 3-0 non-absorbable suture.
- Needleholder, forceps.

PITFALLS

- Bleeding.
- Loss of landmarks and difficulty localising veins.

RISKS / COMPLICATIONS

- Haematoma.
- Phlebitis.
- Cellulitis.
- Venous thrombosis.
- Saphenous nerve injury.

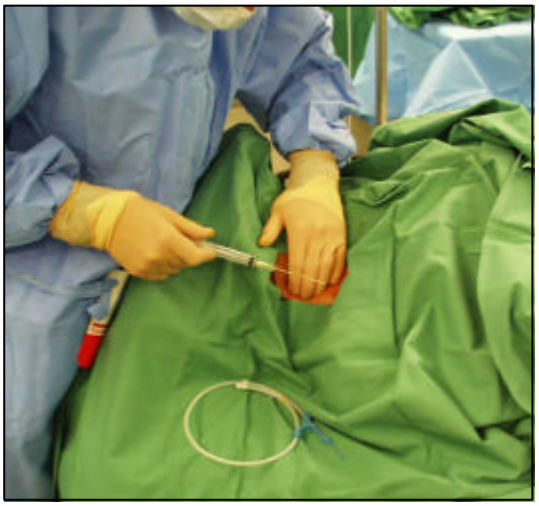
IT CAN BE VERY DIFFICULT TO CANNULATE A SUBSTANCE ABUSER – CONSIDER FEMORAL LINE EARLY!

FIXATION

Bring the IV tubing between the 1st and 2nd toe and fix with elastoplast roll to prevent dislodging.

INDICATIONS

1. Emergency venous access.
2. Volume loading.
3. Central venous pressure monitoring.
4. Routine venous cannulation.
5. Infusion of concentrated solutions and vasoactive drugs.
6. Placement of pulmonary artery catheters, transvenous pacemakers, and short term haemodialysis catheters.



FEMORAL APPROACH

The 8.5 Fr wide bore rapid infusion devices have 2 lengths: 6.4 and 10cms. Use the longer one for the femoral vein to reduce the chances of it dislodging.

Procedure:

1. Place the patient in a supine position.
2. Cleanse the skin well around the venepuncture site and drape the area. Sterile gloves should be worn when performing this procedure.
3. Locate the femoral vein by palpating the femoral artery. The vein lies directly medial to the femoral artery (nerve, artery, vein, empty space). A finger should remain on the artery to facilitate anatomical location, and to avoid insertion of the catheter into the artery. (Caution: Do not press too hard as the vein may be squashed flat and prove difficult to locate).
4. If the patient is awake, use a local anaesthetic at the venepuncture site.
5. Introduce a 19-gauge needle attached to a 5ml syringe with 0.5-1ml of saline. (In obese patients, the inner needle from an 18g or 16g IV cannula or Cook's needle may be required). The needle, directed cephalad, should enter the skin directly over the femoral vein.
6. The needle and syringe are held parallel to the sagittal plane.
7. Directing the needle cephalad and posteriorly, slowly advance the needle while gently withdrawing the plunger of the syringe.
8. When a free flow of blood appears in the syringe, remove the syringe and occlude the needle with a finger to prevent air embolism.
9. Insert the guidewire and remove the needle.
10. Push directly down the line of the guidewire with the point of a #15 (or #11) scalpel to enlarge the skin puncture.
11. Thread the catheter and dilator assembly over the guidewire down to the skin surface.
12. Hold the end of the guidewire firmly. DO NOT ALLOW IT TO ADVANCE WITH THE CATHETER.

13. Advance the dilator and catheter assembly 2 cm at a time, grasping it close to the entry port each time and using a gentle twisting motion.
14. Advance the hub of the catheter to skin level, then remove the dilator and guidewire as one, placing thumb over end of catheter.
15. Aspirate to ensure catheter is in venous circulation.
16. Connect to primed intravenous tubing.
17. Affix the catheter in place (i.e. with suture), and dress the area.
18. Tape the intravenous tubing in place.

Complications of Femoral Venepuncture

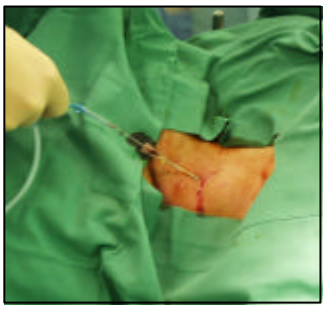
- Haematoma formation with vein perforation.
- Arterial puncture.
- Nerve injury.
- Cellulitis.
- Thrombosis.
- Phlebitis.
- Arteriovenous fistula.
- Lost catheters and guidewires.
- Improperly placed catheters.
- Air embolism.

SUBCLAVIAN APPROACH FOR CVC

Not to be used in resuscitation room. Use with caution in patients with head injury as positioning required will increase ICP!

Procedure

1. Place the patient in a supine position, at least 15 degrees head-down to distend the neck veins and to prevent air embolism. Turn the patient's head away from the venepuncture site. The patient must be monitored by ECG to allow detection of arrhythmias.



2. This is a surgical procedure and sterility is of utmost importance. A proper scrub and donning of mask, sterile gown and gloves are essential.
3. Cleanse the skin well and widely around the venepuncture site and drape the area carefully.
4. If the patient is awake, use a local anaesthetic (1% Lignocaine) at the venepuncture site.
5. Introduce a 5 cm Cook's needle, attached to a 5-ml syringe (with 0.5-1 ml of saline optional), 1 cm below the junction of the middle and medial thirds of the clavicle.
6. The needle and syringe are held parallel to the frontal plane.
7. Direct the needle medially, slightly cephalad, and posteriorly behind the clavicle toward the posterior, superior angle of the sternal end of the clavicle (toward finger placed in the suprasternal notch).
8. Slowly advance the needle while gently withdrawing the plunger of the syringe.
9. When a free flow of blood appears in the syringe, remove the syringe and occlude the needle with a finger to prevent an air embolism.
10. Insert the guidewire to about 20 cm and withdraw the needle.
11. Push the point of the scalpel along the line of the guidewire to enlarge the skin opening.
12. Dilate the tract by threading the dilator over the guidewire.
13. Remove dilator, leaving guidewire in place.
14. Insert the catheter to a predetermined depth (tip of catheter should be above the right atrium for fluid administration).
15. Remove the guidewire and use a syringe to aspirate blood to ensure intravenous catheter placement.
16. Connect the catheter to the intravenous tubing. Aspirate and flush all unused lumens with normal saline to prevent clotting.
17. Suture the catheter in place and cover with a sterile transparent dressing.

18. Obtain a chest x-ray to ascertain position of the catheter tip and to exclude pneumothorax.

Complications of Subclavian Approach:

- Arterial puncture.
- Pneumothorax / haemothorax.
- Line sepsis.
- Thrombosis.
- Cardiac arrhythmia.
- Air embolism.
- Phrenic nerve injury.
- Thoracic duct injury on left.

INTERNAL JUGULAR APPROACH

Not to be used in resuscitation room. Use with caution in patients with head injury as positioning required will increase ICP!

Indications:

As for subclavian venepuncture.

The internal jugular route may be preferred in a number of circumstances. These are:

1. When the operator is more skilled and confident at using that route.
2. Where a coagulopathy is known to exist.

The disadvantages are a higher risk of infection and slightly higher risk of arterial puncture. The lines are also more difficult to secure and immobilise.

Procedure:

1. Place the patient in a supine position, at least 15 degrees head-down to distend the neck veins and to prevent air embolism. Turn the patient's head away from the venepuncture site. The right internal jugular is usually preferred as the internal jugular and brachiocephalic veins and the superior vena cava are in a straight line.
2. This is a surgical procedure and sterility is of utmost importance. A proper scrub and donning of mask, sterile gown and gloves are essential.
3. Cleanse the skin well and widely around the venepuncture site and drape the area carefully.
4. If the patient is awake, use a local anaesthetic (1% Lignocaine) at the venepuncture site.
5. Introduce a Cook's needle attached to a 5ml syringe (with 0.5-1ml of saline) into the centre of the triangle formed by the two lower heads of the sternomastoid and the clavicle.
6. Direct the needle caudally, parallel to the sagittal plane, at a 30-degree posterior angle with the frontal plane.
7. Slowly advance the needle while gently withdrawing the plunger of the syringe.
8. When a free flow of blood appears in the syringe, remove the syringe and occlude the needle with a finger to prevent air embolism. If the vein is not entered, withdraw the needle and redirect it 5 to 10 degrees laterally.
9. Alternatively, the internal jugular vein may be punctured halfway along an imaginary line joining the mastoid process and the sternoclavicular joint, immediately lateral to the carotid pulse.
10. Insert the guidewire to about 20 cm and withdraw the needle.
11. Push the point of the scalpel along the line of the guidewire to enlarge the skin opening.
12. Dilate the tract by threading the dilator over the guidewire.
13. Remove dilator, leaving guidewire in place.
14. Insert the catheter to a predetermined depth (tip of catheter should be above the right atrium for fluid administration).
15. Remove the guidewire and use a syringe to aspirate blood to ensure intravenous catheter placement.

16. Connect the catheter to the intravenous tubing. Aspirate and flush all unused lumens with normal saline to prevent clotting.
17. Suture the catheter in place and cover with a sterile transparent dressing.
18. Obtain a chest x-ray to ascertain position of the catheter tip and to exclude pneumothorax.

Complications of Internal Jugular Approach:

- Arterial puncture.
- Pneumothorax / haemothorax.
- Line sepsis.
- Thrombosis.
- Cardiac arrhythmia.
- Air embolism.
- Phrenic nerve injury.
- Brachial plexus injury.

Equipment

The choice of catheter depends on the indication for the cannulation.

- Single, double or triple lumen catheters are not suitable for fluid resuscitation due their small caliber and long length. They are used in the trauma setting only to allow central venous pressure monitoring and infusion of drugs.
- Large bore (7.5 Fr or 8.5 Fr) cannulae are appropriate for rapid infusion.
- Sterile swabs.
- Skin preparation solution.
- Drapes.
- Syringe and needle for injection of local anaesthetic.
- Lignocaine 1%.
- Scalpel blade.
- Suture / needleholder.
- Normal saline for flushing lines.
- Sterile transparent dressing.

Pitfalls and traps

- Central venous cannulation should only be considered when peripheral cannulation is unsuccessful. Unless a large bore cannula is used, it is also inadequate for rapid infusion of fluid.
- In any catheter over guidewire technique, it is essential that the guidewire is not advanced with the catheter. The wire should be held firmly in one hand, while the catheter is advanced with the other.
- **Short** (i.e. not a CVC catheter), large bore (7.5-8.5 French) catheters only should be used. Central lines are too small and too slow for trauma resuscitations.
- **When surface anatomy is unclear**, a cannula can be used instead of the Cook needle. This allows easier connection to a transducer or manometer to exclude arterial puncture and to avoid subsequent dilation of the artery.

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