SIMULATION with SKILLS: Trauma

Skills to be practised and assessed during the trauma simulations:

- MILS
- 20° tilt

Skills to be demonstrated and discussed during the trauma simulations:

- pelvic binder – candidates should practise applying these to themselves or the manikin

Candidates should be informed that the skill will be assessed when they prepare to perform it.

Skills to be demonstrated and discussed during the trauma simulations/learning conversations:

- splints and tourniquet application
- finger thoracostomy and chest drain landmarks/insertion
- familiarity with chest drain equipment
- analgesia including femoral nerve block

SET

We are now going to practise the skills required in this simulation. These are ……..

During the simulation, the initial candidate should perform the skill “in real time”. Following the closure of the simulation with any teaching points clarified as necessary, the rest of the candidates should perform the skills until competent.

The following is for background information about each of the skills and to give you context if questions are asked.

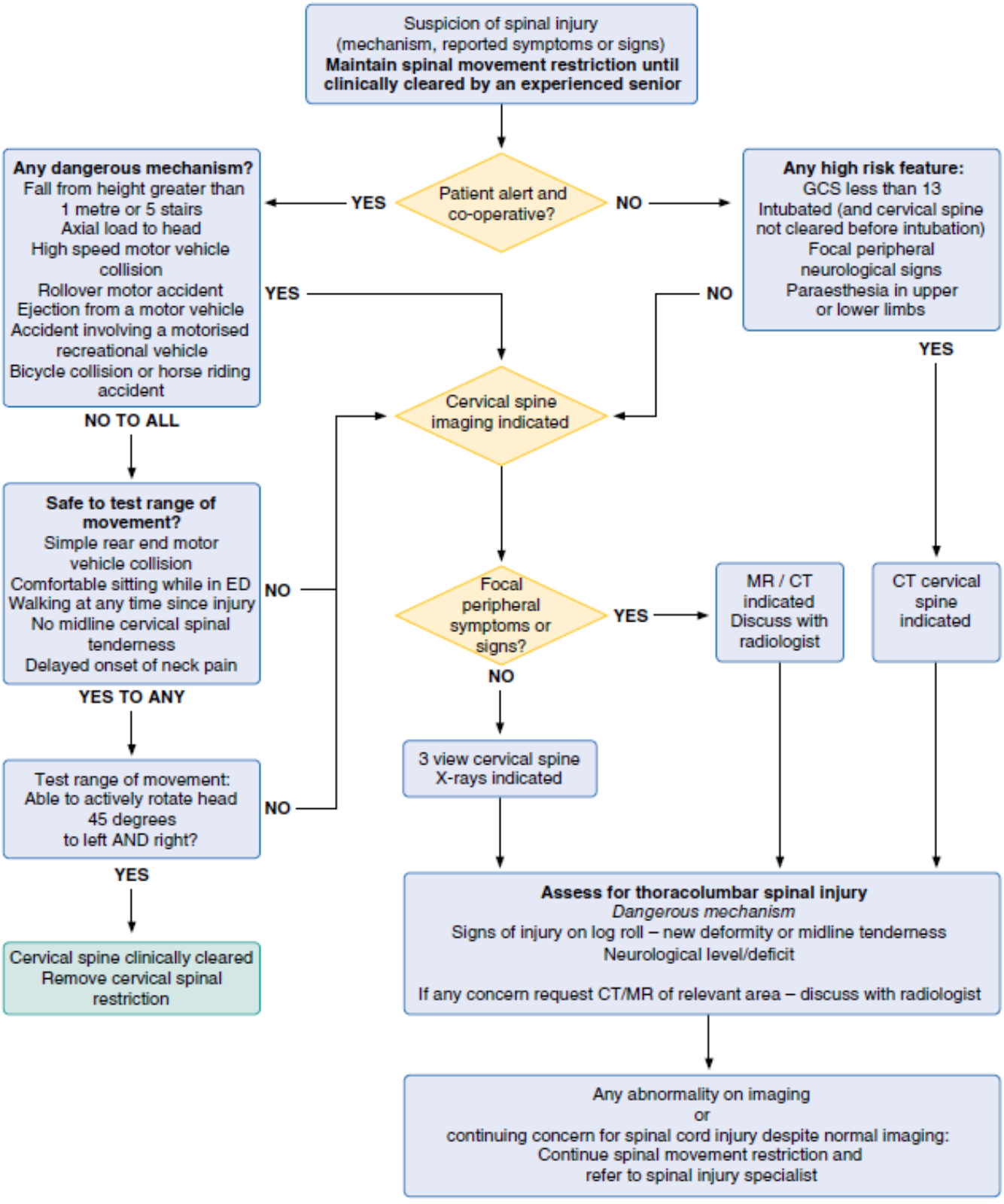
Remember however that you are coaching not teaching these skills.

Skills that are being assessed have the key assessment points listed in the tables.

CERVICAL SPINE IMMOBILISATION

This algorithm is specifically for those children **with a suspected spinal injury.**
Most children do not have spinal injuries and therefore accurate assessment and clearance of the cervical spine is essential.

Spinal



MANUAL IN-LINE STABILISATION (MILS)

All children with serious trauma must be treated as though they have a spinal injury. It is only when an adequate examination and history is taken, and appropriate investigations have been performed that the decision to remove the spinal protection can be made. This should be as soon as possible. Specialist consultation may be needed prior to this decision.

Where there is risk of neck injury, manual in-line cervical stabilisation should be continued until the head blocks and tape have been applied or the cervical spine has been cleared clinically (see below).

APLS providers would not be expected to clear a c-spine. This should be an expert' decision.

APPLICATION OF HEAD BLOCKS AND TAPE

Assessment table

Application of head blocks and tape	Performed (Y/N)
Reassures child and talks through application procedure	
Ensure in-line cervical stabilisation is maintained by a second person throughout. *(see picture above)*	
Place a head block either side of the head.	
Apply the forehead strap and attach it securely to the trolley	
Apply the lower strap across the chin and attach it securely to the trolley.	

Once the head blocks are in place, the neck may be obscured. Before application of the head blocks, look for the following signs quickly and without moving the neck:

- Distended veins
- Tracheal deviation
- Wounds
- Laryngeal crepitus
- Subcutaneous emphysema
- Visible blood at external auditory meatus

Exceptions

An injured child may be uncooperative for many reasons including fear, pain and hypoxia. Manual immobilisation should be maintained and the contributing factors addressed. Overzealous immobilisation of the head and neck may paradoxically increase the leverage on the neck as the child struggles. Children with traumatic torticollis should be manually immobilised in their current position.

MINIMAL HANDLING – 20° TILT

In order to minimise the chances of exacerbating unrecognised spinal cord injury and disruption of a clot in major abdominal trauma, non-essential movements of the spine must be avoided until adequate examination and investigations have excluded them. If manoeuvres that might cause spinal movement are essential (e.g., examination of the back for the secondary survey) or the child needs to be removed from a scoop stretcher, then the **20° tilt** should be performed. The aim of the **20° tilt** is to maintain the alignment of the spine during turning of the child. The basic requirements are an adequate number of carers and good control.

In blunt trauma the **20° tilt** should take place if required after the trauma CT. The child's injuries should be assessed with the minimal amount of handling, but if hidden injury suspected the 20° tilt should be performed with a team of 3-4 members as indicated below. It is extremely important to ensure that the tilt is performed consistently and carefully without twisting the spine or torso in a controlled manner.

Assessment table

<table>
<tr><th>20° tilt</th><th>Performed (Y/N)</th></tr>
<tr><td>Gather together enough staff to tilt the child – 3 for infants/small children, 4 for larger children:

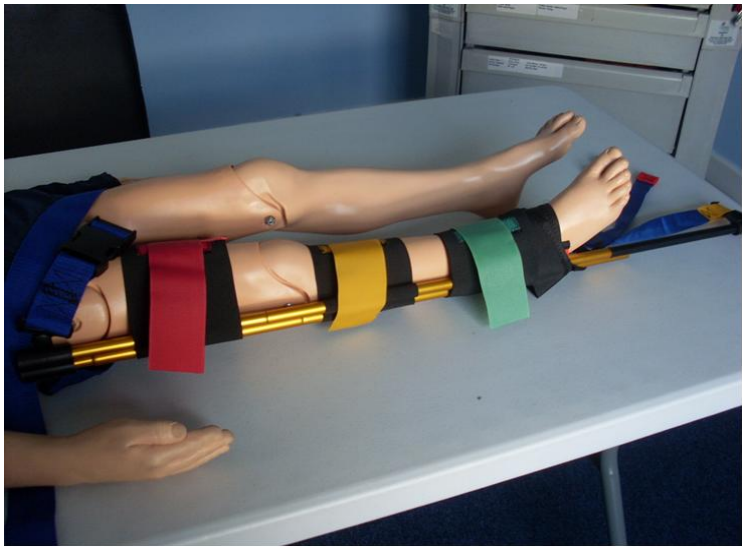
Table 21.1 Position of staff for the 20° tilt
<table>
<tr><th></th><th colspan="2">Position of staff for:</th></tr>
<tr><th>Staff member no.</th><th>Smaller child and infant</th><th>Larger child</th></tr>
<tr><td>1</td><td>Head</td><td>Head</td></tr>
<tr><td>2</td><td>Chest</td><td>Chest</td></tr>
<tr><td>3</td><td>Legs and pelvis</td><td>Pelvis</td></tr>
<tr><td>4</td><td></td><td>Legs</td></tr>
</table>
</td><td></td></tr>
<tr><td>Reassures child and talks through the tilt</td><td></td></tr>
<tr><td>Place the staff as shown in the pictures below:
 
  </td><td></td></tr>
<tr><td>Ensure each member of staff knows what they are going to do.</td><td></td></tr>
<tr><td>Carry out the essential manoeuvres as quickly as possible.</td><td></td></tr>
</table>

PERIPHERAL LIMB SPLINTAGE

Specific limb splintage should be demonstrated and discussed with the candidates including the principles of analgesia (including femoral nerve block), traction and application of a number of peripheral limb splints and neurovascular observations. (The image and instructions will be available as supporting laminates). Box splint, Kendrick splint, Thomas splint should be discussed in turn and their application and use explained.

Kendrick splint procedure

1. Institute manual in-line traction of the limb above and below the site of the injury.
2. Pass the upper thigh strap under the knee and carefully slide it so that it sits as high as possible towards the groin, ensuring that the pole holes are on the outside of the leg.
3. Lengthen/shorten the pole so that it is one section length below the foot, comparing this to the non-fractured leg if possible.
4. Insert the pole into the holes of the upper thigh strap.
5. Next apply the ankle hitch, the padding to the back of the ankle.
6. Once this is complete, use the yellow tabbed part of the ankle strap to secure the black section of the ankle pole.
7. Carefully slide the three bracing straps under the leg with the Velcro on the inside of the leg, colour side down.
8. Green is the shortest and sites at the ankle, yellow sits just above the knee, red is placed at thigh-level.
9. Ensure that the straps are not level with any joints or possible fracture sites.
10. Fasten the yellow knee strap, ensuring it wraps over the pole.
11. Pull the red tabbed part of the ankle strap for tension, remembering to push the pole gently in the opposite direction in order to apply a small amount of counter-tension.
12. Tighten the system by fastening the green strap.
13. Traction should be applied until the leg is comfortably under traction and in anatomical alignment.
14. Check distal perfusion.
15. The green ankle strap and the red thigh strap can now be applied and manual traction released.



Femoral nerve block

The femoral nerve supplies the femur with sensation, and a block is useful in cases of femoral fracture. The technique may also be of benefit when analgesic agents would interfere with the management or assessment of other injuries. A long-acting local anaesthetic agent should be used so that radiographs and splinting can be undertaken with minimal distress to the child.

PELVIC SPLINTAGE

Stabilisation of a pelvic injury before uncompensatable haemorrhage has occurred and clotting mechanisms are still intact should be done as early as possible after the injury. A pelvic splint should therefore be applied during the circulatory 'C' element of primary survey. The binder should be used in children with a suspected rotational or vertically unstable pelvic fracture. **Remember, that first clot is best clot and avoid excessive movement of the child** (see minimal handling below).

When assessing a child in a trauma situation, the pelvis should not be palpated for instability or pain. A conscious child may be able to give information about pain in the lower back, groin or hips. Once a splint has been applied, analgesia may be provided to a haemodynamically stable child prior to transfer.

When applied correctly, the flat square portion of the pelvic binder should be under the patient's buttocks and the middle strap should overlap the child's greater trochanteric and pubic region (see note below about devices used in younger children).

NB. A strap should not be applied above the iliac crests as this can increase abdominal pressure. Replacement of the pelvic binder should only be considered in the child who is haemodynamically stable.

Procedure

1. Prepare the pelvic binder for application. This preparation will vary depending on the model used but ensure that you will be able to pass it easily under the child during either the 20^{o} tilt or the vertical lift. If the child is arriving in the department and you know that a pelvic binder will be required, have this available on the trolley/bed ready for their arrival.
2. Undress the patient fully, or if not possible, remove all objects form the child's pockets and pelvic area.
3. During the 20^{o} tilt or the vertical lift place the pelvic binder under the child ensuring that they will return to the correct position on the binder when returned to the trolley/bed.
4. Slide the pelvic splint under the patient at the level of the greater trochanters.
5. Secure the strap over the symphysis pubis and greater trochanteric region first in devices where there are multiple straps. Further straps should be placed
    a. between the anterior superior iliac spine and iliac crests and
    b. at the level of the symphysis pubis and ischial tuberosity
6. Check the patient for the following: pulses, pockets, phones and genitalia
7. Where possible, use a splint applicator to reduce friction and patient movement. Once in place, remove the upper applicator in the same direction that it was inserted.
8. Ensure the splint is still located at the greater trochanter level, and then fasten as per the manufacturer's directions.

Complications

- Increased blood loss
- Misplaced binder

Removal

Currently there is no standard guidance on the removal of the pelvic binder within the emergency department, however this should be carried out on the advice of a paediatric pelvic specialist.

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In young children where commercially available binders do not fit it has been suggested that circumferential pelvic sheeting is an option. A folded sheet should be placed underneath the patient between the iliac crests and greater trochanters. Two team members should cross the sheet across the pubic symphysis and pull the sheet firmly. Twist the ends together and secure with a plastic clamp where possible.

TOURNIQUETS

Tourniquets are an effective means of arresting life-threatening external haemorrhage from a limb injury. There are a wide variety of commercial tourniquets available, and in a hospital setting it may also be possible to use a pneumatic tourniquet from theatres to allow monitoring and control of pressure settings. The tourniquet is designed to completely and consistently occlude arterial blood flow. The UK Defence Medical Services selected the Combat Application Tourniquet® (North American Rescue Products, Inc., USA) after experimental studies showed 100% effectiveness in occluding distal arterial flow using human volunteers (King et al., 2006). In civilian practice it is rare to encounter catastrophic external haemorrhage from a limb, but these scenarios can be encountered in the context of stabbings, firearms incidents, industrial accidents and major incidents.

Indications for use

- Extreme life-threatening limb haemorrhage or limb amputation/mangled limb with multiple bleeding points, to allow immediate management of airway and breathing.
- Life-threatening limb haemorrhage when simple methods fail to control the haemorrhage.
- Major incident or multiple casualties with extremity haemorrhage.
- Where the benefits of preventing death from hypovolaemic shock by cessation of ongoing external haemorrhage are greater than the risk of limb damage or ischaemia caused by tourniquet use (Lee et al., 2007).

Procedure

1. The tourniquet should be placed as distal as possible, but at least 5 cm proximal to the injury.
2. Spare the joints as much as possible.
3. Apply directly to the skin to avoid slipping.
4. The effectiveness is determined by the cessation of external haemorrhage and not by the presence or absence of a distal pulse.
5. If bleeding persists, a second tourniquet can be placed just proximal to the first.
6. The time of application must be recorded.

Complications

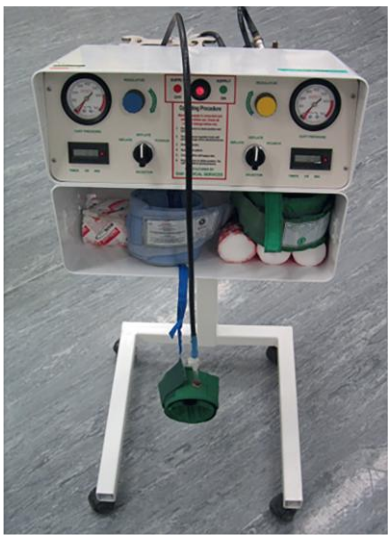
- Permanent nerve injury.
- Permanent muscle injury (including contractures, rhabdomyolysis and compartment syndrome).
- Vascular injury.
- Skin necrosis (Wakai et al., 2001).

Removal

Assuming that the tourniquet has been applied for the correct indications, a decision will need to be made regarding its continued use. It is possible that after a period of time of reduced arterial blood flow from tourniquet use, clotting will have occurred sufficiently to arrest haemorrhage, allowing simpler methods to be effective and reducing the complications from continued tourniquet use.

Before release of the tourniquet, the clinician should have secured wound packing and application of direct pressure over the bleeding point. The torniquet must be replaced with a pneumatic torniquet as soon as possible as they are much more controllable and safer to use. This decision will be taken depending on multiple factors including the haemodynamic status of the child, the medical resources available and the time to definitive treatment in the operating room.

The Combat Application Tourniquet®



Pneumatic Tourniquet

Finger thoracocentesis followed by chest drain placement

The procedure for finger thoracocentesis is the same as the initial steps (steps 1–6 below) undertaken using the open technique for placing a chest drain. Be aware that in infants and small children, it may not be possible to clear a path using a finger sweep (step 6). In general, the largest size drain that will pass between the ribs should be used, as a guide use size 4 × endotracheal tube size.

Minimum equipment

- Gloves
- Skin preparation and surgical drapes
- Scalpel
- Blunt dissecting forceps
- Large clamps ×2
- Suture and tape
- (Local anaesthetic)
- Scissors
- Chest drain tube
- Underwater seal

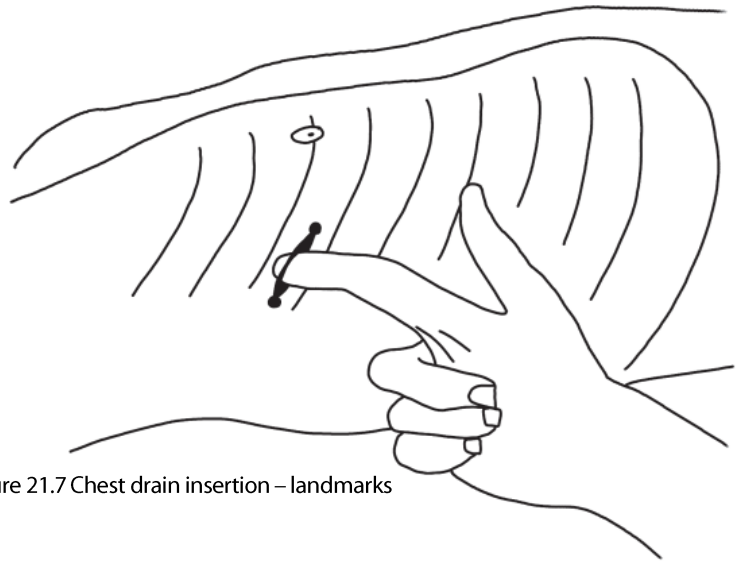


Figure 21.7 Chest drain insertion – landmarks

Procedure

1. Decide on the insertion site (usually the fifth intercostal space in the mid-axillary line) on the side with the pneumothorax/fluid (Figure 21.7).
2. Swab the chest wall with surgical preparation or an alcohol swab.
3. Use local anaesthetic if necessary.
4. Make a 2–3 cm skin incision along the line of the intercostal space, just superior to the rib below.
5. Using the dissecting forceps, bluntly dissect through the subcutaneous tissues through the incision just made until you puncture the parietal pleura.
6. Clear a path into the pleura (Figure 21.8). This can usually be done using a gloved finger but may not be possible in infants and small children when just forceps should be used.

Chest drain placement (steps 7–11)

7. Advance the chest drain tube into the pleural space during expiration. Using a clamp on the tip of the drain may be helpful to guide the drain through the track. Advance the tube until all the holes are in the pleural cavity.
8. Ensure the tube is in the pleural space by listening for air movement, and by looking for fogging of the tube during expiration.
9. Connect the chest drain tube to an underwater seal.
10. Suture the drain in place, and secure with tape.
11. Obtain a chest radiograph.

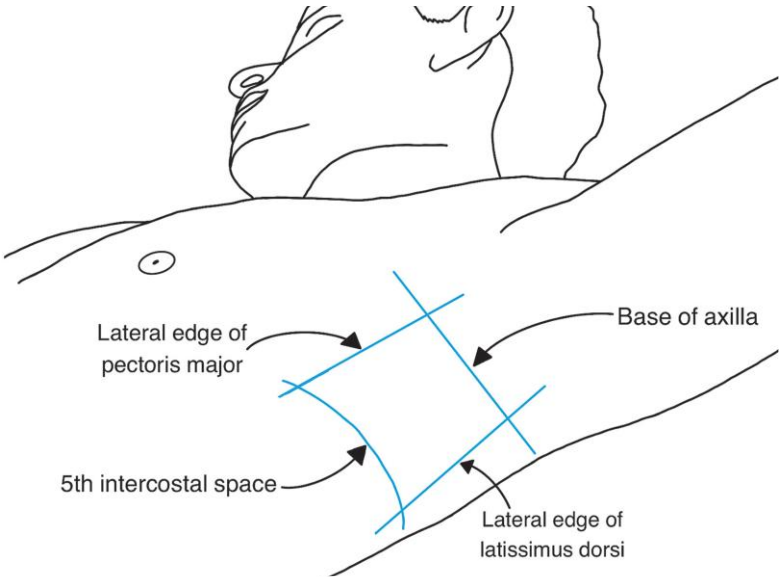


Figure 21.8 Chest drain insertion clearing the path