



Queensland Government
Queensland **Health**

Simulation facilitator manual

Skills training program: Insertion of chest tubes in adults



Skills training program: Insertion of chest tubes in adults

Simulation Facilitator's manual

This manual is for Simulation Facilitators who are delivering the simulation component of the chest tube insertion program for doctors.

Table of Contents

SKILLS TRAINING PROGRAM: INSERTION OF CHEST TUBES IN ADULTS	1
OVERVIEW OF PROGRAM	4
ONLINE COMPONENT OF PROGRAM	5
SIMULATION COMPONENT OF PROGRAM	5
<i>Pre-requisites</i>	5
FLOWCHART OF CHEST DRAIN INSERTION PROGRAM	6
HOW TO CONDUCT THE SCENARIOS.....	7
PART 1. INSERTING A CHEST TUBE IN AN UNCOMPLICATED PATIENT SCENARIO	7
<i>Assessing part 1:</i>	7
PART 2. ASSESSING RISK AND MANAGING COMPLICATIONS WHEN INSERTING CHEST TUBES IN MORE	
COMPLEX SCENARIOS	8
<i>Constructing the scenario</i>	8
<i>Risk factors for an adverse outcome</i>	9
<i>Scenario examples</i>	11
<i>Assessment part 2</i>	11
ASSESSMENT TOOL 1A.....	12
CRITERIA SHEET FOR INSERTING LARGE BORE CHEST TUBE BY BLUNT DISSECTION	14
ASSESSMENT TOOL 1B.....	15
CRITERIA SHEET FOR INSERTING SMALL BORE CATHETERS BY SELDINGER TECHNIQUE	17
ASSESSMENT TOOL 2	18
ROLES AND RESPONSIBILITIES OF STAKEHOLDERS	19
THE SIMULATION FACILITATOR	19
THE PROCEDURAL EXPERT	19
HOW TO ORGANISE SIMULATION SKILLS TRAINING	20
STAGE 1 - PLANNING A SIMULATION ACTIVITY	20
STAGE 2 - LEAD-UP TO SIMULATION ACTIVITY	20
STAGE 3 - ON THE DAY	20
FLOWCHART FOR MANAGING A SIMULATION SKILLS TRAINING ACTIVITY	21
THE ENVIRONMENT AND EQUIPMENT	22
PREPARING THE ENVIRONMENT	22
EQUIPMENT FOR INSERTION OF A CHEST TUBE	22
THE MANNEQUIN.....	23

Online component of program

This simulation skills training has been designed to integrate with, and run in collaboration with, the online course:

'Insertion of chest tubes and management of chest drains in adults'

This course is available at:

- Queensland Healthstaff– http://www.sdc.qld.edu.au/course_chest_drain.php
- Others –
 - <http://www.safetyandquality.gov.au/our-work/healthcare-associated-infection/building-clinician-capacity/>

Prior to undertaking simulation skills training, participants should consider completing the relevant online learning.

- All participants
 - "Assessing risk and minimising complications in chest tube insertion"
- Less experienced candidates or failure to achieve required mark in the online assessment quiz
 - "Anatomy refresher"
 - "Insertion of large bore chest tube by blunt dissection in adults" and/or
 - "Insertion of small bore catheter by Seldinger techniques in adults"
- Completing the on-line assessment quiz and achieving a pass mark of 14/15 is a **mandatory requirement** and a pre-requisite to attending simulation training. A copy of the online quiz with the result must be printed and taken to simulation training.

Simulation component of program

The simulation skills training has been designed in 2 parts. Doctors practise and demonstrate hands-on skills when:

Part 1. Inserting a chest tube in an uncomplicated patient

Part 2. Assessing risk and managing complications in more complex simulation scenarios involving insertion of a chest tube

Pre-requisites

1. Doctors attending the simulation environment must tender proof of achieving a pass mark of at least 14/15 in the on-line assessment quiz.
2. Demonstrating competency in insertion of a chest tube in a mannequin is a pre-requisite to proceeding to the more complex scenarios.



Golden Rule!

Completing the on-line assessment and achieving a pass mark of 14/15 is a mandatory requirement and a pre-requisite to attending simulation training.

Overview of program

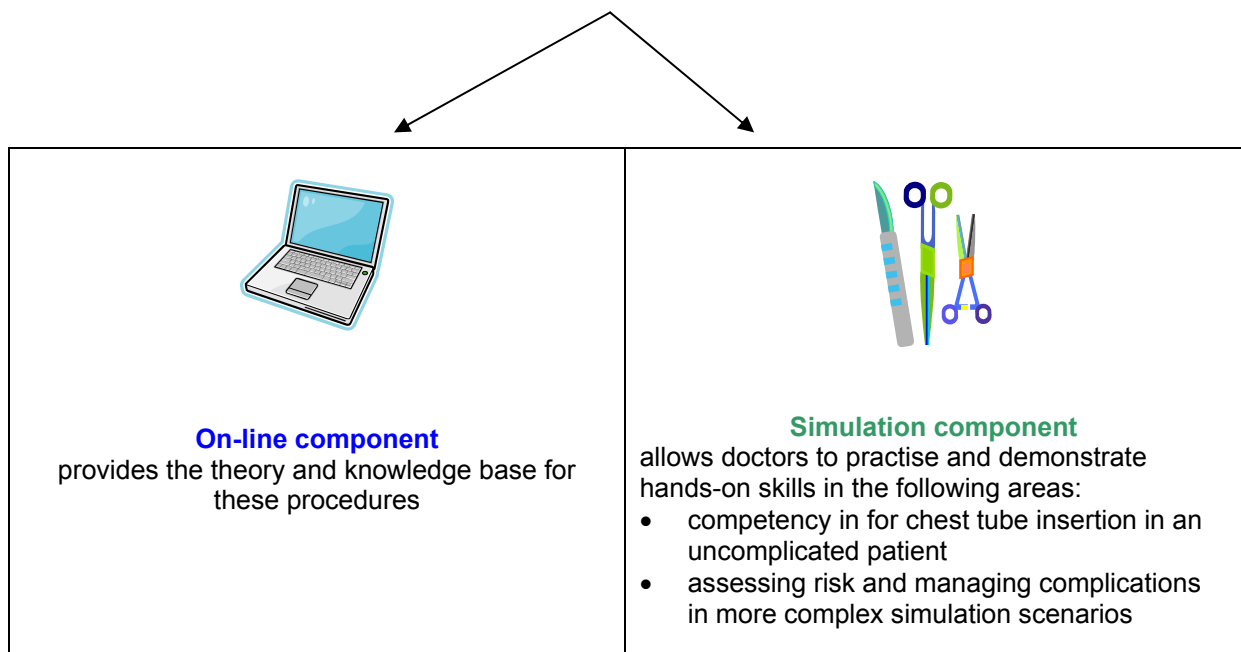
The insertion of a chest tube of any size and by any insertion method may result in significant iatrogenic injury. The objective of this program is to improve patient safety in clinical environments by advancing, both the skills and clinical judgement of medical officers inserting chest tubes.

Online education and assessment tools for simulation training are available for

- large bore chest tubes inserted by blunt dissection and
- small bore catheters inserted by Seldinger technique.

Doctors may wish to train in one or both techniques, depending on clinical practice at their institution.

The complete chest tube insertion program for doctors consists of two components:



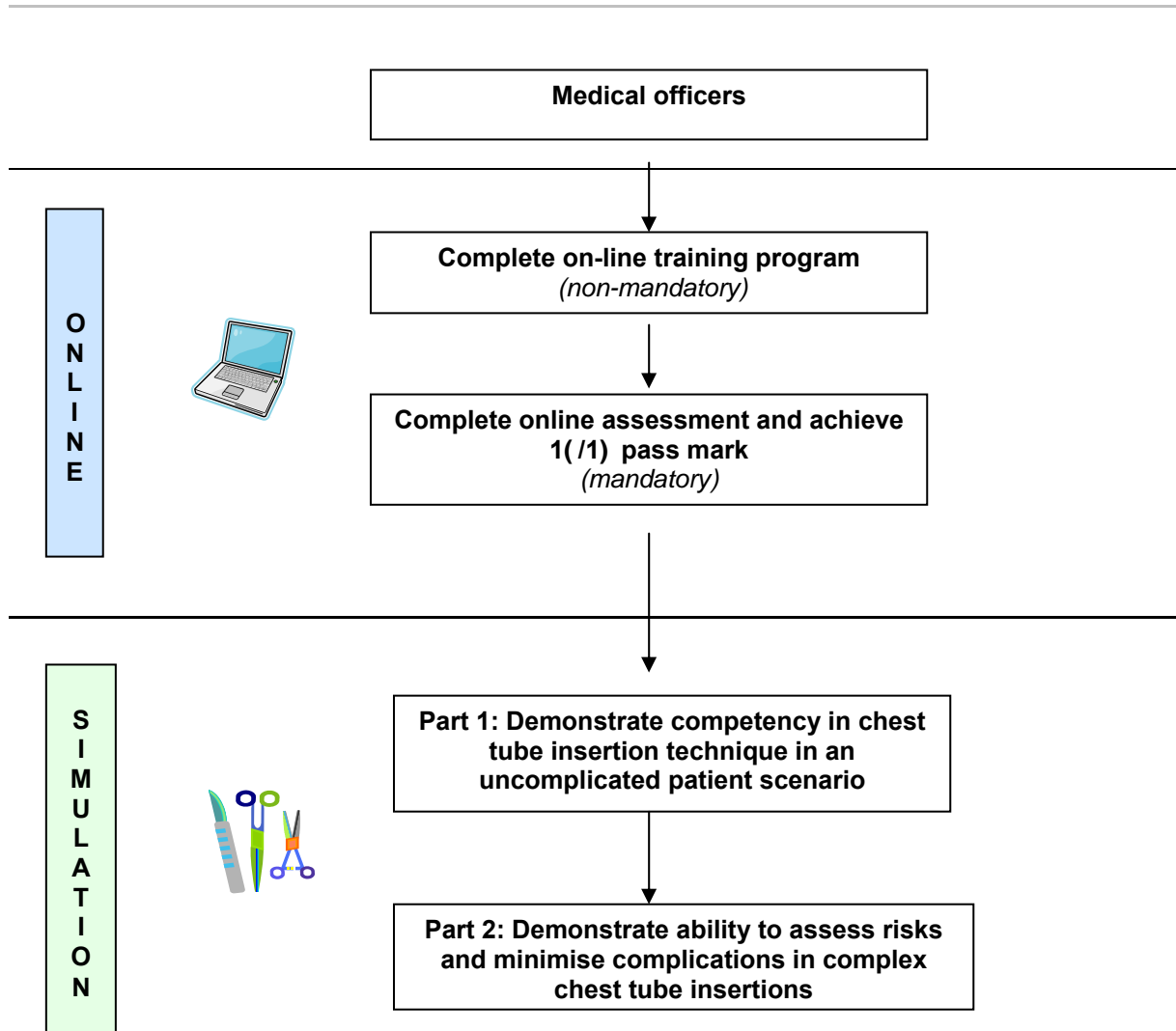
Caution!

This program provides training in what is considered to be a safe approach to inserting a chest tube. It does not represent a “gold standard” or standard of care. Substantial variations in practice occur in clinical practice, which are likely to be of comparable safety and efficacy.

On-line education and simulation training do not replace the need for supervision/observation of chest tube insertion in patients prior to independent practice.

Flowchart of chest drain insertion program

Figure 1 - Flowchart for chest drain insertion skills training for doctors



How to conduct the scenarios

Part 1. Inserting a chest tube in an uncomplicated patient scenario

Learning objective for part 1 of the simulation training is for the participant to:

- Be able to safely insert a chest tube in an uncomplicated patient

The Procedural Expert is responsible for:

- Demonstrating chest tube insertion for novice participants
- Guiding the participant through one or more practice runs
- Assessing and recording the participant's skill, on a final "run" using the assessment tool
- Providing feedback and reflecting with the participant on their performance.

The Simulation Facilitator is responsible for:

- Set-up of the simulation room, equipment and mannequin in consultation with the Procedural Expert
- Assisting the participant in the scenarios (Ideally this role would be undertaken by a nurse who will be working with the training doctor).

Assessing part 1:

Use the following assessment tools:

For insertion of large bore chest tube by blunt dissection

- Assessment tool 1A - Assessment sheet for inserting large bore chest tubes by blunt dissection
- Criteria sheet for inserting large bore chest tube by blunt dissection

Complete assessment tool 1A for each participant, using the criteria sheet, for more detail, where necessary.

For insertion of small bore catheters by Seldinger technique

- Assessment tool 1B: Assessment sheet for insertion of small bore catheter by Seldinger technique
- Criteria sheet for insertion of small bore catheter by Seldinger technique

Complete Assessment tool 1B for each participant, using the criteria sheet for more detail where necessary.

Part 2. Assessing risk and managing complications when inserting chest tubes in more complex scenarios

Before a participant can move onto part 2 of the simulation skills training program, they must first demonstrate that they can safely insert a chest tube in the simulation mannequin.

Learning objective for part 2 of the simulation training is to:

- demonstrate and practise hands-on skills in assessing risk and managing complications, when inserting a chest tube in more complex simulation scenarios

The Procedural Expert is responsible for:

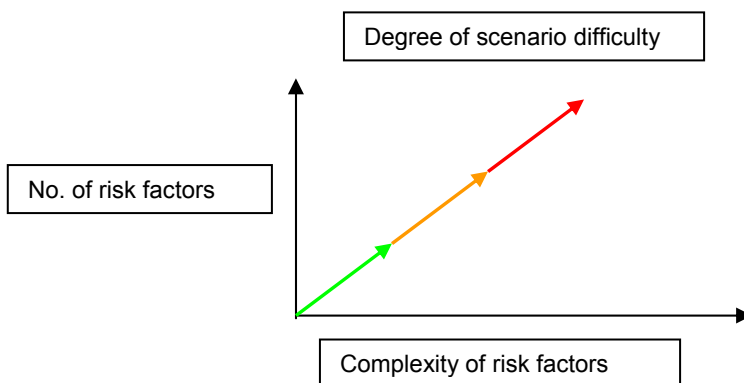
- Selecting the simulation scenarios
- Guiding the participant through the scenarios
- Assessing and recording the participant's skills
- Providing feedback and reflecting with the participant on their performance.

The Simulation Facilitator is responsible for:

- Set-up of the simulation room, equipment and mannequin in consultation with the Procedural Expert
- Assisting the participant, as Stimulation Facilitator, in the scenarios.

Constructing the scenario

The degree of difficulty of the scenarios can be adjusted by varying the type and number of risk factors or confounders included in a specific scenario.



Use the following list of risk factors to construct scenarios for training. They have been organised according to a PEEP framework:

- **P**eople
- **E**quipment
- **E**nvironment
- **P**rocedures.



Practice tip!

For examples of scenarios constructed using the risk factor list, see the boxed examples in the page following the list.

Risk factors for an adverse outcome

People-related risk factors

Doctor-related (and Facilitator-related)

- Inexperience
- Fatigue
- No access to expertise
- Distraction
- Anxiousness
- Time-pressure

Patient-related

1. Haemodynamic instability

2. Coagulopathy (e.g. coagulopathy, DIC, pro-coagulant)

- Warfarin, heparin
- Anti-platelet agent, e.g. aspirin, clopidogrel

3. Impaired respiratory function (e.g. COPD, hypoxia: lung-related, hypoxia: CNS depression)

4. Patient behaviour

- Agitated
- Hypoxia, e.g. COPD
- Anxiety
- Hypovolaemia
- Pain
- Blood glucose levels
- Mental Health, e.g. dementia
- Intellectual impairment

- Decreased consciousness

5. Other co-morbidities

- That increase the risk of infection, e.g. diabetes, skin infections, immunosuppression
- That increase risk of death from other conditions
- Unstable angina

6. Ability to position patient appropriately for the procedure

- Elderly
- Heart failure (orthopnea)
- Musculoskeletal abnormalities
- Women with pendulous breasts

7. Body habitus

- Overweight
- Obese, morbidly obese

8. Altered external anatomy

- Musculoskeletal abnormalities, e.g. scoliosis or other thoracic wall abnormality
- Previous surgery
- Flail chest
- Subcutaneous emphysema

9. Altered internal anatomy:

- bullous disease
- lung/ pleural surgery, e.g. pneumonectomy
- elevated hemi-diaphragm due to phrenic nerve palsy
- pleural adhesions
- cardiac/aortic surgery
- radiotherapy

Risk factors for an adverse outcome *cont.*

Equipment-related risk factors

- Incorrect chest drain insertion equipment and not adapted to pt, e.g. long instruments and needles for obese or subcutaneous. emphysema patients
- No access to resuscitation equipment
- No access to imaging or inadequate imaging
- No access to monitoring equipment

Environment-related risk factors

- Inadequate lighting
- Inappropriate and safe location, e.g.? roadside
- Not enough room to manoeuvre
- Unclean environment
- Lack privacy

Procedure-related risk factors

Risks related to difficulty in completing the steps of the insertion procedure:

- Step 1 - Select and mark the insertion site
- Step 2 – Choose chest tube and check equipment
- Step 3 - Prepare the patient
- Step 4 - Local anaesthetic
- Step 5 - Incise skin and dissect to the pleura (large bore chest tube)
- Step 6 - Insert the tube
- Step 7 - Anchor the tube - suturing
- Step 8 - Connect the tube to a drain
- Step 9 – Dress the site
- Step 10 - Confirm tube placement

No access to supervision for inexperienced staff

Scenario examples



Examples!

Here are 3 different training scenarios constructed using confounders, chosen from the risk factor list. These scenarios test the ability of a trainee to identify risks, take steps to mitigate them and perform the insertion procedure.

1. Insert a chest tube in a patient who is obese

This scenario contains one patient-related risk factor that is operative at many steps throughout the insertion procedure. For this scenario, the trainee is given the patient's BMI as part of the patient history. The trainee should be able to identify the steps in the procedure impacted by the patient's obesity, and suggest or demonstrate actions to eliminate/minimise risk. For example:

- **risk identification:** recognise that standard equipment may not be suitable for special needs of obesity-
 - **action to address risk:** modify equipment before undertaking procedure, i.e. include spinal needles for injecting local anaesthetic, ensure artery forceps are long enough to dissect through to the pleural cavity.
- **risk identification:** recognise that inability to clearly identify the ribs and intercostal space by palpation increases the risk of insertion in wrong site and/or neurovascular damage-
 - **action to address risk:** bedside ultrasound guidance to ensure correct insertion site

2. Insert a chest tube in an uncomplicated patient where there is:

- **wrong equipment on tray**
- **inadequate lighting**
- **no assistant**

This scenario contains multiple equipment and environment-related risk factors which, together, increase the chance of an adverse outcome for the patient. These risk factors are not disclosed to the trainee, but are built into the set-up of the scenario, e.g. the curved artery forceps for dissecting are absent from the equipment tray, the procedural room is set up with inadequate lighting, and part-way through the scenario, the assistant says they have to leave. The trainee must identify these risks and take steps to mitigate them.

3. Insert a chest tube in a patient who:

- **has a left-sided traumatic haemothorax**
- **has severe chest pain and shortness of breath and is agitated**
- **has history of previous myocardial infarction**
- **develops 'crushing' chest pain moving to his jaw and left shoulder during set-up for procedure**

This scenario contains a patient-related risk factor which is potentially life threatening (possible MI). In this scenario, trainee should investigate and address chest pain, prior to starting procedure.

Assessment part 2

Use the following assessment tools:

- Assessment tool 2 - Global assessment for chest tube insertion in risk / complex scenarios

Complete assessment tool 2 for each participant, however, you may need to refer to Assessment tool 1A or 1B to ensure the relevant insertion procedure is being adhered to.

Assessment tool 1A

Date: _____ Participant Name: _____ Procedural Expert: _____

Assessment sheet for inserting large bore chest tubes by blunt dissection			
NOTE: Not all details will be simulated, however the participant must be able to fully describe these aspects. (e.g. aseptic technique)	Completes step		Comments
	Yes	No	
Step 1 - Select and mark the insertion site			
Performs risk assessment			
Checks consent			
Positions patient appropriately for chest tube insertion. *			
Determines the insertion site using appropriate anatomical markers. *			
Marks site of insertion with indelible marker.			
Considers ultrasound guidance for some scenarios e.g. loculated effusion			
Step 2 – Choose the chest tube and check equipment			
Checks that appropriate equipment is available, sterile, and on-hand.			
Selects appropriate sized tube without a trocar. *			
Step 3 – Prepare the patient			
'Time out' including confirming side and site for insertion by reviewing clinical signs and radiological investigations			
Considers premedication			
Obtains reliable venous access			
Uses a facilitator.			
Use strict aseptic technique. *			
Step 4 – Infiltrate local anaesthetic			
Uses adequate volume of local anaesthetic (3mg/kg Lignocaine 1% - 20ml / 70kg). *			
Infiltrates skin, subcutaneous tissue, muscle, periosteum and pleura along superior surface of rib margin. *			
When enters pleural space, aspirates with LA syringe to confirm right location and diagnosis.			
Waits 3- 5 minutes for the local anaesthetic to take effect			

* Refer to criteria sheet for additional information

Assessment tool 1A cont.

Assessment sheet for inserting large bore chest tube by blunt dissection			
	Completes step		
	Yes	No	Comments
Step 5: Incise the skin and dissect to the pleura			
Makes a horizontal incision along the superior surface of rib margin, and parallel to it			
Inserts wound closure suture (a mattress / interrupted suture(s)) loosely across middle of wound			
Uses blunt dissection utilising artery forceps (or similar), to spread subcutaneous fat, and muscle			
Punctures parietal pleura with tip of forceps			
Ensures track through the intercostal muscles is wide enough to allow easy passage of chest tube (forceps or finger)			
Digitally examines thoracic cavity to ensure no underlying organs are present			
Step 6: Insert the chest tube			
Inserts chest tube using artery forceps or guided by a finger			
Ensures all side holes of chest tube are inside the pleural cavity			
Attaches chest tube to chest drain or clamps the tube, while suturing and dressings are completed			
Operator asked how they would clinically confirm correct placement of chest tube, and correct answer given *			
Step 7: Anchor the tube – suturing			
Uses stout, non-absorbable suture material such as Mersilene 0 or silk 1 on cutting needle to suture tube			
Secures tube with stay or anchoring suture			
Ties the loose ends of wound closure suture together at distal end and winds around tube near skin			
Secures tubing to skin in manner to facilitate drainage and reduce tube dislodgment, e.g. using a mesenteric tag of tape			
Step 8: Connect the tube to a drain			
If not already connected, removes protective cap from end of drainage tube to chest drain and connects chest tube to chest drain. If used, removes clamp on chest tube			
Tapes junction of chest tube and drainage tube to prevent separation, and ensures connection remains visible			
Step 9: Dress the site			
Uses appropriate dressing			
Step 10: Confirm tube placement			
Confirms tube placement with an x-ray			
Step 11: Document the procedure			
Ensures procedure is documented in patient chart			

* Refer to criteria sheet for additional information.

Criteria sheet for inserting large bore chest tube by blunt dissection

Step 1: Select and mark the insertion site	
Positions patient appropriately for chest tube insertion – discuss alternative sites	<p>Axillary approach</p> <ul style="list-style-type: none"> Recline patient on bed at 30-60 degrees, slightly rotated with the arm on affected side abducted to expose axillary area (hand behind head, hand on hip or arm away from body) or Sitting upright leaning over adjacent table on pillow or lateral decubitus <p>OR Second intercostal space in mid-clavicular line - recline OR Posterior insertion – leaning over adjacent table on pillow</p>
Determines the insertion site using appropriate anatomical markers (requires live model)	<p>Preferred position is through 4th or 5th intercostal space, midaxillary or anterior axillary line, in a region bounded by:</p> <ul style="list-style-type: none"> lateral border of pectoralis major anterior border of latissimus dorsi 5th intercostal space, and apex in the axilla <p>Second intercostal space</p>
Step 2: Choose the chest tube and check equipment	
Selects appropriate sized tube without a trocar	<ul style="list-style-type: none"> Pneumothorax: 20 – 24 Fr (6.7- 8 mm) Effusion/pus: 20 – 28 Fr (8 – 9.3 mm) Blood/pus: 32 Fr (10.7 mm)
Step 3: Prepare the patient	
Use strict aseptic technique	<p>Dons personal protective equipment (PPE):</p> <ul style="list-style-type: none"> sterile gown and gloves, mask and protective eyewear <p>Cleans patient's skin with 2 applications of alcoholic chlorhexidine or povidone iodine 10% w/v solution Drapes site with sterile drapes</p>
Step 4: Infiltrate local anaesthetic	
Uses adequate volume of local anaesthetic – 3 mg/kg (Lignocaine 1%-20 ml/ 70 kg)	<p>Ask operator how they calculated dose of anaesthetic. Use of adrenaline (pre-mix vial) allows up to 5mg/kg lignocaine to be used</p>
Infiltrates skin, subcutaneous tissue, muscle, periosteum and pleura along superior surface of rib margin	<p>Ask operator to explain what anatomical structures they need to infiltrate</p>
Step 6: Insert the chest tube	
Clinically confirms correct placement of chest tube	<p>Correct placement of the chest tube can be clinically confirmed by observing:</p> <ul style="list-style-type: none"> fogging of chest tube with expiration movement of air/fluid through tube 'swinging', 'tidalling' or 'oscillating' of fluid level in water seal chamber

Assessment tool 1B

Date: _____ Participant Name: _____ Procedural Expert: _____

Assessment sheet for the inserting small bore catheter by Seldinger technique			
NOTE: Not all details will be simulated, however the participant must be able to fully describe these aspects. (e.g. aseptic technique)	Completes step		
	Yes	No	Comments
Step 1 – Risk assessment			
Performs risk assessment			
Checks consent			
Step 2 – Select and mark the insertion site			
Positions patient appropriately for chest tube insertion *			
Determines the insertion site using appropriate anatomical markers *			
Marks site of insertion with indelible marker			
Considers ultrasound guidance for some scenarios, e.g. loculated effusion			
Step 3 – Choose the chest tube and check equipment			
Checks that appropriate equipment is available, sterile, and on-hand.			
Uses an assistant			
Step 4 - Prepare the patient			
'Time out' including consent, ID, labelling of x-rays (displayed) and confirm side and site for insertion by reviewing clinical signs and radiological investigations			
Considers premedication			
Obtains reliable venous access			
Ensures continuous oximetry			
Uses strict aseptic technique *			
Step 5 – Infiltrate local anaesthetic			
Uses adequate volume of local anaesthetic (3mg/kg Lignocaine 1% - 20ml / 70kg). *			
Infiltrates skin, subcutaneous tissue, muscle, periosteum and pleura along superior surface of rib margin. *			
Aspirates with LA syringe to confirm right location and diagnosis			
Waits 3- 5 minutes for the local anaesthetic to take effect			

* Refer to criteria sheet for additional information

Assessment tool 1B cont.

Assessment sheet for the inserting small bore catheter by Seldinger technique			
	Completes step		Comments
	Yes	No	
Step 6 – Insert small bore catheter			
Confirms intrapleural placement of introducer needle			
Equipment all inserted in same plane			
Guide wire not kinked or contaminated			
Ensures all side holes of catheter in pleural space			
Attaches 3 way tap and turns 'off to patient'			
Attaches chest tube to chest drain or clamps the tube or 3 way tap 'off to patient', while suturing and dressings are completed			
Step 7 – Anchor the tube – suturing			
Secures tube with stay or anchoring suture			
Acknowledges that anchoring device does not replace need to suture catheter			
Step 8– Connect the tube to a drain			
Attaches adaptor to catheter / 3 way tap			
Removes protective cap from end of drainage tubing of under water seal drain			
Connects catheter to chest drain.			
If used, removes clamp on chest tube or turns 3 way tap to connect pleural space to UWSD			
Tapes junction of chest tube and drainage tube to prevent separation, and ensures connection remains visible			
Operator asked how they would clinically confirm correct placement of chest tube and correct answer given *			
Step 9– Dress the site			
Uses appropriate dressing			
Step 10 – Confirm catheter placement			
Confirms catheter placement with an x-ray			
Step 11– Document the procedure			
Ensures procedure is documented in patient chart			

**Refer to criteria sheet for additional information*

Criteria sheet for inserting small bore catheters by Seldinger technique

Step 2: Select and mark the insertion site	
Positions patient appropriately for chest tube insertion – discuss alternative sites	<p>Axillary approach</p> <ul style="list-style-type: none"> Recline patient on bed at 30-60 degrees, slightly rotated with the arm on affected side abducted to expose axillary area (hand behind head, hand on hip or arm away from body) or Sitting upright leaning over adjacent table on pillow or Lateral decubitus <p>OR second intercostal space in mid-clavicular line – recline OR posterior – leaning over adjacent table on pillow</p>
Determines the insertion site using appropriate anatomical markers (requires live model)	<p>Preferred position is through 4th or 5th intercostal space, midaxillary or anterior axillary line, in a region bounded by:</p> <ul style="list-style-type: none"> lateral border of pectoralis major anterior border of latissimus dorsi fifth intercostal space, and apex in the axilla <p>Second intercostal space in mid-clavicular line</p>
Step 3: Prepare the patient	
Use strict aseptic technique	<ol style="list-style-type: none"> Dons personal protective equipment (PPE): <ul style="list-style-type: none"> sterile gown and gloves mask protective eyewear Cleans patient's skin with 2 applications of alcoholic chlorhexidine or povidone iodine 10% w/v solution Drapes site with sterile drapes
Step 5: Infiltrate local anaesthetic	
Uses adequate volume of local anaesthetic—3 mg/kg (Lignocaine 1%-20 ml/ 70 kg)	<ul style="list-style-type: none"> Ask operator how they calculated dose of anaesthetic Use of adrenaline (premix vials) allows up to 5mg/kg lignocaine to be used
Infiltrates skin, subcutaneous tissue, muscle, periosteum and pleura along superior surface of rib margin	<ul style="list-style-type: none"> Ask operator to explain what anatomical structures they need to infiltrate
Step 8: Insert the chest tube	
Clinically confirms correct placement of chest tube	<p>Correct placement of the chest tube can be clinically confirmed by observing:</p> <ul style="list-style-type: none"> movement of air/fluid through tube swinging', 'tidalling' or 'oscillating' of fluid level in water seal chamber

Assessment tool 2

Date:

Participant Name:

Procedural Expert:

Global assessment for chest tube insertion in risk / complex scenarios

Only use this section with simulation scenarios containing risks:

	Identifies risk			Verbalises a plan to minimise/ eliminate this risk			Demonstrates mitigation <i>(if applicable)</i>	Endangers patient	Comments
	Correct	Correct with prompts	Incorrect	Correct	Correct with prompts	Incorrect	Tick if yes	Tick if yes	
Low - moderate risk: scenario with low to moderate level of risk/ complexity									
List risk(s) included in scenario:									
Moderate - high risk: scenario with moderate to high level of risk/ complexity									
List risk(s) included in scenario:									

Roles and responsibilities of stakeholders

The Simulation Facilitator

The Simulation Facilitator is appointed by the Local Activity Manager. The Local Activity Manager is responsible for the overall planning and organisation of the simulation program on insertion of chest tubes. The Simulation Facilitator is responsible for the 'on the ground' organising of the activity and assisting in the scenarios. Simulation Facilitators are usually clinical educators, preferably nurses.

The Simulation Facilitator's role:

- Set-up the simulation room, equipment and mannequin in consultation with the Procedural Expert
- Assist the Procedural Expert in carrying out the simulation scenarios
- Assist the participant, as Stimulation Facilitator, in the scenarios.

Selection criteria:

- Clinical educator, preferably a nurse with experience in management of chest tubes and drains
- A familiarity with the educational resources, program and simulation mannequin
- Experience operating within a simulation environment (Ideally this role would be undertaken by a nurse who will be working with the training doctor).



Golden Rule!

The Simulation Facilitator should be familiar with all the information contained in the Simulation manual

The Procedural Expert

The Procedural Expert is appointed by the Local Activity Manager. They have recognised expertise in inserting chest tubes, are responsible for selecting and conducting the simulation scenarios as well as assessing and providing feedback to participants on their performance.

The Procedural Expert's role:

- Part one
 - Demonstrate the technique of chest tube insertion for novice participants
 - Guide the participant through one or more practice runs
 - Assess and record the participant's skill on a final "run" using assessment tool 1A and/or 1B
- Part two
 - Select and undertake the simulation scenarios
 - Assess and record the participant's skill using assessment tool 2
- Provide feedback on the performance of the participant

Selection criteria:

- Advanced competency in inserting a chest tube and have procedural expertise that would be recognised by peers.
- Experience operating within a simulation environment
- Familiarity with both the online and simulation components of the chest tube insertion program

How to organise simulation skills training

Organisation of a simulation activity can be broken down into three stages:

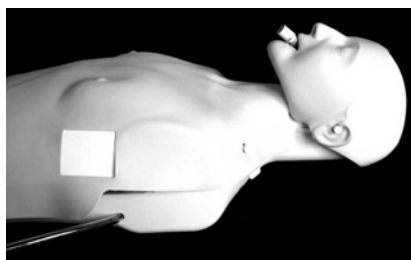
- Stage 1 – Planning the Activity
- Stage 2 – Lead up to the planned activity
- Stage 3 – On the Day

The Local Activity Manager is mostly involved in Stage 1 and 2 of the organisation, while the Simulation Facilitator will be mostly involved in the organisation on the day.

Stage 1 - Planning a simulation activity

The initial planning phase involves the following steps:

- ensure there is access to a suitable simulation mannequin. The mannequin recommended for simulation training is the Super-Annie 1 or 2. The mannequin is manufactured by Richard Morris at Simcentral.



Contact:

Web: <http://www.simcentral.com.au>

Email: enquiries@simcentral.com.au

- ensure there is access to a suitable venue. The ideal simulation environment is a room set up as a procedure room or ward environment.
- decide on simulation format – standard procedure training or non-standard procedure training, incorporating more complex clinical scenarios
- identify participants
- select and appoint a Simulation Facilitator and a local Procedural Expert
- select date(s) and book venue.

Stage 2 - Lead-up to simulation activity

Once the meeting has been planned the next steps are to:

- invite participants and ensure they are provided with information about the program and prerequisites to complete before simulation activity
- ensure that both the Simulation Facilitator and Procedural Expert have access to online education program and are provided with a Simulation manual and participant list
- finalise program with Simulation Facilitator:
 - ensure availability of venue, required equipment and mannequin
 - provide copies of assessment sheets, evaluation forms and record of attendance form (if required) to Simulation Facilitator

Stage 3 - On the day

On the day, the role of the Local Activity Manager is mainly to:

- support the Simulation Facilitator and Procedural Expert
- collect evaluation forms and record of attendance form (if required) from Simulation Facilitator, at the end of the event

Flowchart for managing a simulation skills training activity

Time line	Stages	Tasks
↑ Approx. 4 weeks	1 Activity planning	Ensure access to simulation mannequin ↓ Decide on format ↓ Identify participants ↓ Select and appoint Simulation Facilitator and Procedural Expert ↓ Select date and venue
↓ Approx. 4 weeks ↑	2 Lead-up to activity	Invite participants and provide them with program information ↓ Provide Simulation Facilitator and Procedural Expert with access to online program, Simulation manual and participant list ↓ Finalise program with Simulation Facilitator ↓ Ensure availability of venue, equipment and mannequin ↓ Provide copies of assessment sheets, evaluation forms and record of attendance forms to Simulation Facilitator
↓	3 On the day	Support the Simulation Facilitator and Procedural Expert ↓ Collect evaluation forms and record of attendance form (if required)

The environment and equipment

Preparing the environment

The ideal simulation environment is a room set up as a procedure room or ward environment. The environment is part of the simulation exercise and may require modification, depending on the scenarios, e.g. adjust lighting, bed height and other aspects of the environment.

Equipment for insertion of a chest tube

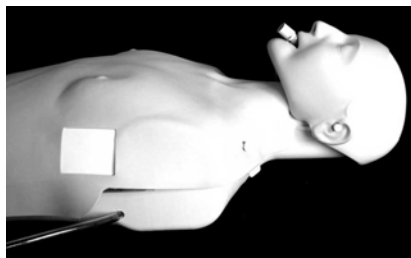
In addition to an appropriate environment, the following adjunctive equipment is suggested to perform the chest tube insertion skills training. Equipment may require modification, depending on the scenarios.

Soluble/ impermanent marker to mark insertion site - do not use permanent marker on the mannequin
Surgical tray
Trolley
Operator's preparation
<u>MO</u>
sterile gown
sterile gloves
mask
protective eyewear
Patient skin preparation
Proxy for antiseptic solution (e.g. bottle of water labelled 'alcoholic chlorhexidine' or 'iodine')
Sterile drapes
Local anaesthetic
Syringe – 20 ml and drawing up needle
Needle (25 G for skin and 21 G for deeper layers)
Proxy for local anaesthetic agent (vial of water labelled 0.5% or 1% lignocaine)
Chest tube
Selection of chest tubes sizes 20, 28, 32 and small bore catheter kit
Incision
Scalpel and blade no 11 or disposable scalpel
Blunt dissection of tract
Curved artery forceps
Insertion and securing of chest tube
Stout, non-absorbable suture material (e.g. Mersilene 0 or Silk 1) on cutting needle
Needle holder
Tape, e.g. leukosilk
Scissors
Forceps
Tube clamps (non-serrated)
Dressing
Dressings
Adhesive tape to secure dressing
Connection to UWSD
Sterile tubing/ Adaptors
Under water drain seal drainage system which is primed according to manufacturer's instructions

The mannequin

Features of the mannequin

The mannequin recommended for simulation training is the Super-Annie 1 or 2. The mannequin is manufactured by Richard Morris at Simcentral.



Contact:

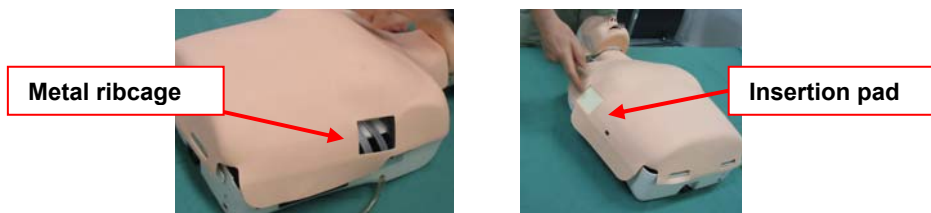
Web: <http://www.simcentral.com.au>

Email: enquiries@simcentral.com.au

Insertion of chest tube

Super Annie has a realistic ribcage and a pad positioned in each lateral chest wall. The pad facilitates insertion of large chest tubes and small bore or pigtail catheters. Each pad is compatible with the whole insertion procedure - from prepping the skin and infiltrating with local anaesthetic, to suturing the tube in place and applying the dressing.

The Super-Annie mannequins differs from Laerdal's Little Anne resuscitation CPR mannequin in that it has a metal ribcage and an insertion pad positioned in each lateral chest wall.



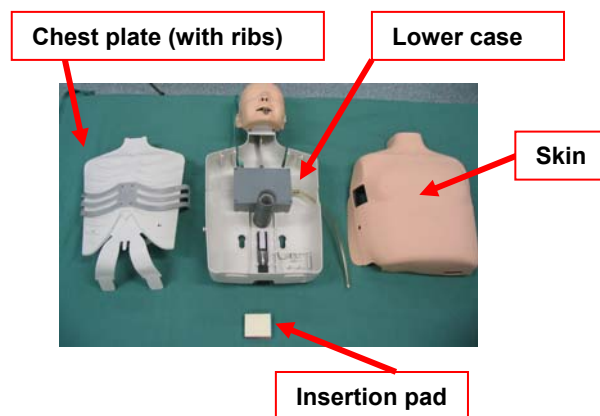
The insertion pad has multiple layers representing skin, subcutaneous fat, fascia, muscle and pleura. It allows the following techniques to be simulated:

- prepping of the skin
- infiltrating insertion site with local anaesthetic
- inserting and anchoring large bore chest tubes by blunt dissection and small bore catheters by Seldinger or other technique
- removing chest tube

Set up of the mannequin

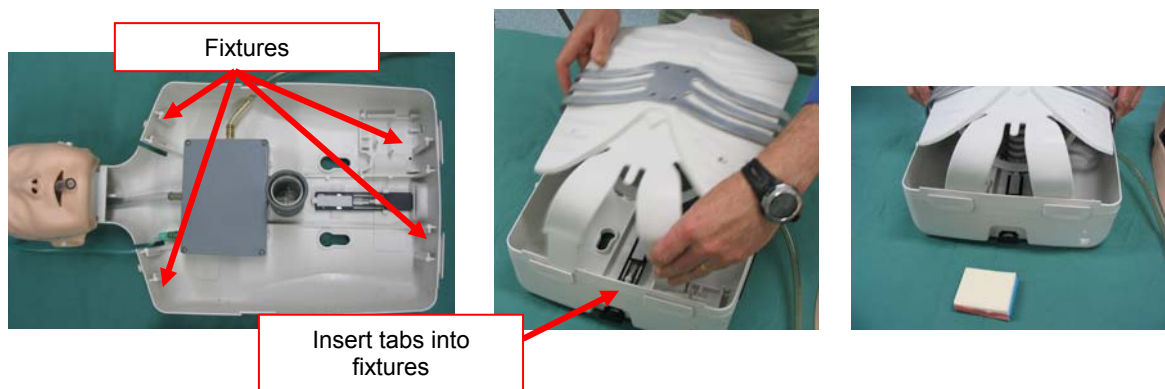
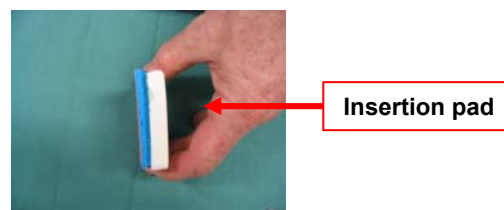
The chest drain mannequin has several different components. These components require assembly prior to conducting scenarios. The chest drain mannequin's components are:

- Lower Case (with head and thorax)
- Chest plate (with aluminium ribs)
- Skin
- Insertion Pads
Insertion Pads have 4 different colored layers. The insertion pads aim to simulate the relevant anatomy in this area of the chest/thorax. Each layer represents the following aspects of the chest anatomy.
 - White - skin and subcutaneous layer
 - Green - fascial layer
 - Blue - muscle layer
 - Cream - parietal pleura

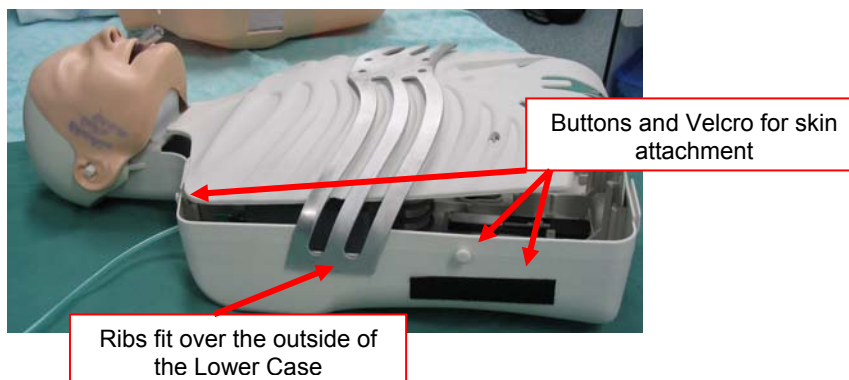


The procedure for set up is to:

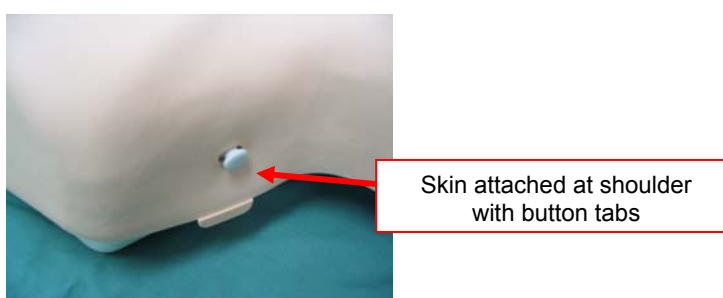
- Position the mannequin storage case on the bed or bench.
- Unpack the four components of the chest drain insertion mannequin.
- Position the lower case section on the bed with the head of mannequin at the head of the bed.
- Position the Chest plate over the Lower Case.
- Insert the bottom tabs of the chest plate into fixtures on the inside and at the top and bottom of the Lower Case.



- Ensure the aluminium ribs fit over the outside of the Lower case as you slowly drop the top tabs into the fixtures on the inside and at the top of the Lower Case.



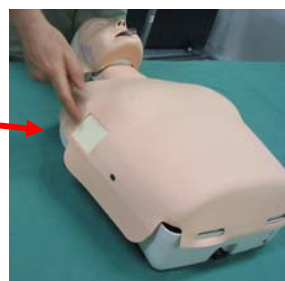
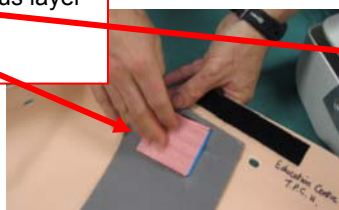
- After the Chest plate has been secured to the Lower Case, position the Skin over the mannequin.
- Attach the Skin section at the shoulders with the button tabs on the thorax.



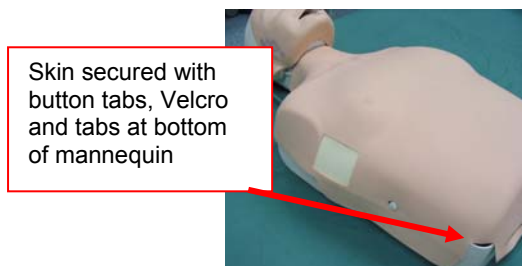
- Position the Insertion Pads into specified area of the skin component.
- It is imperative that the Insertion Pad is positioned correctly.
- Position with the white side of the Insertion pad facing the outer aspect of the thorax.
- The pink side of the Insertion Pad should face the internal aspect of the thorax.

Position insertion pad into skin component with:

- white skin and subcutaneous layer to outside
- pleural layer to inside



- Secure the Skin section on both sides of the thorax, using the Velcro and additional button tabs.
- Secure the Skin at the bottom of the mannequin with the tabs.





Caution!

The chest drain insertion mannequin (Super-Annie 1 or 2) appears very similar to a CPR simulation mannequin. The Super-Annie mannequins *are not to be used* for any purpose other than insertion of chest drains. *Do not practice external cardiac compression* techniques on Super-Annie, as this will damage internal components. Other procedures that Super-Annie is not to be used for include:

- intubation with an endotracheal tube
- defibrillation/cardioversion
- cannulation.

Care of the mannequin

Routine disinfection of the entire mannequin is not required, however, periodic cleaning of the head, torso, chest and skin is recommended. These should be washed with a mild, warm, soapy solution, and then rinsed with a clean damp cloth. Proper care will maintain the appearance and general condition of your simulator.

A small amount of water may accumulate within the mannequin during simulation procedures, from the swabbing process and from the anaesthetisation process. If there are to be multiple runs during a session it is important to *dry the interior of the mannequin in between attempts*, as excessive water within the unit may damage electrical components.

Any repairs should be referred to either your biomedical engineering department or to the manufacturer:

Contact:

Web: <http://www.simcentral.com.au>

Email: enquiries@simcentral.com.au

Appendices

Forms available:

- Assessment tool 1A - Assessment sheet for inserting large bore chest tube by blunt dissection
- Criteria sheet for inserting large bore chest tubes by blunt dissection
- Assessment tool 1B - Assessment sheet for inserting small bore catheters by Seldinger technique
- Criteria sheet for inserting small bore catheters by Seldinger technique
- Assessment tool 2 - Global assessment for chest tube insertion in high risk / complex scenarios
- Risk factor list
- Evaluation sheet for simulation skills training

Assessment tool 1A

Date: _____ Participant Name: _____ Procedural Expert: _____

Assessment sheet for inserting large bore chest tubes by blunt dissection			
NOTE: Not all details will be simulated, however the participant must be able to fully describe these aspects. (e.g. aseptic technique)	Completes step		Comments
	Yes	No	
Step 1 - Select and mark the insertion site			
Performs risk assessment			
Checks consent			
Positions patient appropriately for chest tube insertion. *			
Determines the insertion site using appropriate anatomical markers. *			
Marks site of insertion with indelible marker.			
Considers ultrasound guidance for some scenarios e.g. loculated effusion			
Step 2 – Choose the chest tube and check equipment			
Checks that appropriate equipment is available, sterile, and on-hand.			
Selects appropriate sized tube without a trocar. *			
Step 3 – Prepare the patient			
'Time out' including confirming side and site for insertion by reviewing clinical signs and radiological investigations			
Considers premedication			
Obtains reliable venous access			
Uses a facilitator.			
Use strict aseptic technique. *			
Step 4 – Infiltrate local anaesthetic			
Uses adequate volume of local anaesthetic (3mg/kg Lignocaine 1% - 20ml / 70kg). *			
Infiltrates skin, subcutaneous tissue, muscle, periosteum and pleura along superior surface of rib margin. *			
When enters pleural space, aspirates with LA syringe to confirm right location and diagnosis.			
Waits 3- 5 minutes for the local anaesthetic to take effect			

* Refer to criteria sheet for additional information

Assessment tool 1A cont.

Assessment sheet for inserting large bore chest tubes by blunt dissection			
	Completes step		Comments
	Yes	No	
Step 5 – Incise the skin and dissect to the pleura			
Makes a transverse incision along the superior surface of rib margin and parallel to it.			
Inserts wound closure suture (a mattress / single interrupted suture(s)) loosely across middle of wound			
Uses blunt dissection utilising artery forceps (or similar), to spread subcutaneous fat, and muscle.			
Punctures parietal pleura with the tip of forceps.			
Ensures track through the intercostal muscles and hole in the pleura are wide enough to allow easy passage of chest tube. *			
Digitally examines thoracic cavity to ensure no underlying organs are present			
Step 6 – Insert the chest tube			
Inserts chest tube using artery forceps or guided by a finger.			
Ensures all side holes of chest tube are inside the pleural cavity.			
Attaches chest tube to chest drain or clamps the tube, while suturing and dressings are completed.			
Ask operator how they would clinically confirm correct placement of chest tube. *			
Step 7 – Anchor the tube – suturing			
Uses stout, non-absorbable suture material such as Mersilene 0 or Silk 1 on cutting needle to suture tube.			
Secures tube with stay or anchoring suture.			
Ties the loose ends of wound closure suture together at distal end and winds around tube near skin.			
Secures tubing to skin in manner to facilitate drainage and reduce tube dislodgment, e.g. using a mesenteric tag of tape			
Step 8 – Connect the tube to a drain			
If not already connected, removes protective cap from end of drainage tube of chest drain and clamp from chest tube and immediately connects the chest tube to chest drain			
Tapes the junction of the chest tube and drainage tube to prevent separation and ensures connection remains visible			
Step 9 – Dress the site			
Asks nurse to dress site and apply mesenteric tag			
Step 10 – Confirm tube placement			
Confirms tube placement with an x-ray			
Step 11 – Document the procedure			
Ensures procedure is documented in patient chart			

**Refer to criteria sheet for additional information*

Criteria sheet for inserting large bore chest tube by blunt dissection

Step 1: Select and mark the insertion site	
Positions patient appropriately for chest tube insertion	<ul style="list-style-type: none"> Recline patient on bed at 30-60 degrees, slightly rotated with the arm on affected side abducted to expose axillary area (hand behind head, hand on hip or arm away from body) or Sitting upright leaning over adjacent table on pillow or lateral decubitus
Determines the insertion site using appropriate anatomical markers	<p>Preferred position is through 4th or 5th intercostal space, midaxillary or anterior axillary line, in a region bounded by:</p> <ul style="list-style-type: none"> lateral border of pectoralis major anterior border of latissimus dorsi 5th intercostal space, and apex in the axilla
Step 2: Choose the chest tube and check equipment	
Selects appropriate sized tube without a trocar	<ul style="list-style-type: none"> Pneumothorax: 20 – 24 Fr (6.7- 8 mm) Effusion/pus: 20 – 28 Fr (8 – 9.3 mm) Blood/pus: 32 Fr (10.7 mm)
Step 3: Prepare the patient	
Use strict aseptic technique	<ol style="list-style-type: none"> Dons personal protective equipment (PPE): <ul style="list-style-type: none"> sterile gown and gloves mask protective eyewear Cleans patient's skin with alcoholic chlorhexidine or povidone iodine 10% w/v solution Drapes site with sterile drapes
Step 4: Infiltrate local anaesthetic	
Uses adequate volume of local anaesthetic – 3 mg/kg (Lignocaine 1%-20 ml/ 70 kg)	Ask operator how they calculated dose of anaesthetic
Infiltrates skin, subcutaneous tissue, muscle, periosteum and pleura along superior surface of rib margin	Ask operator to explain what anatomical structures they need to infiltrate
Step 5: Incise the skin and dissect to the pleura	
Ensures track through the intercostal muscles, and hole in the pleura, are wide enough to allow easy passage of chest tube.	Track can be widened with artery forceps or a gloved finger
Step 6: Insert the chest tube	
Clinically confirms correct placement of chest tube	<p>Correct placement of the chest tube can be clinically confirmed by observing:</p> <ul style="list-style-type: none"> fogging of chest tube with expiration movement of air/fluid through tube 'swinging', 'tidalling' or 'oscillating' of fluid level in water seal chamber

Assessment tool 1B

Date: _____ Participant Name: _____ Procedural Expert: _____

Assessment sheet for the inserting small bore catheter by Seldinger technique			
NOTE: Not all details will be simulated, however the participant must be able to fully describe these aspects. (e.g. aseptic technique)	Completes step		Comments
	Yes	No	
Step 1 – Risk assessment			
Performs risk assessment			
Checks consent			
Step 2 – Select and mark the insertion site			
Positions patient appropriately for chest tube insertion *			
Determines the insertion site using appropriate anatomical markers *			
Marks site of insertion with indelible marker			
Considers ultrasound guidance for some scenarios, e.g. loculated effusion			
Step 3 – Choose the chest tube and check equipment			
Checks that appropriate equipment is available, sterile, and on-hand.			
Uses an assistant			
Step 4 - Prepare the patient			
'Time out' including confirming side and site for insertion by reviewing clinical signs and chest x-ray			
Considers premedication			
Obtains reliable venous access			
Ensures continuous oximetry			
Uses strict aseptic technique *			
Step 5 – Infiltrate local anaesthetic			
Uses adequate volume of local anaesthetic (3mg/kg Lignocaine 1% - 20ml / 70kg). *			
Infiltrates skin, subcutaneous tissue, muscle, periosteum and pleura along superior surface of rib margin. *			
Aspirates with LA syringe to confirm right location and diagnosis			
Waits 3- 5 minutes for the local anaesthetic to take effect			

* Refer to criteria sheet for additional information

Assessment tool 1B cont.

Assessment sheet for the inserting small bore catheter by Seldinger technique			
	Completes step		Comments
	Yes	No	
Step 6 – Insert small bore catheter			
Confirms intrapleural placement of introducer needle			
Equipment all inserted in same plane			
Guide wire not kinked or contaminated			
Ensures all side holes of catheter in pleural space			
Attaches 3 way tap and turns 'off to patient'			
Attaches chest tube to chest drain or clamps the tube or 3 way tap 'off to patient', while suturing and dressings are completed			
Step 7 – Anchor the tube – suturing			
Secures tube with stay or anchoring suture			
Acknowledges that anchoring device does not replace need to suture catheter			
Step 8– Connect the tube to a drain			
Attaches adaptor to catheter / 3 way tap			
Removes protective cap from end of drainage tubing of under water seal drain			
Connects catheter to chest drain.			
If used, removes clamp on chest tube or turns 3 way tap to connect pleural space to UWSD			
Tapes junction of chest tube and drainage tube to prevent separation, and ensures connection remains visible			
Operator asked how they would clinically confirm correct placement of chest tube, and correct answer given *			
Step 9– Dress the site			
Asks nurse to dress site			
Step 10 – Confirm catheter placement			
Confirms catheter placement with an x-ray			
Step 11– Document the procedure			
Ensures procedure is documented in patient chart			

**Refer to criteria sheet for additional information*

Criteria sheet for inserting small bore catheters by Seldinger technique

Step 2: Select and mark the insertion site	
Positions patient appropriately for chest tube insertion	<ul style="list-style-type: none"> • Recline patient on bed at 30-60 degrees, slightly rotated with the arm on affected side abducted to expose axillary area (hand behind head, hand on hip or arm away from body) or • Sitting upright leaning over adjacent table on pillow or • Lateral decubitus
Determines the insertion site using appropriate anatomical markers	<p>Preferred position is through 4th or 5th intercostal space, midaxillary or anterior axillary line, in a region bounded by:</p> <ul style="list-style-type: none"> • lateral border of pectoralis major • anterior border of latissimus dorsi • fifth intercostal space, and • apex in the axilla
Step 3: Prepare the patient	
Use strict aseptic technique	<ol style="list-style-type: none"> 1) Dons personal protective equipment (PPE): <ul style="list-style-type: none"> • sterile gown and gloves • mask • protective eyewear 2) Cleans patient's skin with 2 applications of alcoholic chlorhexidine or povidone iodine 10% w/v solution 3) Drapes site with sterile drapes
Step 5: Infiltrate local anaesthetic	
Uses adequate volume of local anaesthetic—3 mg/kg (Lignocaine 1%-20 ml/ 70 kg)	<ul style="list-style-type: none"> • Ask operator how they calculated dose of anaesthetic • Use of adrenaline (premix vials) allows up to 5mg/kg lignocaine to be used
Infiltrates skin, subcutaneous tissue, muscle, periosteum and pleura along superior surface of rib margin	<ul style="list-style-type: none"> • Ask operator to explain what anatomical structures they need to infiltrate
Step 8: Insert the chest tube	
Clinically confirms correct placement of chest tube	<p>Correct placement of the chest tube can be clinically confirmed by observing:</p> <ul style="list-style-type: none"> • movement of air/fluid through tube • swinging', 'tidalling' or 'oscillating' of fluid level in water seal chamber

Assessment tool 2

Date: _____ **Participant Name:** _____ **Procedural Expert:** _____

Global assessment for chest tube insertion in risk / complex scenarios

Only use this section with simulation scenarios containing risks:

	Identifies risk			Verbalises a plan to minimise/ eliminate this risk			Demonstrates mitigation <i>(if applicable)</i>	Endangers patient	Comments
	Correct	Correct with prompts	Incorrect	Correct	Correct with prompts	Incorrect	Tick if yes	Tick if yes	
Low - moderate risk: scenario with low to moderate level of risk/ complexity									
List risk(s) included in scenario:									
Moderate - high risk: scenario with moderate to high level of risk/ complexity									
List risk(s) included in scenario:									

Risk factors for an adverse outcome

People-related risk factors

Doctor-related (and facilitator-related)

- Inexperience
- Fatigue
- No access to expertise
- Distraction
- Anxiousness
- Time-pressure

Patient-related

1. Haemodynamic instability

2. Coagulopathy (e.g. coagulopathy, DIC, pro-coagulant)

- Warfarin, heparin
- Anti-platelet agent, e.g. aspirin, clopidogrel

3. Impaired respiratory function (e.g. COPD, hypoxia: lung-related, hypoxia: CNS depression)

4. Patient behaviour

- Agitated
- Hypoxia, e.g. COPD
- Anxiety
- Hypovolaemia
- Pain
- Blood glucose levels
- Mental Health, e.g. dementia
- Intellectual impairment

- Decreased consciousness

5. Other co-morbidities

- That increase the risk of infection, e.g. diabetes, skin infections, immunosuppression
- That increase risk of death from other conditions
- Unstable angina

6. Ability to position patient appropriately for the procedure

- Elderly
- Heart failure (orthopnea)
- Musculoskeletal abnormalities
- Women with pendulous breasts

7. Body habitus

- Overweight
- Obese, morbidly obese

8. Altered external anatomy

- Musculoskeletal abnormalities, e.g. scoliosis or other thoracic wall abnormality
- Previous surgery
- Flail chest
- Subcutaneous emphysema

9. Altered internal anatomy:

- bullous disease
- lung/ pleural surgery, e.g. pneumonectomy
- elevated hemi-diaphragm due to phrenic nerve palsy
- pleural adhesions
- cardiac/aortic surgery
- radiotherapy

Risk factors for an adverse outcome *cont.*

Equipment-related risk factors

- Incorrect chest drain insertion equipment and not adapted to pt, e.g. long instruments and needles for obese or subcutaneous emphysema patients
- No access to resuscitation equipment
- No access to imaging or adequate imaging
- No access to monitoring equipment

Environment-related risk factors

- Inadequate lighting
- Inappropriate and safe location, e.g. roadside
- Not enough room to manoeuvre
- Unclean environment
- Lack privacy

Procedure-related risk factors

- Risks related to difficulty in completing the steps of the insertion procedure:
- Step 1 - Select and mark the insertion site
 - Step 2 - Choose tube and check equipment
 - Step 3 – Prepare the patient
 - Step 4 - Local anaesthetic
 - Step 5 - Incise the skin and dissect to the pleura (large bore chest tubes)
 - Step 6 - Insert the tube
 - Step 7 - Anchor the tube - suturing
 - Step 8 - Connect the tube to a drain
 - Step 9 – Dress the site
 - Step 10 - Confirm tube placement
- No access to supervision for inexperienced staff

Evaluation sheet for simulation skills training: Insertion of chest tubes in adults

Date of simulation exercise: _____
Location of simulation exercise: _____

Learning Goals

Rank your achievement of each learning goal using the scale below:

- 1 - Unable to meet learning goal
- 3 - Able to meet the goal to a major extent
- 5 - Can confidently meet the goal

To what extent were you able to meet the learning goals?

- be able to insert a chest tube in an uncomplicated patient using a standard technique
- be able to identify and analyse the factors that may lead to complications when inserting a chest tube in an adult
- be able to minimise a patient's risk of complications from chest tube insertion

Simulation exercise

To what extent did you find this simulation useful as a learning opportunity? (Tick one.)

- Very useful
- Fairly useful
- Not useful

To what extent was the simulation exercise clear and easy to follow? (Tick one.)

- Clear and easy to follow
- Mostly clear and easy to follow
- Unclear/difficult to follow

Which online units did you complete prior to attending? (Tick all relevant.)

- Quiz
- Risk assessment
- Anatomy
- Insertion of chest tube
- Others

Did the online units help you to complete the simulation exercise? (Tick one.)

- Yes
- Somewhat
- No

Comments

Evaluation sheet for simulation scenario 1: assisting in inserting a chest tube *cont.*

Evaluation sheet

Practice

As a result of completing this simulation will you be making any modifications to your practice? (Tick one.)

- My practice will remain unchanged
- I confirmed my practice
- I plan to review my practice
- I plan to make modifications to my practice

Comments

Facilitator

Did the facilitator promote your learning?

- Yes
- Somewhat
- No

Comments

General Comments

What features did you like/dislike about the simulation exercise?

How could this simulation exercise be improved?
