Clinical Skills in Hospitals Project
Chest tube management
Module 1: Intercostal catheters (ICCs)
Module 2: Pleurocaths
Module 3: Underwater seal drains
Module 4: Management scenarios
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Acknowledgments

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- Dr Stuart Dilley, Mr Naveed Alam, Dr Robert O’Brien, Julian Van Dijk, Santina Cotela and Dr Neil Cunningham from St Vincent’s Hospital, Melbourne, for their tireless efforts as the primary authors of Chest tube management.

- Mr Matthew Williams at St Vincent’s Education Centre for his contributions to this package.

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Preface

In 2007 the Department of Human Services commissioned St Vincent’s Hospital Melbourne, to design and develop simulation-based training packages for clinical skills trainers in Victorian hospitals.

The project provides Victorian health professionals—specifically, hospital clinical educators—with a resource to deliver simulation-based clinical skills training.

The information in this manual complements current training programs and should be considered as a resource in the workplace, rather than the definitive resource on the topic.

Every effort has been made to provide the most current literature references. Authors have consulted other health professionals and current programs when possible in development to ensure that the modules produced in this package are consistent with current health practices.
Course delivery in condensed form

Sample timetable for one-day workshop

This is an example of how the modules in *Chest tube management* could be combined into a one-day workshop. A sample timetable is provided for a course consisting of Modules 1, 2, 3 and 4.

**Course 1 (Modules 1, 2, 3 and 4)**

<table>
<thead>
<tr>
<th>Timing</th>
<th>Activity</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.30 to 8.45</td>
<td>Introduction to faculty and participants</td>
<td></td>
</tr>
<tr>
<td>8.45 to 9.15</td>
<td>Facilitated discussion</td>
<td>Module 1: 1, 2, 3</td>
</tr>
<tr>
<td>9.15 to 10.00</td>
<td>ICC insertion skills session</td>
<td>Module 1: 3 and 4</td>
</tr>
<tr>
<td>10.00 to 10.10</td>
<td>Summary of main points from Module 1</td>
<td>Module 1: all</td>
</tr>
<tr>
<td>10.10 to 10.25</td>
<td>Morning tea</td>
<td></td>
</tr>
<tr>
<td>10.25 to 11.10</td>
<td>Facilitated discussion</td>
<td>Module 2: 1</td>
</tr>
<tr>
<td>11.10 to 11.55</td>
<td>Skill station using part task trainers</td>
<td>Module 2: 2, 3</td>
</tr>
<tr>
<td>11.55 to 12.10</td>
<td>Scenario around pleural catheter insertion</td>
<td></td>
</tr>
<tr>
<td>12.10 to 12.40</td>
<td>Debrief of scenario</td>
<td>Module 2: all</td>
</tr>
<tr>
<td>12.40 to 12.50</td>
<td>Summary of main points from Module 2</td>
<td>Module 2: all</td>
</tr>
<tr>
<td>12.50 to 1.15</td>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>1.15 to 1.35</td>
<td>Facilitated discussion</td>
<td>Module 3: all</td>
</tr>
<tr>
<td>1.35 to 2.15</td>
<td>Skill station/case study</td>
<td>Module 3: all</td>
</tr>
<tr>
<td>2.15 to 2.25</td>
<td>Summary of main points from Module 3</td>
<td>Module 3: all</td>
</tr>
<tr>
<td>2.25 to 2.40</td>
<td>Afternoon tea</td>
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</tr>
<tr>
<td>2.40 to 3.00</td>
<td>Introduction and manikin familiarisation</td>
<td>Module 4: 1</td>
</tr>
<tr>
<td>3.00 to 3.10</td>
<td>Simulation 1</td>
<td>Module 4: all</td>
</tr>
<tr>
<td>3.10 to 3.40</td>
<td>Debrief</td>
<td>Module 4: all</td>
</tr>
<tr>
<td>3.40 to 3.50</td>
<td>Simulation 2</td>
<td>Module 4: all</td>
</tr>
<tr>
<td>3.50 to 4.20</td>
<td>Debrief</td>
<td>Module 4: all</td>
</tr>
<tr>
<td>4.20 to 4.30</td>
<td>Summary of main points from Module 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Course evaluation</td>
<td></td>
</tr>
</tbody>
</table>
Chest tube management

Introduction

*Chest tube management* was developed as a teaching and learning tool for Victorian clinical educators. The information contained in each module was developed using evidence-based resources and examples of best practice. Where expert opinion varies, a discussion section is included. However, it is not within the scope of *Chest tube management* to address the full spectrum of local variations. Variations can occur in several areas, including practices relating to types of equipment used, infection control processes, practice guidelines and so on. Therefore, educators should, where appropriate, adapt content to reflect their local policies, procedures and protocols. This will ensure the relevancy of the package content to your learners.

The modules are designed to be discrete courses in their own right. They are timetabled so they can be completed in a 1–2 hour timeframe. This timeframe was chosen after we received feedback from clinical educators requesting shorter courses, because health professionals often have limited time to educate away from patients. However, the packages may also be combined into a one- or two-day course.

*Chest tube management* should be used as an educational tool to assist in the teaching of clinical skills. It is structured as a guide to assist clinical educators, and uses many concepts taught in the *Clinical Skills in Hospitals* Project (Train-the-Trainer courses). Educators are encouraged to build on this resource by adding their own scenarios which incorporate health service protocols, policies and other resources. Each module is designed as a lesson plan to incorporate the simulations into the teaching of clinical skills.

Aims

*Chest tube management* aims to make participants confident in their application of skills associated with identifying indications for inserting intercostal catheters and fine-bore cannulae, and appropriately inserting and managing these catheters and cannulae in different environments and settings. This package is intended for use with medical and nursing participants.

Package structure

*Chest tube management* contains four modules that provide learning opportunities for health professionals at all levels of experience and from medical and nursing disciplines. Modules 1 and 2 are regarded as fundamental. Modules 3 and 4 are more difficult and are regarded as intermediate.
Skills included in *Chest tube management* include chest tube insertion, needle aspiration, fine-bore catheter insertion (for example, Pleurocath) underwater seal drains and haemo-pneumothorax management.

This package was designed to develop participants’ knowledge, skills and behaviours in the safe management of pneumothoraces and haemothoraces, including chest tube insertion and management. The modules expose participants to increasingly complex skills and knowledge and test their ability to combine these individual skills, work as a team and solve problems in more difficult situations.

Educators delivering these modules should be aware of participants’ level of experience and choose appropriate modules. Modules presume an increasing level of knowledge as they progress, ranging from a fundamental knowledge of anatomy and physiology for the fundamental modules, up to detailed knowledge of haemo-pneumothorax management for the complex modules. Novice participants (such as first-year graduates) are expected to start with the fundamental modules, and only move onto intermediate and more complex modules as they demonstrate proficiency. More experienced participants may start at the intermediate level if the educator is satisfied that they have the prior knowledge and skills. Individual educators are responsible for assessing each participant’s baseline knowledge and determining which modules they need to complete. More specific descriptions of presumed knowledge are outlined in each module.
The design of these packages presumes that the clinical educators using them have knowledge and expertise in current best practice regarding the teaching of clinical skills and conducting facilitated discussions. Knowledge and expertise are presumed commensurate with the Department of Human Services’ basic and advanced Train-the-Trainer programs. Clinical educators are encouraged to refer to the Department of Human Services’ *Clinical Skills Facilitators Manual* for theory on:

1. Peyton’s model for teaching clinical skills
2. leading small group discussions
3. giving feedback
4. crisis resource management skills.
Module 1: Intercostal catheters (ICCs)

Introduction

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<table>
<thead>
<tr>
<th>Level of complexity</th>
<th>Package structure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Complex</strong></td>
<td></td>
</tr>
<tr>
<td>For participants with more than 4 years experience or who have completed Modules 1–4</td>
<td></td>
</tr>
<tr>
<td><strong>Intermediate</strong></td>
<td></td>
</tr>
<tr>
<td>For participants in postgraduate years 3–4 or who have completed Modules 1 and 2</td>
<td></td>
</tr>
<tr>
<td><strong>Fundamental</strong></td>
<td></td>
</tr>
<tr>
<td>For participants in postgraduate years 1–2</td>
<td></td>
</tr>
</tbody>
</table>

- Underwater seal drains
- Chest tube management scenarios
- Intercostal catheters
- Pleurocaths
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3. giving feedback
4. crisis resource management skills.
Module 1: Intercostal catheters (ICCs)
Authors: Mr Naveed Alam, Dr Robert O’Brien

Aims
This module teaches participants to identify the indications for the insertion of a chest tube, and prompts discussion and practice of the technique for insertion of intercostal catheters (ICCs).

Presumed knowledge
This module is targeted to medical professionals with minimal experience in inserting chest tubes. However, they are expected to have a basic knowledge of:
1. The anatomy of the chest wall and chest cavity
2. Infection control and working in sterile environments
3. Basic surgical skills (i.e. making incisions and suturing.
This module gives nursing professionals the opportunity to increase their awareness of the procedure as performed by a medical practitioner.

Objectives
By the end of this module, participants should have:
1. discussed the anatomy of the chest wall and chest cavity
2. identified the indications for insertion of an ICC
3. discussed the recommended site and technique for placement and insertion of an ICC
4. practised the recommended site and technique for placement and insertion of an ICC.

Background information for educators
This module encourages participants to become familiar with ICCs. Educators should take note of the mix of health professionals in the group. While medical staff are responsible for insertion of pleural catheters, all health professionals should be aware of the indications, techniques and problems associated with ICC insertion. If the group comprises non-medical staff, the focus of discussion and learning sessions should be on familiarity with equipment and assisting medical staff with pleural catheter insertion.

Overview
Pleural space
- anatomy
- diseases.

Chest tubes
- indications
- insertion.
Drainage systems
- management.

Anatomy of the pleural space
The pleura has two layers:
- visceral—on the lung surface
- parietal—on the chest wall, mediastinum and diaphragm.

Pleural space is a potential space:
- in normal circumstances, there is no space, and the visceral and parietal layers are in apposition
- space develops when there is disruption of the layers.

Pleural space normally has minimal fluid in it (10 mL), which is used as a lubricant to minimise friction during respiration.

Diseases of the pleural space
Air—pneumothorax (PTX) can be classified as open or closed.

Open pneumothoraces:
- communicate with atmospheric pressure through a hole in the chest wall
- are usually secondary to trauma.

Closed pneumothoraces:
- can be spontaneous, related to trauma or iatrogenic
- traumatic closed pneumothoraces are usually related to blunt trauma.

Air—pneumothorax (PTX) can also be classified as tension or non-tension.

Tension pneumothoraces are defined by:
- hypotension—secondary to lack of venous return and subsequent decreased cardiac output:
  - normally, venous return to the heart is facilitated by the somewhat negative intrathoracic pressure
  - when there is a tension PTX, the intrathoracic pressure becomes elevated
- signs include:
  - ipsilateral absence of breath sounds
  - hyper-resonance
  - contralateral tracheal deviation

**Tension pneumothoraces require immediate decompression—do not wait for CXR to confirm tension pneumothoraces.**
use large IV cannula (14 or 16 gauge) into the second intercostal space (ICS) in the mid-clavicular line

after decompression, place normal chest tube (24 or 28 French).

If a chest X-ray is taken, one can see:

- mediastinal shift
- depression of ipsilateral diaphragm
- complete collapse of the lung.

Chest tubes for PTX generally should be guided apically, and can be placed in the fourth ICS in the anterior to mid-axillary line.

**Blood—haemothorax**

- usually secondary to trauma
- may also be related to malignancy.

Often a well-placed chest tube is the most important step in the management of a haemothorax. Proper drainage of the pleural space enables expansion of the underlying lung, which can often tamponade the source of bleeding.

Immediate evacuation of greater than 1.5 litres of blood, or ongoing drainage of > 200 mL per hour for more than two hours are indications for operative exploration.

Chest tubes can be placed by experienced practitioners in lower positions and guided posteriorly. If placed by inexperienced staff they should be placed in the fourth ICS in the mid-axillary line.

**Pus—pyothorax or empyema**

- often related to pneumonia
- other causes are post-traumatic and post-operative
- usually requires drainage, either with chest tubes or surgical procedures.

**Excess pleural fluid—pleural effusion**

Pleural effusion can be transudative or exudative:

- transudates:
  - can be related to congestive heart failure or liver failure
  - often respond to medical management

- exudates:
  - can be related to pneumonia or malignancy
  - often require drainage.
**Chyle—chylothorax**
- usually related to surgery in the chest or malignancy
- management is complex, and often starts with drainage and dietary restrictions.

**Chest tube indications**
- as noted above.

**Chest tube insertion—set up**

<table>
<thead>
<tr>
<th>Equipment list</th>
</tr>
</thead>
<tbody>
<tr>
<td>- chest tube</td>
</tr>
<tr>
<td>- suture—large gauge (0 silk or Prolene)</td>
</tr>
<tr>
<td>- long curved forcep (Roberts)</td>
</tr>
<tr>
<td>- scalpel</td>
</tr>
<tr>
<td>- local anaesthetic</td>
</tr>
<tr>
<td>- preparation</td>
</tr>
<tr>
<td>- drapes</td>
</tr>
<tr>
<td>- clamps</td>
</tr>
</tbody>
</table>

*Figure 1: Table set-up*

**Patient positioning**

Make the patient as comfortable as possible.

It is generally easier to place a chest tube when the patient is in a lateral position with their arms folded together and a pillow between them in the praying position. This helps the patient to be comfortable and allows placement by creating a flat surface.

If not possible, tubes may need to be placed with the patient in a supine position, or even semi-upright.
Chest tube insertion—steps

1. local anaesthesia
2. incision
3. dissection
4. finger dilation
5. chest tube insertion
6. suture tube placement and connection to drainage system.

Local anaesthetic

Be generous with the local anaesthetic. Dilute the agent so that you can use approximately 40 mL. Lignocaine with adrenaline can be given up to 7 mg per kg body weight, for example, 49 mL of 1% solution for a 70 kg man. The maximum dose of lignocaine without adrenaline is 3–5 mg/kg.

- Use 1–2 mL to anaesthetise the skin and raise a weal.
- Make your incision.
- Anaesthetise the deeper layers—do not waste local anaesthetic on the superficial layers such as fat because they are insensate.
- Use a four-quadrant technique to anaesthetise the intercostal space where the tube will be inserted: anterior inferior, anterior superior, posterior inferior and posterior superior.
- First advance the needle to the inferior rib—inject a few mL into the periosteum.
- Advance the needle above the rib, All the while gently withdrawing on the syringe. Proceed until you enter the pleural space. You will know you have entered the pleura when air (if it is a PTX) or pleural fluid (if it is an effusion) enters the syringe.
- Immediately upon entering the pleural space, pull back the needle while continuing to withdraw on the syringe until air or fluid no longer enters the syringe. Now you are in the thin layer of the pleura.
- Inject several mL.
- Repeat the procedure for the other quadrants.
- For the superior rib, ensure that you do not inject into the intercostal vessels.

Chest tube insertion should be pain free. If the patient complains of pain, then administer more local anaesthetic.
Incision

- Use a scalpel to make a 1.5 cm incision above the rib, below the interspace that will be used for insertion.
- A larger incision should be used for obese individuals, because the chest cavity will be deeper from the skin.
- Inexperienced practitioners should use a larger incision; e.g. 5cm
- Take care not to plunge deep into the chest, but just enter the pleural space to avoid injury to deep structures.

**Figure 5: Blunt dissection using curved forceps**

**Finger dilation**

- So that multiple tracts are not required, and that the tract created is not lost, ensure that either the forcep, your finger or the tube is in the pleural space through the hole at all times.
- Gently insert your finger into the pleural cavity. The lung can often be palpated.
- If you can easily insert a finger, then the tube will also be easy to insert.

**Figure 6: Finger dilation**
**Chest tube insertion**

- Remove your finger and insert the tube into the pleural space.
- If the tract is well established, then the tube should ‘feather’ in nicely.
- If there is difficulty, enlarge the tract.
- The forcep can be used to hold the tract open while the tube is inserted.
- The forcep can also be used to clamp the end of the tube and direct it into the pleural space.

*Figure 7: Tube insertion*

**Suturing the tube in place**

- Connect the tube to the underwater drainage system.
- Use a large suture to close the wound and secure the tube.
- Do not spiral the suture up the tube (‘roman sandal’), because if it slides down it will become loose.

*Figure 8: Suturing process*
Drainage systems

Classic three-bottle system

Three bottles are connected in sequence to form the drainage system:

1. The first bottle is for collection.
2. The second bottle is the water seal—the one-way valve that allows air to leave the pleural space but not enter it.
3. The third bottle is for suction control.

Newer systems

New drainage bottles use dry apparatus to replace either one or both of the second and third bottles. Dry one-way valves and dry suction are available.

Management and troubleshooting

The quantity and quality of drainage are important (for example, 200 mL every 24 hours of serosanguinous fluid).

Air leaks should be documented and graded. The following scale can be used:

- continuous air leak
- air leak with passive expiration
- air leak with forced expiration (cough)
- no air leak.

Swinging of the tube denotes patency. Tubes that do not swing are blocked, or the underlying lung is completely expanded and is occluding the apertures.

Drains should not be clamped, except in special circumstances. Drains are usually clamped to determine if there is a very small air leak. Chest tubes should only be clamped in controlled circumstances by staff who fully understand the physiology.
Learning activities

Suggested learning activities and timetables are outlined below.

<table>
<thead>
<tr>
<th>Timing</th>
<th>Activity</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 minutes</td>
<td>Facilitated discussion</td>
<td>1, 2 and 3</td>
</tr>
<tr>
<td>45 minutes</td>
<td>Chest tube insertion demonstration and practice</td>
<td>3 and 4</td>
</tr>
<tr>
<td>10 minutes</td>
<td>Summary</td>
<td>All</td>
</tr>
<tr>
<td>10 minutes</td>
<td>Evaluation</td>
<td></td>
</tr>
</tbody>
</table>

Total time = 1 hour 35 minutes

Facilitated discussion

The facilitator should lead a discussion amongst participants about the issues covered in the background information. The facilitator should not give a didactic lecture, but instead promote open discussion and knowledge sharing amongst participants. Participants should be encouraged to describe any real-life experiences they have encountered.

Major issues which the facilitator should ensure are covered include:

- the anatomy of the chest wall and chest cavity
- the indications for insertion of an ICC
- the recommended site and technique for placement and insertion of an ICC.

PowerPoint slides are available for the facilitator to use to summarise these main points at the end of the discussion, or as triggers if participants have not identified the major issues.

Skills stations

The skills stations allow participants to practise completing inserting a chest tube. Participants should be guided through the skill using Peyton’s four-step model. Feedback should be provided at the completion of the skill and as the facilitators walk around the room.

The program and resources required assume two facilitators for every 12 participants, a ratio of 1:6. Depending on the professional mix of the group (that is, medical and nursing), facilitators should place appropriate emphasis on those ‘assisting’ and ‘doing’, as deemed appropriate for individual institutions.

For more information on how to insert a chest tube, watch the instructional video included or go to the New England Journal of Medicine’s Videos in Clinical Medicine ‘Chest-Tube Insertion’ presentation at http://content.nejm.org/misc/videos.shtml.
Summary

The summary session reinforces content covered in the learning activities, and is an opportunity for participants to reflect on what they have covered. No new material should be introduced.

Major points to recap in the summary include:
- the anatomy of the chest wall and chest cavity
- the indications for insertion of a chest tube
- recommended site and technique for placement and insertion of a chest tube.

Participants should be offered access to equipment and educators in the future to allow them to practise these skills if they need to improve their skill level or confidence. Participants may be encouraged to observe or assist experienced colleagues performing these skills in controlled settings to put these skills into a clinical context.

Resource list

The following resource list assumes three facilitators for every 12 participants, a ratio of 1:4. As a minimum, the following resources are needed to conduct this module.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Quantity</th>
<th>Additional comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest tube</td>
<td>13</td>
<td>May need various sizes</td>
</tr>
<tr>
<td>Suture—large gauge (0 silk or Prolene)</td>
<td>13</td>
<td>Used in skill station</td>
</tr>
<tr>
<td>Long curved forcep (Roberts)</td>
<td>13</td>
<td>Used in skill station</td>
</tr>
<tr>
<td>Scalpel and blades</td>
<td>13</td>
<td>Used in skill station</td>
</tr>
<tr>
<td>Water to simulate local anaesthetic</td>
<td>13</td>
<td>Used in skill station</td>
</tr>
<tr>
<td>Syringe</td>
<td>13</td>
<td>Used in skill station</td>
</tr>
<tr>
<td>Mats</td>
<td>13</td>
<td>Used in skill station</td>
</tr>
<tr>
<td>Clamps</td>
<td>13</td>
<td>Used in skill station</td>
</tr>
<tr>
<td>Pork spare ribs</td>
<td>13</td>
<td>Have the layer of skin removed so that subcutaneous fat may be removed before the session</td>
</tr>
<tr>
<td>Evaluations</td>
<td>12</td>
<td>One for each participant</td>
</tr>
</tbody>
</table>
Evaluation

A formal evaluation has been specifically developed for this module. It incorporates the objectives of the module and the perceptions of the participants about whether they have increased their understanding by working through the module. It is highly recommended that this formal evaluation be copied and completed by all participants at the completion of the module.

A range of informal evaluation tools may also be used in conjunction with this evaluation throughout the module, including those available in the Department of Human Services’ Clinical Skills Facilitators Manual from the basic course conducted in 2007.

References

1. Alam, N. 2008 Inter Costal Catheter Insertion Course, St Vincent’s Hospital Medical Education Unit, St Vincent’s Hospital, Melbourne, Australia


3. Royal Australasian College of Surgeons Early Management of Severe Trauma Course (EMST) Melbourne, Australia
Resources

Facilitator feedback form

The following form should be used to assist you in giving feedback after each participant has practised their ICC skills at the skill station.

Feedback using the Pendleton model

Pendleton’s model of feedback assists learners to maximize their potential at different stages of training, raise their awareness of strengths and areas for improvement, and identify actions to be taken to improve performance. Pendleton’s rules are structured in such a way that the learner identifies the positives first, in order to create a safe environment. This is followed by the facilitator or group reinforcing these positives and discussing skills to achieve them. Different techniques are then suggested. The advantage of this method is that the learner’s strengths are discussed first. Avoiding a discussion of weaknesses right at the beginning prevents defensiveness and allows reflective behaviour in the learner.

Below is a series of questions to assist you in this technique:

1. Ask the learner how they feel.
2. Ask the learner what went well and why (this can be combined with question 1 and 3).
3. Tell the learner what went well and why.
4. Ask the learner what could have been done better and why.
5. Tell the learner what could have been done better and why.
6. Summarise the learner’s strengths and identify up to three things to concentrate on.

Note: This form does not need to be given to the participant — it is a guide for you, the group facilitator.
Module 1: Intercostal catheters (ICCs)—evaluation

Thank you for participating in this module. As part of our commitment to quality improvement the following questionnaire will be used to plan future implementation of this module. We appreciate your time completing this evaluation.

1. Overall

How would you rate this module?

☐ poor  ☐ fair  ☐ good  ☐ very good  ☐ outstanding

2. Learning objectives

Please consider whether this module was successful in meeting the following learning objectives:

<table>
<thead>
<tr>
<th>Chest tube management</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Slightly agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussed the anatomy of the chest wall and chest cavity</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Identified the indications for insertion of an ICC</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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</tr>
<tr>
<td>Discussed the recommended site and technique for placement and insertion of an ICC</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>Practised the recommended site and technique for placement and insertion of an ICC</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

3. Important learning outcomes

What are the three most important things you have learned from this module?
4. Module implementation

Please indicate to what extent you agree or disagree with each of the following statements in relation to the implementation of the module.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Slightly agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The facilitator respected my experience</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
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</tr>
<tr>
<td>The facilitator encouraged my participation</td>
<td>□</td>
<td>□</td>
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<tr>
<td>I was able to ask the facilitator questions</td>
<td>□</td>
<td>□</td>
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<tr>
<td>The facilitator was able to answer my questions</td>
<td>□</td>
<td>□</td>
<td>□</td>
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<tr>
<td>The feedback I received was clear</td>
<td>□</td>
<td>□</td>
<td>□</td>
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</tr>
<tr>
<td>The feedback I received will assist me in my future performance</td>
<td>□</td>
<td>□</td>
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<tr>
<td>There was adequate time for the introduction</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>I have increased my confidence in my knowledge and skill for ICC insertion</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>I have identified future learning needs in this topic area</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

5. Future module implementation

Do you think the module should be altered in any way? □ yes □ no

If yes, what recommendations do you have?

__________________________

__________________________

Thank you
PowerPoint Presentation

1. Clinical Skills in Hospitals Project

   Chest Tubes and Management
   
   MODULE 1
   ‘Inter Costal Catheters’

2. Inter Costal Catheters

   Pleural Space
   • Anatomy
   • Diseases

3. Inter Costal Catheters

   Chest tubes
   • Indications
   • Insertion

4. Inter Costal Catheters

   Drainage systems
   • Management

   Anatomy of the Pleural space

5. Inter Costal Catheters

   Diseases of the pleural space
   • Air – pneumothorax (ptx)
   • Blood – hemotherax
   • Pus – pyothorax or empyema
   • Excess pleural fluid – pleural effusion
   • Chyle – chylothorax
Module 2: Pleurocaths

Introduction

Chest tube management was developed as a teaching and learning tool for Victorian clinical educators. The information contained in each module was developed using evidence-based resources and examples of best practice. Where expert opinion varies, a discussion section is included. However, it is not within the scope of Chest tube management to address the full spectrum of local variations. Variations can occur in several areas, including practices relating to types of equipment used, infection control processes, practice guidelines and so on. Therefore, educators should, where appropriate, adapt content to reflect their local policies, procedures and protocols. This will ensure the relevancy of the package content to your learners.

The modules are designed to be discrete courses in their own right. They are timetabled so they can be completed in a 1–2 hour timeframe. This timeframe was chosen after we received feedback from clinical educators requesting shorter courses, because health professionals often have limited time to educate away from patients. However, the packages may also be combined into a one- or two-day course.

Chest tube management should be used as an educational tool to assist in the teaching of clinical skills. It is structured as a guide to assist clinical educators, and uses many concepts taught in the Clinical Skills in Hospitals Project (Train-the-Trainer courses). Educators are encouraged to build on this resource by adding their own scenarios which incorporate health service protocols, policies and other resources. Each module is designed as a lesson plan to incorporate the simulations into the teaching of clinical skills.

Aims

Chest tube management aims to make participants confident in their application of skills associated with identifying indications for inserting intercostal catheters and fine-bore cannulae, and appropriately inserting and managing these catheters and cannulae in different environments and settings. This package is intended for use with medical and nursing participants.

Package structure

Chest tube management contains four modules that provide learning opportunities for health professionals at all levels of experience and from medical and nursing disciplines. Modules 1 and 2 are regarded as fundamental. Modules 3 and 4 are more difficult and are regarded as intermediate.
Skills included in Chest tube management include chest tube insertion, needle aspiration, fine-bore catheter insertion (for example, Pleurocath) underwater seal drains and haemo-pneumothorax management.

This package was designed to develop participants’ knowledge, skills and behaviours in the safe management of pneumothoraces and haemothoraces, including chest tube insertion and management. The modules expose participants to increasingly complex skills and knowledge and test their ability to combine these individual skills, work as a team and solve problems in more difficult situations.

Educators delivering these modules should be aware of participants’ level of experience and choose appropriate modules. Modules presume an increasing level of knowledge as they progress, ranging from a fundamental knowledge of anatomy and physiology for the fundamental modules, up to detailed knowledge of haemo-pneumothorax management for the complex modules. Novice participants (such as first-year graduates) are expected to start with the fundamental modules, and only move onto intermediate and more complex modules as they demonstrate proficiency. More experienced participants may start at the intermediate level if the educator is satisfied that they have the prior knowledge and skills. Individual educators are responsible for assessing each participant’s baseline knowledge and determining which modules they need to complete. More specific descriptions of presumed knowledge are outlined in each module.
The design of these packages presumes that the clinical educators using them have knowledge and expertise in current best practice regarding the teaching of clinical skills and conducting facilitated discussions. Knowledge and expertise are presumed commensurate with the Department of Human Services’ basic and advanced Train-the-Trainer programs. Clinical educators are encouraged to refer to the Department of Human Services’ Clinical Skills Facilitators Manual for theory on:

1. Peyton’s model for teaching clinical skills
2. leading small group discussions
3. giving feedback
4. crisis resource management skills.
Module 2: Pleurocaths

Author: Dr Neil Cunningham

Aims
This module teaches health professionals to insert, or assist in the insertion of, a pleural catheter confidently and competently; and to recognise and act on important complications.

Presumed knowledge
This module is aimed at medical and nursing health professionals involved in inserting, using and maintaining ICCs. They are expected to have a basic knowledge of:

1. chest wall anatomy—surface, intercostal muscles, pleura
2. thoracic and abdominal anatomy—pleura, lung, heart, diaphragm, spleen, liver and kidneys.

Objectives
By the end of this module, participants should have:

1. reviewed the indications for pleural aspiration and insertion of pleural catheters
2. reviewed the potential complications of pleural aspiration/catheter insertion
3. practised pleural aspiration and insertion of pleural catheters using part task trainers
4. practised dealing with pleural catheter insertion and management on a simulated patient.

Background information for educators
This module allows participants to become familiar with pleural catheters. Educators should take note of the mix of health professionals in the group. While medical staff are responsible for insertion of pleural catheters, all health professionals should be aware of the indications, techniques and problems associated with pleural catheter insertion. If the group comprises non-medical staff, the discussion and learning sessions should focus on familiarity with equipment and assisting medical staff with pleural catheter insertion.
Types of pneumothorax

Trauma related:
- open
  - a pneumothorax with an open wound communicating to external atmosphere
- tension
  - a build-up of pleural air sufficient to place pressure on mediastinal structures
- haemopneumothorax
  - a combination of blood and air in the pleural space.

Non-trauma related:
- primary
  - pneumothoraces that occur in otherwise healthy people without lung disease
- secondary
  - pneumothoraces that occur in people with underlying lung disease.

Fluid accumulation

Various fluids can accumulate in the pleura:
- pus (empyema)
- effusion:
  - transudate—protein < 3 g per mL
  - exudate—protein > 3 g per mL
- blood
- chyle.

Options for draining the air or fluid (for therapeutic or diagnostic purposes)
- intercostal catheter (chest drain)—can be used for drainage of traumatic or non-traumatic air or fluid
- needle aspiration—suitable as an emergency procedure (in the setting of tension pneumothorax) or as an aspiration technique in diagnostic or therapeutic thoracentesis
- pleurocath—a fine-bore tube inserted into the pleura through a bevelled hollow metal cylinder
- pneumocath—a fine-bore tube inserted into the pleura using the Seldinger technique.
Indications for aspiration

This is also covered in detail in Chest tube management—Module 3: Underwater seal drains.

Indications for chest drain insertion:

- pneumothorax:
  - in any ventilated patient
  - tension pneumothorax after initial needle relief
  - persistent or recurrent pneumothorax after simple aspiration
  - large secondary spontaneous pneumothorax in patients over 50 years
- malignant pleural effusion
- empyema and complicated parapneumonic pleural effusion
- traumatic haemopneumothorax
- postoperative—for example, thoracotomy, oesophagectomy, cardiac surgery.

When to use a fine-bore pleural catheter rather than a chest tube

Primary pneumothorax

Conservative management should be employed for small closed, mildly symptomatic spontaneous pneumothoraces.

Aspiration

Initial aspiration can be performed with fine-bore pleural catheters. The catheter can be left in place while full expansion of lung occurs. Connection to suction via an underwater seal or one-way valve system can be performed if full expansion has not occurred.

Aspiration compared to ICC

A variation in approaches to dealing with non-traumatic pneumothoraces exists, and significant lack of adherence to pneumothorax treatment guidelines is evident in practice. The current evidence-based recommendations are below.

Aspiration (using either needle or pleural catheter) is as effective as intercostal catheter insertion in the treatment of primary pneumothorax when considering recurrence rates and success of lung re-expansion. Patients are less likely to be hospitalised, have shorter hospital stays and lower pain scores after aspiration.

Secondary pneumothorax

Secondary pneumothoraces occur in patients with pre-existing lung disease (such as emphysema). Successful lung re-expansion following aspiration is less than that seen in primary pneumothoraces.

Most secondary pneumothoraces can be successfully aspirated. Aspiration is no less effective than ICC placement in recurrence rates.

Large secondary pneumothoraces should be considered high risk for failure following aspiration, and high risk for recurrence.
Pleural effusion

Symptomatic pleural effusion is suitable for drainage by needle (cannula), pleurocath or intercostal catheter. Pus or heavily blood-stained fluid may require an intercostal catheter, due to higher risk of catheter blockage.

Malignant pleural effusion

Repeated pleural aspiration for symptomatic relief is recommended for patients with short life expectancies. There is a high recurrence rate, so pleurodesis is recommended otherwise.

Fine-bore pleural catheters result in less discomfort and scarring than large chest tubes, and are ideally suited to this type of patient.

---

Figure 1: Treatment of primary pneumothoraces

Start

Breathless and/or rim of air > 2cm on chest radiograph?

YES

Aspiration

Successful

NO

Consider repeat aspiration

Successful

NO

Intercostal drain

Successful

NO

Referral to chest physician within 48 hours Suction

Referral to thoracic surgeon after 5 days

YES

Remove 24 hours after full re-expansion/cessation of air leak without clamping

YES

Consider discharge

NO
Figure 2: Treatment of secondary pneumothoraces

Secondary pneumothorax

Start

Breathless + age > 50 years + rim of air > 2cm on chest radiographic?

- YES
  - Intercostal drain
    - Successful
      - YES
        - Aspiration
      - NO
        - NO
        - NO
        - NO
        - YES
          - Referral to chest physician after 48 hours Suction
            - Successful
              - YES
                - Remove 24 hours after full re-expansion/cessation of air leak
              - NO
                - Early discussion with surgeon after 3 days
  - NO
    - NO
    - NO
    - YES
      - Admit to hospital for stays

- NO
  - YES
    - Referral to chest physician after 48 hours Suction
      - Successful
        - YES
          - Aspiration
        - NO
          - NO
          - NO
          - NO
          - NO
          - YES
            - Consider discharge
Steps involved in inserting a needle or pleural catheter

1. Pleurocath insertion—for pneumothorax
2. Pleurocath insertion—for pleural effusion
3. Pneumocath insertion—for pneumothorax
4. Emergency needle aspiration in tension pneumothorax
5. Needle aspiration in primary pneumothorax

1. Pleurocath insertion—for pneumothorax

Indication

Consent

Explain the procedure to the patient before starting.

Equipment

- part task trainer
- 1% lignocaine 10 mL
- 23 g needle
- 10 mL syringe
- pleurocath
- scalpel
- three-way tap
- 50 mL syringe
- two large tegaderm
- option of Heimlich flutter valves connected to a drainage bag or underwater seal suction kit.

Premedication

- optional benzodiazepine or opiate in distressed patients
- diazepam 10 mg oral or 1–5 mg IV
- morphine 1–5 mg IV.

Confirm insertion site

- confirm patient’s identity
- confirm correlation between clinical signs and available imaging (CXR/CT).

The clinical signs in a pneumothorax are reduced or absent breath sounds on auscultation, with hyper-resonance to percussion on the affected side. In large pneumothoraces, there will be tracheal deviation away from the affected side.
**Insert catheter**

Insert the catheter through the ‘safe triangle’, which is bordered by the ribline of the fourth or fifth intercostal space and the midaxillary line. This minimises risk of puncture of internal mammary artery, and scarring of breast and muscle tissue.

**Position patient**

- semi-recumbent with arm (of affected side) behind head.

**Preparation of equipment**

Aseptic technique:

- sterile gloves
- gown
- equipment and skin cleansing (iodine/chlorhexidine)—there is no indication for IV antibiotics in non-trauma, non-empyema cases.

Local anaesthesia:

- 1% lignocaine infiltrated to skin/intercostal/pleural levels.

**Catheter insertion procedure**

Local anaesthesia:

- 1% lignocaine to skin/intercostal/pleural levels
- pleural level will be noted by aspiration of bubbles.

Remove the syringe, leaving the needle in place within the anaesthetised track.

Make a nick in the skin to assist entry of catheter.

Remove needle and insert tip of metal cannula into the ‘safe triangle’, which is bordered by the ribline of the fourth or fifth intercostal space and the midaxillary line, using a corkscrew motion to move through the layers.

Once into the pleural space do not advance the metal cannula any further; instead, advance the flexible catheter into the pleural space to the desired length.

Remove the metal cannula and hold onto the flexible catheter at the skin.

Apply tegaderm dressings sandwiched around the catheter.

Remove stopper from end of catheter.

The catheter is first covered in a sterile fashion, sandwiched between two large tegaderm dressings. A flexible catheter will kink if folded directly to the skin, and can be securely fastened using a medicine cup, split up on one side. This allows the catheter to emerge perpendicular to the skin.
Confirm position:
- clinically (air expelled from catheter/needle)
- radiologically (repeat CXR if leaving the catheter in to confirm appropriate length of tube in pleural cavity).

**Drainage**

Either:
- attach three-way tap and 50 mL syringe and aspirate until resistance is felt
  or
- attach dry (Heimlich flutter valves connected to a drainage bag) or wet (underwater seal) suction.

**Suction/no suction**

No evidence exists to support routine use of suction in spontaneous pneumothorax. If needed, use the underwater seal at 10–20 cm H₂O.

**Remove catheter**

No evidence exists to support clamping during catheter removal. Advise patient about the Valsalva manoeuvre or expiration during removal.

2. **Pleurocath insertion—for pleural effusion**

**Indication**

**Consent**

Explain the procedure to the patient before starting.

**Equipment preparation**

- 1% lignocaine 10 mL
- 23 g needle
- 10 mL syringe
- pleurocath
- scalpel
- three-way tap
- 50 mL syringe
- two large tegaderm
- option of Heimlich flutter valve connected to drainage bag.

**Premedication**

- optional benzodiazepine or opiate in distressed patients
- diazepam 10 mg oral or 1–5 mg IV
- morphine 1–5 mg IV.
Confirm insertion site

- confirm patient’s identity
- confirm correlation between clinical signs and available imaging (CXR/CT).

The clinical signs in a pleural effusion are reduced or absent breath sounds on auscultation, with dullness to percussion on the affected side. In large effusions there will be tracheal deviation away from the affected side.

Insert catheter

Insert the catheter through the ‘safe triangle’, which is bordered by the ribline of the fourth or fifth intercostal space and the midaxillary line. This minimises risk of puncture of internal mammary artery, and scarring of breast and muscle tissue. Alternatively, the posterior position can be used with the insertion site seventh intercostal space, aiming to place the catheter in a basal position.

Position patient:

- semi-recumbent with arm (of affected side) behind head
- seated upright for posterior insertion.

Aseptic technique:

- sterile gloves
- gown
- equipment
- skin cleansing (iodine/chlorhexidine).

There is no indication for IV antibiotics in non-trauma, non-empyema cases.

Local anaesthesia:

- 1% lignocaine infiltrated to skin/intercostal/pleural levels.

Catheter insertion procedure

Local anaesthesia:

- 1% lignocaine to skin/intercostal/pleural levels
- pleural level will be noted by aspiration of fluid.

Remove syringe, leaving the needle in place of anaesthetised track.

Make a nick in the skin to assist entry of catheter.

Remove needle and insert tip of metal cannula into the ‘safe triangle’, which is bordered by the ribline of the fourth or fifth intercostal space and the midaxillary line, or posteriorly, into the seventh intercostal space using a corkscrew motion to move through the layers.
Once in the pleural space, do not advance the metal cannula any further; instead, advance the flexible catheter into the pleural space to the desired length.

Remove the metal cannula and hold onto the flexible catheter at the skin.

Apply tegaderm dressings sandwiched around the catheter.

Remove stopper from end of catheter.

**Cover aspiration site/secure drain tube**

Confirm position:
- clinically (fluid expelled from catheter)
- radiologically (repeat CXR if leaving the catheter in to confirm appropriate length of catheter in pleural cavity).

**Drainage**

Closed system using drainage bag or aspiration using three-way tap.

**Remove catheter**

No evidence exists to support clamping during catheter removal. Advise the patient about the Valsalva manoeuvre or expiration during removal.

**3. Pneumocath insertion—for pneumothorax**

**Consent**

Explain the procedure to the patient before starting.

**Equipment**
- 1% lignocaine 10 mL
- 23 g needle
- 10 mL syringe
- pneumocath kit
- scalpel
- three-way tap
- 50 mL syringe
- two large tegaderm.

**Premedication**
- optional benzodiazepine or opiate in distressed patients
- diazepam 10 mg oral or 1–5 mg IV
- morphine 1–5 mg IV.
Confirm insertion site
- confirm patient’s identity
- confirm correlation between clinical signs and available imaging (CXR/CT).

The clinical signs in a pneumothorax are reduced or absent breath sounds on auscultation, with hyper-resonance to percussion on the affected side. In large pneumothoraces there will be tracheal deviation away from the affected side.

Insert catheter
Insert the catheter through the ‘safe triangle’, which is bordered by the ribline of the fourth or fifth intercostal space and the midaxillary line. This minimises risk of puncture of internal mammary artery, and scarring of breast and muscle tissue.

Position patient
- semi-recumbent with arm (of affected side) behind head.

Preparation of equipment
Aseptic technique:
- sterile gloves
- gown
- equipment
- skin cleansing (iodine/chlorhexidine).

There is no indication for IV antibiotics in non-trauma, non-empyema cases.
Local anaesthesia:
- 1% lignocaine infiltrated to skin/intercostal/pleural levels.

Catheter insertion procedure
Local anaesthesia:
- 1% lignocaine to skin/intercostal/pleural levels
- pleural level will be noted by aspiration of bubbles.

Remove syringe, leaving the needle in place of the anaesthetised track.

Make a nick in the skin to assist entry of catheter.

Remove needle and insert trochar (sharp hollow needle) into the ‘safe triangle’, which is bordered by the ribline of the fourth or fifth intercostal space and the midaxillary line, using a corkscrew motion to move through the layers.

Once in the pleural space, advance round-tipped guidewire through the lumen of the trocar.

Remove trocar and advance the flexible pneumocath over the guidewire.

Remove guidewire.
Apply tegaderm dressings sandwiched around the catheter.

For drainage of pneumothorax either:
- attach three-way tap and 50 mL syringe and aspirate until resistance is felt.

**Remove catheter**

No evidence exists to support clamping during catheter removal. Advise patient about the Valsalva manoeuvre or expiration during removal.

**4. Emergency needle aspiration in tension pneumothorax**

**Equipment**

- 14 or 16g cannula

**Procedure**

This is an emergency—you do not have time for the normal preparatory steps.

Insert cannula into second/third intercostal space, midclavicular line.

After the needle enters (when a hiss is observed coming from the cannula), withdraw the needle, leaving the cannula in place.

The cannula inserted into the chest for aspiration should be manually held for the duration of the procedure.

Prepare for insertion of intercostal catheter.

**5. Needle aspiration in primary pneumothorax**

**Equipment**

- 16 g cannula attached to fluid filled syringe (water/saline)
- three-way tap
- 50 mL syringe.

**Procedure**

Local anaesthesia:
- 1% lignocaine to skin/intercostal/pleural levels.

Insert cannula into second/third intercostal space, midclavicular line.

After the needle enters (a bubbling will be observed in the fluid-filled syringe), withdraw the needle, leaving the cannula in place.

Attach three-way tap to cannula and 50 mL syringe.

Manually aspirate air until resistance is felt.

A hollow needle inserted into the chest for aspiration/drainage should be manually held for the duration of the procedure.
6. Needle aspiration for investigation of pleural effusion

**Equipment**
- 21 g (green) needle
- 20 mL syringe.

**Procedure**
Remove 20 mL.

Note appearance and odour.

Order tests for:
- cytology
- protein
- LDH
- pH
- gram stain
- culture
- sensitivity
- AAFB stains.

Ultrasound-guided aspiration is recommended if the effusion is small or loculated.

**Potential complications of insertion of a pleural catheter**

During procedure:
- difficulty due to previous operative scars, loculated collections, blocked catheter
- long-term disease (emphysema/asthma)
- rupture of bullae
- excessive bleeding (warfarin, haemophilia).

After procedure:
- pneumothorax
- re-accumulation of air/fluid
- bleeding
- infection (local skin, empyema)
- pulmonary oedema
- liver, spleen, great vessel or heart puncture.
Learning activities

Suggested learning activities and timetable are outlined below.

<table>
<thead>
<tr>
<th>Timing</th>
<th>Activity</th>
<th>Objective</th>
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<tbody>
<tr>
<td>30 minutes</td>
<td>Facilitated discussion</td>
<td>1, 2</td>
</tr>
<tr>
<td>15 minutes</td>
<td>Scenario skills station 1</td>
<td>3, 4</td>
</tr>
<tr>
<td>15 minutes</td>
<td>Scenario skills station 2</td>
<td>3, 4</td>
</tr>
<tr>
<td>15 minutes</td>
<td>Scenario skills station 3</td>
<td>3, 4</td>
</tr>
<tr>
<td>15 minutes</td>
<td>Scenario skills station 4</td>
<td>3, 4</td>
</tr>
<tr>
<td>30 minutes</td>
<td>Debrief</td>
<td>4</td>
</tr>
<tr>
<td>15 minutes</td>
<td>Summary</td>
<td></td>
</tr>
</tbody>
</table>

Total time = 2 hours 15 minutes

Facilitated discussion

The facilitator should lead a discussion amongst participants about the issues covered in the background information for example, indications for pleural catheter insertion, techniques of insertion and potential complications. The facilitator should not give a didactic lecture, but instead promote open discussion and knowledge sharing amongst participants. Participants should be encouraged to describe any real-life experiences they have encountered.

PowerPoint slides are available for the facilitator to use to summarise these main points at the end of the discussion, or as triggers if participants have not identified the major issues.

Skills stations

1. Pleurocath insertion—for pneumothorax

Equipment

- part task trainer
- 1% lignocaine 10 mL
- 23 g needle
- 10 mL syringe
- pleurocath
- scalpel
- three-way tap
- 50 mL syringe
- two large tegaderm
- option of Heimlich flutter valves connected to a drainage bag or underwater seal suction kit.
Scenario 1: Spontaneous pneumothorax

A 23-year-old female presents with breathlessness and left-sided pleuritic chest pain. You order a CXR, which shows a left-sided pneumothorax > 2 cm. You decide on manual aspiration.

Scenario 2 (advanced scenario): Blocked catheter

You are called to see the 23-year-old woman, in whom you placed a pleurocath and attached this to an underwater seal. After initial improvement in her symptoms, she complains of worsening breathlessness and shoulder tip pain. Her repeat CXR shows the catheter curled around several times adjacent to the diaphragm. The pneumothorax is still present. The underwater seal is not bubbling.

What do you think is happening?
What will you do next?

2. Pleurocath insertion—for pleural effusion

Equipment preparation:

- part task trainer
- 1% lignocaine 10 mL
- 23 g needle
- 10 mL syringe
- pleurocath
- scalpel
- three-way tap
- 50 mL syringe
- two large tegaderm
- option of Heimlich flutter valve connected to drainage bag.

Scenario 3: Malignant effusion

A 75-year-old man with disseminated pancreatic cancer is admitted to your ward. He is jaundiced and breathless with O₂ saturation 88% on 10 L O₂. He has absent breath sounds and is dull to percussion on the right side. His CXR shows a right-sided pleural effusion.

You diagnose a pleural effusion and decide to place a pleuracath to drain this.

Scenario 4 (advanced): Malignant effusion/hypotension

You are called to see the 75-year-old man. He has drained 4.5 L of bloodstained fluid (which is still draining) and complains of feeling unwell. He is diaphoretic, HR 120, sBP 75, O₂ saturation 92% on 10 L O₂. He has improving breath sounds on the left side. He has a syncopal episode.

What do you think is happening?
What will you do next?
3. Pneumocath insertion—for pneumothorax

Equipment:
- part task trainer
- 1% lignocaine 10 mL
- 23 g needle
- 10 mL syringe
- pneumocath kit
- scalpel
- three-way tap
- 50 mL syringe
- two large tegaderm.

Scenario 1: Spontaneous pneumothorax
A 23-year-old female presents with breathlessness and left-sided pleuritic chest pain. You order a CXR which shows a left-sided pneumothorax > 2 cm. You decide on manual aspiration.

4. Emergency needle aspiration in tension pneumothorax

Equipment:
- mannequin with tension pneumothorax facility
- 16 g cannula.

Case study: Tension pneumothorax
A 24-year-old male patient in the emergency department presents with head and chest injuries, including left-sided flail chest. His GCS is 3 on arrival, and he has just been intubated. Suddenly his blood pressure drops (sBP 60), he becomes tachycardic (HR 130) and breath sounds on the left side are absent. His collar had been removed for intubation and you notice distended neck veins. His trachea is deviated to the right, and he has have muffled heart sounds. You diagnose a tension pneumothorax.
Treat the tension pneumothorax.
5. Needle aspiration in primary pneumothorax

Equipment:
- part task trainer
- 16 g cannula attached to fluid filled syringe (water/saline)
- three-way tap
- 50 mL syringe.

6. Needle aspiration for investigation of pleural effusion

Equipment:
- part task trainer
- 21 g (green) needle
- 20 mL syringe.

Case study: Malignant effusion

A 75-year-old man with disseminated pancreatic cancer is admitted to your ward. He is jaundiced and breathless initially, his O2 saturation improves to 98% on 10 L O2, and his breathlessness settles.

He has absent breath sounds, and is dull to percussion on the right side. His CXR shows a right-sided pleural effusion.

You diagnose a pleural effusion and decide to perform a diagnostic tap.

Summary

The summary session reinforces content covered in the learning activities, and is an opportunity for participants to reflect on what they have covered. No new material should be introduced.

Important points to include in the summary are:
- small, asymptomatic spontaneous pneumothorax is suitable for conservative management
- large, symptomatic spontaneous pneumothorax is suitable for aspiration by needle, pleurocath, pneumocath or intercostal catheter
- pleural effusions are suitable for aspiration by needle, pleurocath or intercostal catheter
- follow procedural steps before and after procedure to prevent complications
- tension pneumothorax needs immediate treatment.
Evaluation

A formal evaluation has been specifically developed for this module. It incorporates the objectives of the module and the perceptions of the participants about whether they have increased their understanding by working through the module. It is highly recommended that this formal evaluation be copied and completed by all participants at the completion of the module.

A range of informal evaluation tools may also be used in conjunction with this evaluation throughout the module, including those available in the Department of Human Services’ Clinical Skills Facilitators Manual from the basic course conducted in 2007.

References


Resources

Facilitator feedback form

The following form should be used to assist you in giving feedback after each participant has practised their Pleurocaths skills at the skill station.

Feedback using the Pendleton model

Pendleton’s model of feedback assists learners to maximize their potential at different stages of training, raise their awareness of strengths and areas for improvement, and identify actions to be taken to improve performance. Pendleton’s rules are structured in such a way that the learner identifies the positives first, in order to create a safe environment. This is followed by the facilitator or group reinforcing these positives and discussing skills to achieve them. Different techniques are then suggested. The advantage of this method is that the learner’s strengths are discussed first. Avoiding a discussion of weaknesses right at the beginning prevents defensiveness and allows reflective behaviour in the learner.

Below is a series of questions to assist you in this technique:

1. Ask the learner how they feel.
2. Ask the learner what went well and why (this can be combined with question 1 and 3).
3. Tell the learner what went well and why.
4. Ask the learner what could have been done better and why.
5. Tell the learner what could have been done better and why.
6. Summarise the learner’s strengths and identify up to three things to concentrate on.

Note: This form does not need to be given to the participant — it is a guide for you, the group facilitator.
Module 2: Pleurocaths—evaluation

Thank you for participating in this module. As part of our commitment to quality improvement the following questionnaire will be used to plan future implementation of this module. We appreciate your time completing this evaluation.

1. Overall
How would you rate this module?

☐ poor  ☐ fair  ☐ good  ☐ very good  ☐ outstanding

2. Learning objectives
Please consider whether this module was successful in meeting the following learning objectives:

<table>
<thead>
<tr>
<th>Chest tube management</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Slightly agree</th>
<th>Agree</th>
<th>Strongly agree</th>
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<tr>
<td>Reviewed the indications for pleural aspiration and insertion of pleural catheters</td>
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<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Reviewed the potential complications of pleural aspiration/catheter insertion</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Practised pleural aspiration and insertion of pleural catheters using part task trainers</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Practiced dealing with pleural catheter insertion and management on a simulated patient</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

3. Important learning outcomes
What are the three most important things you have learned from this module?
4. Module implementation

Please indicate to what extent you agree or disagree with each of the following statements in relation to the implementation of the module.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Slightly agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The facilitator respected my experience</td>
<td>□</td>
<td>□</td>
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<tr>
<td>The facilitator encouraged my participation</td>
<td>□</td>
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</tr>
<tr>
<td>I was able to ask the facilitator questions</td>
<td>□</td>
<td>□</td>
<td>□</td>
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</tr>
<tr>
<td>The facilitator was able to answer my questions</td>
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<tr>
<td>The feedback I received was clear</td>
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<td>□</td>
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<tr>
<td>The feedback I received will assist me in my future performance</td>
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<tr>
<td>There was adequate time for the skills stations</td>
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<tr>
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<tr>
<td>There was adequate time for the simulations</td>
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<tr>
<td>I have increased my confidence in performing a Plural Aspiration</td>
<td>□</td>
<td>□</td>
<td>□</td>
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<td>I have identified future learning needs in this topic area</td>
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<td>□</td>
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</tr>
</tbody>
</table>

5. Future module implementation

Do you think the module should be altered in any way? □ yes □ no

If yes, what recommendations do you have?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Thank you
1. Clinical Skills in Hospitals Project

Chest Tubes and Management

MODULE 2

“Pleurocaths”

2. Pleural Aspiration

Different types of pneumothorax

- Trauma Related
- Non Trauma Related

3. Pleural Aspiration

Indications for Aspiration

- Pneumothorax
- In any ventilated patient
- Tension pneumothorax after initial needle relief
- Persistent or recurrent pneumothorax after simple aspiration
- Large secondary spontaneous pneumothorax in patients over 50 years
- Postoperative pleural effusion
- Postoperative and complicated pneumothorax, pleural effusion
- Postoperative - for example, thoracostomy, oesophagectomy, cardiac surgery

4. Pleural Aspiration

Treatment of secondary pneumothoraces

- Pleurocath insertion – for pneumothorax
- Pleurocath insertion – for pleural effusion
- Pneumothorax insertion – for pneumothorax
- Emergency needle aspiration in tension pneumothorax
- Needle aspiration in primary pneumothorax
- Needle aspiration for investigation of pleural effusion

5. Pleural Aspiration

Potential complications of insertion of a pleural catheter

During procedure:

- Difficult due to previous operative scars, loculated infections, blocked
- Long term disease (emphysema/asthma), rupture of blebs
- Massive bleeding (severe, haemoptysis)

After procedure:

- Pneumothorax
- Decompensation of any fluid
- Bleeding
- Infection (coastal sin, empyema)
- Postoperative infection
Module 3: Underwater seal drains

Introduction

*Chest tube management* was developed as a teaching and learning tool for Victorian clinical educators. The information contained in each module was developed using evidence-based resources and examples of best practice. Where expert opinion varies, a discussion section is included. However, it is not within the scope of *Chest tube management* to address the full spectrum of local variations. Variations can occur in several areas, including practices relating to types of equipment used, infection control processes, practice guidelines and so on. Therefore, educators should, where appropriate, adapt content to reflect their local policies, procedures and protocols. This will ensure the relevancy of the package content to your learners.

The modules are designed to be discrete courses in their own right. They are timetabled so they can be completed in a 1–2 hour timeframe. This timeframe was chosen after we received feedback from clinical educators requesting shorter courses, because health professionals often have limited time to educate away from patients. However, the packages may also be combined into a one- or two-day course.

*Chest tube management* should be used as an educational tool to assist in the teaching of clinical skills. It is structured as a guide to assist clinical educators, and uses many concepts taught in the *Clinical Skills in Hospitals Project* (Train-the-Trainer courses). Educators are encouraged to build on this resource by adding their own scenarios which incorporate hospital/health service protocols, policies and other resources. Each module is designed as a lesson plan to incorporate the simulations into the teaching of clinical skills.

Aims

*Chest tube management* aims to make participants confident in their application of skills associated with identifying indications for inserting intercostal catheters and fine-bore cannulae, and appropriately inserting and managing these catheters and cannulae in different environments and settings. This package is intended for use with medical and nursing participants.

Package structure

*Chest tube management* contains four modules that provide learning opportunities for health professionals at all levels of experience and from medical and nursing disciplines. Modules 1 and 2 are regarded as fundamental. Modules 3 and 4 are more difficult and are regarded as intermediate.
Skills included in *Chest tube management* include chest tube insertion, needle aspiration, fine-bore catheter insertion (for example, Pleurocath) underwater seal drains and haemo-pneumothorax management.

This package was designed to develop participants’ knowledge, skills and behaviours in the safe management of pneumothoraces and haemothoraces, including chest tube insertion and management. The modules expose participants to increasingly complex skills and knowledge and test their ability to combine these individual skills, work as a team and solve problems in more difficult situations.

Educators delivering these modules should be aware of participants’ level of experience and choose appropriate modules. Modules presume an increasing level of knowledge as they progress, ranging from a fundamental knowledge of anatomy and physiology for the fundamental modules, up to detailed knowledge of haemo-pneumothorax management for the complex modules. Novice participants (such as first-year graduates) are expected to start with the fundamental modules, and only move onto intermediate and more complex modules as they demonstrate proficiency. More experienced participants may start at the intermediate level if the educator is satisfied that they have the prior knowledge and skills. Individual educators are responsible for assessing each participant’s baseline knowledge and determining which modules they need to complete. More specific descriptions of presumed knowledge are outlined in each module.
The design of these packages presumes that the clinical educators using them have knowledge and expertise in current best practice regarding the teaching of clinical skills and conducting facilitated discussions. Knowledge and expertise are presumed commensurate with the Department of Human Services’ basic and advanced Train-the-Trainer programs. Clinical educators are encouraged to refer to the Department of Human Services’ Clinical Skills Facilitators Manual for theory on:

1. Peyton’s model for teaching clinical skills
2. leading small group discussions
3. giving feedback
4. crisis resource management skills.
Module 3: Underwater seal drains

Authors: Santina Cotela, Julian Van Dijk

Aims

This module increases medical, nursing and physiotherapy participants’ knowledge and skills in the management of an underwater seal drainage system (UWSD).

Presumed knowledge

Participants are required to have completed Chest tube management—Module 1: Intercostal catheters, and are expected to have a basic knowledge of:

1. chest wall anatomy and pleural cavity
2. the principles of pneumothorax causation and decompression.

Objectives

By the end of this module, participants should have:

1. discussed the indications for the use of a UWSD system
2. identified and discussed the mechanical principles of a three-chamber UWSD system
3. discussed patient management requiring a UWSD system
4. identified how to assess a functioning UWSD system
5. identified how to determine ineffective functioning of a UWSD
6. discussed troubleshooting strategies
7. participated in the clinical skills stations and case studies.

Background information for educators

Intercostal catheters (ICCs, or chest tubes) are inserted into the patient to relieve the pleural cavity of air and/or fluid. ICC tubes come in several sizes. The size of the catheter depends on the size of the patient, and whether there is a need to drain air and/or fluid. The ICC is inserted into the patient’s pleural cavity by doctors trained in the insertion of ICC through the intercostal muscle at the intercostal space level that is appropriate to drain the air and fluid for the individual patient. The appropriate placement of the ICC is important to facilitate drainage and permit re-expansion of the lung, restoring haemodynamic stability by minimising mediastinal shift, through the re-establishment of the negative intrapleural pressure. This is achieved by connecting the ICC to an underwater seal drain (UWSD).
The UWSD is a specialised drain comprising three chambers: the collection chamber, the water seal chamber and the suction chamber.

The collection chamber allows for the monitoring of the volume, rate and nature of the drainage. Drainage of fluid via an underwater seal drain occurs due to gravity; therefore, the drain should always be kept below chest level.

The water seal chamber acts as a one-way valve. The air is evacuated via the water seal due to the pressure created by normal respiration and coughing. However, atmospheric air cannot penetrate the water seal and therefore cannot re-enter the pleural cavity during the next inspiration. Initially, when an ICC is inserted into a collapsed lung, the bubbling in the intercostal chamber may be continuous. However, as the lung re-expands, this bubbling (air leak) may become intermittent or occur only on cough. At this stage the patient may be taken off low-wall suction if the consultant decides, and the air leak monitored again under the new circumstances.

The suction chamber regulates suction in order to re-expand the lung. Suction pressure is determined by the level of water in the suction control chamber, and affected by attaching low pressure wall suction, which is increased until gentle continuous bubbling is attained.
To achieve full expansion of the lung so that visceral and parietal pleurae are opposite can take varying amounts of time, depending on what condition is being treated and the patient’s general lung health before ICC insertion. The decision to remove an ICC is made by the medical team, upon assessment of drainage, air-leak and CXR. Generally, an ICC may be in situ for approximately a week.

**Nursing**

The objectives of nursing care during UWSD system use are to:

- maintain a respiratory rate of between 12–20 per minute
- prevent infection
- drain the site
- ensure the patient is pain free and comfortable
- maintain patient safety while the drain is in situ.

**Actions and rationales to achieve care objectives**

Observe the patient for signs of respiratory distress, that is, rapid respiration, pallor, cyanosis, sweating or pressure on the chest. These may be symptoms of tension pneumothorax or pulmonary embolism.

Observe the patient for any signs of surgical emphysema, which is the presence of air or gas in the subcutaneous tissues of the body following the insertion of an ICC. This can indicate inappropriate ICC placement.

Observe the patient for verbal and non-verbal signs of pain. Administer adequate analgesia as prescribed to minimise incisional pain and general discomfort, to try to prevent chest infection and promote re-expansion of the lung.

A daily chest X-ray is essential in monitoring the progress of the lung expansion, and monitoring the positioning of the ICC.

Monitor drainage into the UWSD. Monitor the colour and amount of drainage to determine whether it is residual blood in the pleural cavity or acute bleeding into the cavity, which may warrant a return to theatre. The longer the ICC is in situ the less fluid drainage should occur, and the colour should change from a haemoserous to a more serous colour. Documentation of drainage levels should occur as per the medical team’s directions.

Check the patency of the system. The absence of oscillations (swing or tidal) may indicate obstruction of the drainage system by clots or kinks, loss of negative pressure or complete re-expansion of the lung. The fluid in the tube, or in the tube of the underwater seal drainage chamber, should swing up and down—this merely indicates normal breathing and system patency. Stripping or milking of ICC is a method sometimes used if the ICC is blocked. However, this method is controversial.
and should only be performed with medical permission, because it is known to create transient high levels of negative pressure within the pleural cavity.

Air leaks should be documented and graded. The following scale can be used:

- continuous air leak
- air leak with passive expiration
- air leak with forced expiration (cough)
- no air leak.

This is observed by the amount of bubbling occurring in the water seal chamber.

Check that all ICC and UWSD connections are secured correctly. This should prevent air from entering the pleural space. If accidental disconnection occurs, reconnect as soon as possible. If necessary, submerge the drain in water or apply clamps for as short a time as possible.

Keep the drainage system below chest level to prevent fluid from re-entering the chest cavity.

Drains should not be clamped except in special circumstances. Drains are usually clamped to assess if there is a very small air leak. Chest tubes should only be clamped in controlled circumstances by staff who fully understand the physiology.

Observe the ICC insertion site and dressings for signs of infection.

Ensure that all dressings and system changes are performed using a sterile technique. Ensure that the underwater seal chamber and the suction chambers are only filled with sterile water.

It is preferable that patient be nursed in a semi-Fowler’s position (sitting) to assist with breathing and the gravitational drainage of fluid from the pleural cavity.

**Learning activities**

Suggested learning activities and timetables are outlined below.

<table>
<thead>
<tr>
<th>Timing</th>
<th>Activity</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 minutes</td>
<td>Facilitated discussion</td>
<td>1–7</td>
</tr>
<tr>
<td>40 minutes</td>
<td>Skills stations/case studies</td>
<td>1–7</td>
</tr>
<tr>
<td>5 minutes</td>
<td>Summary</td>
<td></td>
</tr>
<tr>
<td>5 minutes</td>
<td>Evaluation</td>
<td></td>
</tr>
</tbody>
</table>

**Total time** = 70 minutes
Facilitated discussion

The facilitator should lead a discussion amongst participants about the issues covered in the background information, for example, the mechanics of the UWSD. The facilitator should not give a didactic lecture, but instead promote open discussion and knowledge sharing amongst participants. Participants should be encouraged to describe any real-life experiences they have encountered.

Key concepts to cover include:

- functional principles of the UWSD system
- functions of each of the three chambers
- assessment of a normally functioning UWSD system
- assessment of an abnormally functioning UWSD system
- troubleshooting procedures to maintain UWSD patency
- patient care requirement during the use of an UWSD system.

Where possible, demonstrations should use the UWSD equipment during the facilitated discussion. This will facilitate for the skills stations that are set around simple case scenarios.

Skills stations

The three skills stations have been set around cases studies. These allow participants opportunities to demonstrate and practise the skills required for the safe operation of the UWSD systems.

The skills stations are designed to present a care requirement discussed in the background information. Set these up as either simple work stations, or if manikins that function with ICCs are available, set up the stations using this recourse.

Simulation of the swing and bubble can be achieved in some manikins, which are recommended if available.

The UWSD systems to be used for this activity are those commonly in use at the educators’ facility. Changes may be required to the skills stations to meet the skill requirements for this module. Clinical educators should practise the skills stations before the session to determine what can be realistically simulated.

The operating protocol for the clinical educators’ health service should be integrated into the skills stations regarding scope of practice appropriate for the participants present.
Making a pleural simulator

Facilitators can make a simple pleural simulator to allow participants to view both normal and abnormal functioning of an UWSD system. This simulator will work with both ‘wet’ and ‘dry’ systems.

Requirements:
- one old-style suction vessel with two openings or tubes (Figure 5: Pleural simulator setup, below, shows an old glass suction bottle with a rubber lid and two tubes through that lid)
- one normal wet or dry UWSD system.
- a small ICC Tube 9 (a size 20 F is shown in Figure 5)
- one balloon (a large party balloon works well)
- Blu-tack (in case of air leaks around the base of the suction bottle lid).

Procedure:
- Set up the low-wall suction and UWSD as per normal setup.
- Using the suction bottle, remove the lid.
- Place the balloon over the end of one of the tubes and sleek the top to the tube to guarantee no air leaks. This becomes the simulated lung that will start to re-expand in the bottle when suction is applied.
- Ensure that the tube connected to the balloon is open to normal air pressure on the outside of the suction container.
- Using the other tube, or entrance into the suction bottle, thread or place an ICC in through the tube until it is seen clearly in the bottle. On the outside ICC connection point, attach and the UWSD tubing as per your health service guidelines.
- Apply either tape or Blu-tack to the entrance point of the ICC, entering the bottle to ensure a good seal.
- The suction bottle housing the ICC and balloon should be sealed so that a negative pressure is achieved when the low-wall suction is applied. This will be obvious, because the balloon will inflate.
- Once the seals have been checked, start the low-wall suction activating the system.

With this module, you can apply leaks to the system by setting up poor connections, allowing participants to problem solve the issue and fix them.

To simulate a haemothorax or pleural aspirate, fill the suction container and allow the bottom of the ICC to go below the fluid level.
Skill station 1
This skill station allows participants to perform a normal assessment to determine if the UWSD is working correctly. The UWSD will be working normally.

**Skill station 1**
You are looking after a 35-year-old man who required an ICC on the right-hand side of his chest. As part of your patient assessment, you assess the UWSD system.

What do you assess to determine if the system is working?

Skill station 2
This skill station allows participants to determine whether there is an air leak, and find a leak in the system that they can fix.

The drain (simulated) should have a leak in the connection between the ICC and the UWSD tubing. Sleek should be made available to fix this problem.

**Case study 2**
You are called to assess Mr Browns, who had an ICC inserted three days ago. He appears to be short of breath and restless. As part of your assessment, you review the UWSD.

What do you find?
What will you do?

Skill station 3
This skill station allows participants to determine that the collection chamber needs to be replaced.

The UWSD requires that the collection chamber is filled to capacity. It will also require a second chamber to be fitted.

**Case study 3**
You are looking after a day 2 thoracic patient who required an ICC and drainage of a hemothorax. On assessment, you notice that the collection chamber is full.

Replace the chamber as per your health service protocols.
Evaluation

A formal evaluation has been specifically developed for this module. It incorporates the objectives of the module and the perceptions of the participants about whether they have increased their understanding by working through the module. It is highly recommended that this formal evaluation be copied and completed by all participants at the completion of the module.

A range of informal evaluation tools may also be used in conjunction with this evaluation throughout the module, including those available in the Department of Human Services’ Clinical Skills Facilitators Manual from the basic course conducted in 2007.

References


Resources

<table>
<thead>
<tr>
<th>Resources</th>
<th>Quantity</th>
<th>Additional comments</th>
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<tbody>
<tr>
<td>Facilitators</td>
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<td>3 UWSD systems</td>
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</tr>
<tr>
<td>Manikins</td>
<td>1–2</td>
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<tr>
<td>UWSD chamber</td>
<td>1–2</td>
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<tr>
<td>Sleek tape</td>
<td>2 rolls</td>
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<td>ICC drains</td>
<td>3</td>
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</tr>
<tr>
<td>Low-wall suction system</td>
<td>1–3</td>
<td>To facilitate correct function</td>
</tr>
</tbody>
</table>
Facilitator feedback form

The following form should be used to assist you in giving feedback after each participant has practised their UWSD skills at the skill station.

Feedback using the Pendleton model

Pendleton’s model of feedback assists learners to maximize their potential at different stages of training, raise their awareness of strengths and areas for improvement, and identify actions to be taken to improve performance. Pendleton’s rules are structured in such a way that the learner identifies the positives first, in order to create a safe environment. This is followed by the facilitator or group reinforcing these positives and discussing skills to achieve them. Different techniques are then suggested. The advantage of this method is that the learner’s strengths are discussed first. Avoiding a discussion of weaknesses right at the beginning prevents defensiveness and allows reflective behaviour in the learner.

Below is a series of questions to assist you in this technique:

1. Ask the learner how they feel.
2. Ask the learner what went well and why (this can be combined with question 1 and 3).
3. Tell the learner what went well and why.
4. Ask the learner what could have been done better and why.
5. Tell the learner what could have been done better and why.
6. Summarise the learner’s strengths and identify up to three things to concentrate on.

Note: This form does not need to be given to the participant — it is a guide for you, the group facilitator.
Module 3: Underwater seal drains—evaluation

Thank you for participating in this module. As part of our commitment to quality improvement the following questionnaire will be used to plan future implementation of this module. We appreciate your time completing this evaluation.

1. Overall

How would you rate this module?

☒ poor ☐ fair ☐ good ☐ very good ☐ outstanding

2. Learning objectives

Please consider whether this module was successful in meeting the following learning objectives:

<table>
<thead>
<tr>
<th>Chest tube management</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Slightly agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discuss the indications for the use of a UWSD system</td>
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<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Identify and discussed the mechanical principles of a three-chamber UWSD system</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Discuss patient management requiring an UWSD system</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Identify how to assess a functioning UWSD system</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Identify how to determine ineffective functioning of a UWSD</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Discuss troubleshooting strategies</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Participated in the clinical Skills stations and case studies</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

3. Important learning outcomes

What are the three most important things you have learned from this module?
4. **Module implementation**

Please indicate to what extent you agree or disagree with each of the following statements in relation to the implementation of the module.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Slightly agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The facilitator respected my experience</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The facilitator encouraged my participation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I was able to ask the facilitator questions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The facilitator was able to answer my questions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The feedback I received was clear</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The feedback I received will assist me in my future performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There was adequate time for the introduction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There was adequate time for the simulations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have increased my confidence in managing chest tubes and UWSD systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have identified future learning needs in this topic area</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. **Future module implementation**

Do you think the module should be altered in any way?  

- [ ] yes  
- [ ] no

If yes, what recommendations do you have? 

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Thank you
PowerPoint presentation

1. Clinical Skills in Hospitals Project
   Chest Tubes and Management
   MODULE 3 ‘Underwater Seal Drains’

2. Module Outline
   • Facilitated discussion
     – Review of UWSD Systems and care
   • Skill Stations
   • Summation
   • Evaluation

3. UWSD System
   • The collection chamber
   • The water seal chamber
   • The suction chamber

4. UWSD Management
   • Standard operation
   • Set up
   • Removal
   • System checks (Shift Check)
   • Documentation

5. Trouble Shooting
   • Air leaks
   • Clamped tubes
   • Full collection chambers

6. Skill Stations
   • 3 skill stations
Module 4: Management scenarios

Introduction

*Chest tube management* was developed as a teaching and learning tool for Victorian clinical educators. The information contained in each module was developed using evidence-based resources and examples of best practice. Where expert opinion varies, a discussion section is included. However, it is not within the scope of *Chest tube management* to address the full spectrum of local variations. Variations can occur in several areas, including practices relating to types of equipment used, infection control processes, practice guidelines and so on. Therefore, educators should, where appropriate, adapt content to reflect their local policies, procedures and protocols. This will ensure the relevancy of the package content to your learners.

The modules are designed to be discrete courses in their own right. They are timetabled so they can be completed in a 1–2 hour timeframe. This timeframe was chosen after we received feedback from clinical educators requesting shorter courses, because health professionals often have limited time to educate away from patients. However, the packages may also be combined into a one- or two-day course.

*Chest tube management* should be used as an educational tool to assist in the teaching of clinical skills. It is structured as a guide to assist clinical educators, and uses many concepts taught in the *Clinical Skills in Hospitals Project* (Train-the-Trainer courses). Educators are encouraged to build on this resource by adding their own scenarios which incorporate hospital/health service protocols, policies and other resources. Each module is designed as a lesson plan to incorporate the simulations into the teaching of clinical skills.

Aims

*Chest tube management* aims to make participants confident in their application of skills associated with identifying indications for inserting intercostal catheters and fine-bore cannulae, and appropriately inserting and managing these catheters and cannulae in different environments and settings. This package is intended for use with medical and nursing participants.

Package structure

*Chest tube management* contains four modules that provide learning opportunities for health professionals at all levels of experience and from medical and nursing disciplines. Modules 1 and 2 are regarded as fundamental. Modules 3 and 4 are more difficult and are regarded as intermediate.
### Level of complexity

<table>
<thead>
<tr>
<th>Complex</th>
<th>Package structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>For participants with more than 4 years experience or who have completed Modules 1–4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intermediate</th>
<th>Package structure</th>
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</thead>
<tbody>
<tr>
<td>For participants in postgraduate years 3–4 or who have completed Modules 1 and 2</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fundamental</th>
<th>Package structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>For participants in postgraduate years 1–2</td>
<td></td>
</tr>
</tbody>
</table>

Skills included in *Chest tube management* include chest tube insertion, needle aspiration, fine-bore catheter insertion (for example, Pleurocath) underwater seal drains and haemo-pneumothorax management.

This package was designed to develop participants’ knowledge, skills and behaviours in the safe management of pneumothoraces and haemothoraces, including chest tube insertion and management. The modules expose participants to increasingly complex skills and knowledge and test their ability to combine these individual skills, work as a team and solve problems in more difficult situations.

Educators delivering these modules should be aware of participants’ level of experience and choose appropriate modules. Modules presume an increasing level of knowledge as they progress, ranging from a fundamental knowledge of anatomy and physiology for the fundamental modules, up to detailed knowledge of haemo-pneumothorax management for the complex modules. Novice participants (such as first-year graduates) are expected to start with the fundamental modules, and only move onto intermediate and more complex modules as they demonstrate proficiency. More experienced participants may start at the intermediate level if the educator is satisfied that they have the prior knowledge and skills. Individual educators are responsible for assessing each participant’s baseline knowledge and determining which modules they need to complete. More specific descriptions of presumed knowledge are outlined in each module.
The design of these packages presumes that the clinical educators using them have knowledge and expertise in current best practice regarding the teaching of clinical skills and conducting facilitated discussions. Knowledge and expertise are presumed commensurate with the Department of Human Services’ basic and advanced Train-the-Trainer programs. Clinical educators are encouraged to refer to the Department of Human Services’ *Clinical Skills Facilitators Manual* for theory on:

1. Peyton’s model for teaching clinical skills
2. leading small group discussions
3. giving feedback
4. crisis resource management skills.
Module 4: Management scenarios

Author: Dr Stuart Dilley

Aims
This module allows participants to practise and consolidate their familiarity with the individual skills (pleural aspiration, chest tube insertion and management of underwater seal drains) learned in the basic modules of the Chest tube management package in a logical and coordinated fashion in a controlled setting.

Presumed knowledge
This module is targeted to health professionals who are competent in the component skills of inserting and managing intercostal catheters, underwater seal drains and performing needle aspiration of the pleural space.

Participants should have already practised these skills in the skills stations, but may not have had an opportunity to apply them to a clinical scenario. If participants do not yet feel confident with the individual skills, they should be redirected to Chest tube management—Module 1: Intercostal catheters, Module 2: Pleurocaths and Module 3: Underwater seal drains.

Objectives
By the end of this module, participants should have:

1. reviewed the options for intervention in patients with pneumothoraces and haemothoraces
2. assessed and appropriately managed a simulated patient (manikin) requiring intervention for these conditions
3. determined the likely cause of a malfunctioning chest tube on a simulated patient (manikin) and initiated appropriate management to rectify this problem.

Background information for educators
Much of the background information pertaining to pleural aspiration, chest tube insertion and management of underwater seal drains was covered in Chest tube management—Module 1: Intercostal catheters, Module 2: Pleurocaths and Module 3: Underwater seal drains. Participants undertaking Module 4: Management scenarios should have the knowledge and skills covered in these earlier modules. This module gives participants the opportunity to put these skills together as a coordinated response in a team environment.
Learning activities

Suggested learning activities and timetables are outlined below. Timetable 1 is designed for 12 participants working in two groups of six. Timetable 2 is designed for six participants working together.

<table>
<thead>
<tr>
<th>Timetable 1</th>
<th>Activity</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 minutes</td>
<td>Introduction, manikin familiarisation</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Group 1</td>
<td>Group 2</td>
</tr>
<tr>
<td>10 minutes</td>
<td>Simulation 1</td>
<td>Simulation 2</td>
</tr>
<tr>
<td>30 minutes</td>
<td>Debrief</td>
<td>Debrief</td>
</tr>
<tr>
<td>10 minutes</td>
<td>Simulation 2</td>
<td>Simulation 1</td>
</tr>
<tr>
<td>30 minutes</td>
<td>Debrief</td>
<td>Debrief</td>
</tr>
<tr>
<td>10 minutes</td>
<td>Summary</td>
<td>All</td>
</tr>
<tr>
<td>10 minutes</td>
<td>Evaluation</td>
<td></td>
</tr>
</tbody>
</table>

**Total time = 2 hours**

<table>
<thead>
<tr>
<th>Timetable 2</th>
<th>Activity</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 minutes</td>
<td>Introduction, manikin familiarisation</td>
<td>1</td>
</tr>
<tr>
<td>10 minutes</td>
<td>Simulation 1</td>
<td>All</td>
</tr>
<tr>
<td>30 minutes</td>
<td>Debrief</td>
<td>All</td>
</tr>
<tr>
<td>10 minutes</td>
<td>Simulation 2</td>
<td>All</td>
</tr>
<tr>
<td>30 minutes</td>
<td>Debrief</td>
<td>All</td>
</tr>
<tr>
<td>10 minutes</td>
<td>Summary</td>
<td>All</td>
</tr>
<tr>
<td>10 minutes</td>
<td>Evaluation</td>
<td></td>
</tr>
</tbody>
</table>

**Total time = 2 hours**

Introduction

The facilitator should lead a brief discussion amongst participants to refresh or clarify any issues relating to the management of pneumothoraces or haemothoraces, and introduce the simulation training to follow. This should not be a comprehensive lecture on chest tube management. Time should be allocated to allow for a familiarisation session with the manikin.
Skills stations

The skills stations allow participants to practise their skills in the recognition and management of pneumothoraces as a team, in a simulated environment. Participants are exposed to clinical scenarios and should manage these within the confines of the skills relevant to their health profession.

The program assumes two facilitators for 12 participants. Participants should be divided into two groups of six (Timetable 1). Three participants each participate in one scenario and observe a second. Those not participating in the scenario observe and participate in the debriefing session. The debriefing period should include all six participants—that is, the active participants and their observers. These scenarios can be run with smaller groups. If only six participants are present, the scenarios can be run consecutively (Timetable 2).

Ideally, these scenarios should be run on human patient simulators that allow for the insertion of intercostal catheters (ICCs). However, they may be run on more basic simulators that do not allow actual insertion of ICCs. Regardless, the focus of the simulation and the debrief is not necessarily on the technical skill, but on the decision making process and the management plans.

Simulation 1: Tension pneumothorax

Scenario design

In this scenario, a tall, thin 40-year-old male presents to the emergency department with pleuritic chest pain and shortness of breath. He shows signs of a tension pneumothorax that requires recognition, needle aspiration and preparation for formal chest tube insertion.

<table>
<thead>
<tr>
<th>Case history</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient details</td>
</tr>
<tr>
<td>Sex</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Past history</td>
</tr>
<tr>
<td>Social history</td>
</tr>
<tr>
<td>History of present illness</td>
</tr>
<tr>
<td>Presenting symptoms</td>
</tr>
</tbody>
</table>

* Side of symptoms may vary, depending on resources/manikins available to educators.
## Resources

### General
- **Setting/environment**: Hospital emergency department
- **Patient attire**: Street clothes: shirt, trousers
- **Monitoring**: ECG, pulse oximetry, non-invasive BP
- **Supporting documentation required**: ED observation and treatment chart

### Equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
<th>Sourced from</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manikin—ideally capable of simulating needle aspiration of pleural space and insertion of ICC</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Hospital bed or ED trolley</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Hospital gown</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Pillow, blanket</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Patient treatment chart</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Hudson mask and tubing</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Oxygen supply</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Resuscitation trolley—ALS drugs and airway equipment</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>IV cannulae</td>
<td></td>
<td>Various sizes, including 14G for needle decompression</td>
</tr>
<tr>
<td>CXR showing pneumothorax</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Pleural aspiration set as used at specific institution—Pleurocath and so on</td>
<td>1 set</td>
<td></td>
</tr>
<tr>
<td>ICC insertion set and intercostal tubes as used at specific institution</td>
<td>1 set</td>
<td></td>
</tr>
<tr>
<td>Underwater seal drain set as used at specific institution</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Heimlich valve—if available at specific institution</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Roles

Participant 1
You are a health professional working in the emergency department of your hospital. An experienced ED nurse has begun to assess a 40-year-old man in the resuscitation cubicle with chest pain and shortness of breath, and calls for your assistance. You have two colleagues on which to call. The resuscitation cubicle is stocked with equipment and drugs as appropriate for a real ED.

Participants 2 and 3
You are health professionals working in the hospital’s ED. Your colleague (Participant 1) has gone to attend to a patient with chest pain in the resuscitation cubicle. Your colleague may call on you for assistance in managing the patient. A nurse is also present (faculty member) to assist with locating equipment and medications.

Faculty role play: ED resus nurse
You are a nurse working in the resuscitation area of the ED. You are assessing a 40-year-old man with chest pain and shortness of breath, who has just arrived having had a GP-arranged CXR performed at an outside X-ray facility. You are concerned about this man’s shortness of breath and blood pressure and ask for assistance by calling in Participant 1 and directing them to the CXR. You assist all participants in finding equipment and appropriate drugs if needed, but do not assemble the underwater seal drain.

Faculty role play: senior clinician
You are a senior clinician working in the ED. If participants experience difficulties, it is appropriate to enter the scenario and offer assistance. Otherwise, at the conclusion of the scenario, you arrive to take a handover of the patient.
### Simulator programming considerations

<table>
<thead>
<tr>
<th>System</th>
<th>Baseline state</th>
<th>Change in State 1</th>
<th>Change in State 2</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVS</td>
<td>HR 120 ST</td>
<td>HR 100 ST</td>
<td>HR 120 ST</td>
<td>HR 90 SR</td>
</tr>
<tr>
<td></td>
<td>BP 80/50 mmHg</td>
<td>BP 110/60 mmHg</td>
<td>BP 80/50 mmHg</td>
<td>BP 120/60 mmHg</td>
</tr>
<tr>
<td>Respiratory</td>
<td>RR 30</td>
<td>RR 18</td>
<td>RR 30</td>
<td>RR 16</td>
</tr>
<tr>
<td></td>
<td>O₂ saturation 80% room air (RA)</td>
<td>O₂ saturation 97% on oxygen</td>
<td>O₂ saturation 90% RA</td>
<td>O₂ saturation 99% on oxygen</td>
</tr>
<tr>
<td></td>
<td>Left-sided* pneumothorax—decreased air entry, absent breath sounds, hyper-expanded Tracheal deviation away from side of PTX</td>
<td>Left-sided* PTX persists Trachea midline</td>
<td>Left-sided* PTX persists Trachea deviated away from side of PTX</td>
<td>PTX signs gone Trachea midline</td>
</tr>
<tr>
<td>Neurologic</td>
<td>GCS 15</td>
<td>GCS 15</td>
<td>GCS 15</td>
<td>GCS 15</td>
</tr>
<tr>
<td></td>
<td>Distressed</td>
<td>More comfortable</td>
<td>Distressed</td>
<td>Comfortable</td>
</tr>
<tr>
<td>Response to participant intervention</td>
<td>Remain in state until needle decompression or chest tube insertion Needle decompression → go to State 1 Chest tube insertion → go to resolution</td>
<td>Chest tube insertion** → go to resolution No chest tube within 5 minutes → go to State 2</td>
<td>Chest tube insertion** → go to resolution</td>
<td>** Some manikins may not allow actual insertion of a chest tube. In this instance, the focus of the simulation should be recognising the need for intervention and going through the process of insertion and setting up the underwater seal drain.</td>
</tr>
</tbody>
</table>

* Side of symptoms may vary, depending on resources/manikins available to educators.

** Some manikins may not allow actual insertion of a chest tube. In this instance, the focus of the simulation should be recognising the need for intervention and going through the process of insertion and setting up the underwater seal drain.
Debriefing points:
- signs and symptoms of tension pneumothorax
- need for rapid decompression of tension pneumothorax
- need for progression from needle decompression to formal chest tube
- sites of insertion for needle decompression and chest tubes.

Simulation 2: Malfunctioning intercostal catheter

Scenario design

In this scenario, a 60-year-old female on the surgical ward following chest tube (ICC) insertion for traumatic haemo-pneumothorax experiences increasing shortness of breath. Her chest tube appears to be blocked and her pneumothorax is re-accumulating. Participants should recognise that the ICC is not functioning, take steps to try and remedy this (which they cannot) and plan to insert a second ICC when they are unsuccessful.

<table>
<thead>
<tr>
<th>Case history</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient details</td>
</tr>
<tr>
<td>Sex</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
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<tr>
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</tr>
</tbody>
</table>

* Side of symptoms may vary, depending on resources/manikins available to educators.
### Resources

#### General

<table>
<thead>
<tr>
<th>Setting/environment</th>
<th>Hospital surgical ward</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient attire</td>
<td>Hospital gown/pyjamas</td>
</tr>
<tr>
<td>Monitoring</td>
<td>ECG, pulse oximetry, non-invasive BP</td>
</tr>
<tr>
<td>Supporting documentation required</td>
<td>Ward observation and treatment chart</td>
</tr>
</tbody>
</table>

### Equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
<th>Sourced from</th>
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<tbody>
<tr>
<td>Manikin—ideally capable of simulating needle aspiration of pleural space and insertion of ICC</td>
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</tr>
<tr>
<td>Pleural aspiration set as used at specific institution—Pleurocath and so on</td>
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<td></td>
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<td>ICC insertion set and intercostal tubes as used at specific institution</td>
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<td>Underwater seal drain set as used at specific institution</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Heimlich valve—if available at specific institution</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Roles

Participant 1

You are a health professional working in the surgical ward of your hospital. An experienced nurse has begun to review a 60-year-old woman with shortness of breath, and calls for your assistance. The patient had been admitted to the surgical ward two days earlier after a motor vehicle accident. An ICC was inserted for a haemo-pneumothorax and a large bloody pleural effusion was drained. You have two colleagues on which to call. The ward’s resuscitation trolley is stocked with equipment and drugs as appropriate for an average surgical ward.

Participants 2 and 3

You are health professionals working in the hospital’s surgical ward. Your colleague (Participant 1) has gone to attend to a patient with shortness of breath. Your colleague may call on you for assistance in managing the patient. A nurse is also present (faculty member) to assist with locating equipment and medications.

Faculty role play: ward nurse

You are a nurse working in the surgical ward. You are assessing a 60-year-old woman with shortness of breath. She had been admitted to the surgical ward two days earlier after a motor vehicle accident. An ICC was inserted for a haemo-pneumothorax and a large bloody pleural effusion was drained. You are concerned about her shortness of breath and believe the ICC is not working properly. You ask for assistance by calling in Participant 1. You assist all participants in finding equipment and appropriate drugs if needed, but are unfamiliar with the workings of the underwater seal drain.

Faculty role play: senior clinician

You are a senior clinician working in the surgical ward. If participants experience difficulties, it is appropriate to enter the scenario and offer assistance. Otherwise, at the conclusion of the scenario, you arrive to take a handover of the patient.
### Simulator programming considerations

<table>
<thead>
<tr>
<th>System</th>
<th>Baseline state</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVS</td>
<td>HR 100 SR BP 120/80 mmHg</td>
<td>HR 100 SR BP 120/80 mmHg</td>
</tr>
<tr>
<td>Respiratory</td>
<td>RR 20 O2 Saturation 90% RA</td>
<td>RR 20 O2 Saturation 98% on oxygen Left-sided PTX persists if participants still preparing to insert second ICC Symptoms resolve if second ICC inserted</td>
</tr>
<tr>
<td>Neurologic</td>
<td>GCS 15</td>
<td>GCS 15</td>
</tr>
</tbody>
</table>
| Response to participant intervention | Remains in baseline state until all of the following have been done or discussed:  
  ■ provision of supplemental oxygen  
  ■ check ICC for patency  
  ■ check location of ICC  
  ■ consider need for CXR  
  ■ call for medical assistance if appropriate  
  ■ consider need for needle decompression  
  ■ consideration of insertion of second ICC |  

* Side of symptoms may vary, depending on resources/manikins available to educators.

** For this scenario, it is not necessary to have a manikin that allows insertion of ICC. Simulating the presence of an ICC by taping the catheter to the manikin’s chest wall, and then covering with appropriate dressings should suffice. In this instance, there is no swing or bubbling to observe in the UWS, therefore simulating a blocked ICC.

Debriefing points:

- recognition of malfunctioning ICC
- awareness of likely causes of ICC malfunctions
- awareness of limits to intervention according to health professional status (medical, nursing, allied health)
- recognition of need for second ICC in some instances.
Summary

The summary session reinforces content covered in the learning activities, and is an opportunity for participants to reflect on what they have covered. No new material should be introduced.

Points to cover in the summary include:

- indications for pleural drainage and intercostal catheter insertion
- options for pleural drainage and intercostal catheter insertion
- recognition of tension pneumothorax and need for rapid response
- options for diagnosing and dealing with chest tube and UWS drain malfunctions.

Participants should be encouraged to review the use of chest drains and their management in their own time to reinforce the skills acquired in this module. This should include exposure to real patients with chest drains in situ. Participants should be offered access to equipment and educators in the future if they need to practise or improve their skill level or confidence.

Resource list

The following resource list assumes two facilitators for every 12 participants, a ratio of 1:6. As a minimum, the following resources are needed to conduct this module.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Quantity</th>
<th>Additional comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment and resources as listed in scenario requirements above</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Evaluation

A formal evaluation has been specifically developed for this module. It incorporates the objectives of the module and the perceptions of the participants about whether they have increased their understanding by working through the module. It is highly recommended that this formal evaluation be copied and completed by all participants at the completion of the module.

A range of informal evaluation tools may also be used in conjunction with this evaluation throughout the module, including those available in the Department of Human Services’ Clinical Skills Facilitators Manual from the basic course conducted in 2007.
Resources

Facilitator feedback form

The following form should be used to assist you in giving feedback after each participant has practised their Pleurocaths skills at the skill station.

Feedback using the Pendleton model

Pendleton’s model of feedback assists learners to maximize their potential at different stages of training, raise their awareness of strengths and areas for improvement, and identify actions to be taken to improve performance. Pendleton’s rules are structured in such a way that the learner identifies the positives first, in order to create a safe environment. This is followed by the facilitator or group reinforcing these positives and discussing skills to achieve them. Different techniques are then suggested. The advantage of this method is that the learner’s strengths are discussed first. Avoiding a discussion of weaknesses right at the beginning prevents defensiveness and allows reflective behaviour in the learner.

Below is a series of questions to assist you in this technique:

1. Ask the learner how they feel.
2. Ask the learner what went well and why (this can be combined with question 1 and 3).
3. Tell the learner what went well and why.
4. Ask the learner what could have been done better and why.
5. Tell the learner what could have been done better and why.
6. Summarise the learner’s strengths and identify up to three things to concentrate on.

Note: This form does not need to be given to the participant — it is a guide for you, the group facilitator.
Module 4: Management scenarios—evaluation

Thank you for participating in this module. As part of our commitment to quality improvement the following questionnaire will be used to plan future implementation of this module. We appreciate your time completing this evaluation.

1. Overall

How would you rate this module?

☐ poor  ☐ fair  ☐ good  ☐ very good  ☐ outstanding

2. Learning objectives

Please consider whether this module was successful in meeting the following learning objectives:

Chest tube management
Learning objectives of Module 4: Management scenarios

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Slightly agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reviewed the options for intervention in patients with pneumothoraces and haemothoraces</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Assessed and appropriately managed a simulated patient (manikin) requiring intervention for these conditions</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Assessed and appropriately managed a simulated patient (manikin) experiencing complications of this management</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

3. Important learning outcomes

What are the three most important things you have learned from this module?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
4. Module implementation

Please indicate to what extent you agree or disagree with each of the following statements in relation to the implementation of the module.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Slightly agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The facilitator respected my experience</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The facilitator encouraged my participation</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I was able to ask the facilitator questions</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The facilitator was able to answer my questions</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The feedback I received was clear</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The feedback I received will assist me in my future performance</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>There was adequate time for the introduction</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>There was adequate time for the simulations</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I have increased my confidence in managing chest tubes</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I have identified future learning needs in this topic area</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

5. Future module implementation

Do you think the module should be altered in any way? ☐ yes ☐ no

If yes, what recommendations do you have?

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

Thank you
PowerPoint presentation

1. Clinical Skills in Hospitals Project
   Chest Tube Management
   MODULE 4
   ‘Chest Tube Management Scenarios’

2. Module Outline
   - Facilitated discussion
     - Review of chest tube management
   - Scenarios x 2
   - Summation
   - Evaluation
## Acronyms, abbreviations and measurements

### Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/C</td>
<td>assist control</td>
</tr>
<tr>
<td>AAFB</td>
<td>acid and alcohol fast bacilli</td>
</tr>
<tr>
<td>ABG</td>
<td>arterial blood gas</td>
</tr>
<tr>
<td>ACS</td>
<td>acute coronary syndromes</td>
</tr>
<tr>
<td>AEDs</td>
<td>automated external defibrillator(s)</td>
</tr>
<tr>
<td>AF</td>
<td>atrial fibrillation</td>
</tr>
<tr>
<td>AHA</td>
<td>American Heart Association</td>
</tr>
<tr>
<td>ALS</td>
<td>advanced life support</td>
</tr>
<tr>
<td>AMI</td>
<td>acute myocardial infarction</td>
</tr>
<tr>
<td>APO</td>
<td>acute pulmonary oedema</td>
</tr>
<tr>
<td>APTT</td>
<td>activated partial thromboplastin time</td>
</tr>
<tr>
<td>ARC</td>
<td>Australian Resuscitation Council</td>
</tr>
<tr>
<td>ASB</td>
<td>assisted spontaneous breathing</td>
</tr>
<tr>
<td>AV node</td>
<td>atrioventricular node</td>
</tr>
<tr>
<td>BBB</td>
<td>bundle branch block</td>
</tr>
<tr>
<td>BiPAP</td>
<td>bilevel positive airway pressure</td>
</tr>
<tr>
<td>BLS</td>
<td>basic life support</td>
</tr>
<tr>
<td>BUN</td>
<td>blood urea nitrogen</td>
</tr>
<tr>
<td>CABG</td>
<td>coronary artery bypass graft</td>
</tr>
<tr>
<td>cath lab</td>
<td>catheterisation laboratory</td>
</tr>
<tr>
<td>CE</td>
<td>cardiac enzymes</td>
</tr>
<tr>
<td>CHB</td>
<td>complete heart block</td>
</tr>
<tr>
<td>CK</td>
<td>creatine kinase</td>
</tr>
<tr>
<td>CKMB</td>
<td>creatine kinase Mb</td>
</tr>
<tr>
<td>CMV</td>
<td>controlled mandatory ventilation</td>
</tr>
<tr>
<td>CNS</td>
<td>central nervous system</td>
</tr>
<tr>
<td>COAD</td>
<td>chronic obstructive airways disease</td>
</tr>
<tr>
<td>COPD</td>
<td>chronic obstructive pulmonary disease</td>
</tr>
<tr>
<td>CPAP</td>
<td>continuous positive airway pressure</td>
</tr>
<tr>
<td>CPR</td>
<td>cardiopulmonary resuscitation</td>
</tr>
<tr>
<td>CRM</td>
<td>crisis resource management</td>
</tr>
<tr>
<td>CVA</td>
<td>cerebrovascular accident</td>
</tr>
<tr>
<td>CVC</td>
<td>central venous catheter</td>
</tr>
<tr>
<td>CVS</td>
<td>cardiovascular system</td>
</tr>
<tr>
<td>CXR</td>
<td>chest X-ray</td>
</tr>
<tr>
<td>DIC</td>
<td>disseminated intravascular coagulation</td>
</tr>
<tr>
<td>DKA</td>
<td>diabetic ketoacidosis</td>
</tr>
<tr>
<td>DKS</td>
<td>Damus-Kaye-Stansel [procedure]</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
</tr>
</tbody>
</table>
| DRABC  | D: danger  
R: response  
A: airway  
B: breathing  
C: circulation |
<p>| DVT     | deep vein thrombosis |
| ECF     | extracellular fluid |
| ECG     | electrocardiogram |
| ED      | emergency department |
| EMD     | electromechanical dissociation |
| ENT     | ear, nose and throat |
| EPAP    | expiratory positive airways pressure |
| ET      | endotracheal |
| FBE     | full blood examination |
| FFP     | fresh frozen plasma |
| FRC     | functional residual capacity |
| g       | gram |
| GCS     | Glasgow Coma Scale |
| GI      | gastro-intestinal |
| GIT     | gastro-intestinal tract |
| GTN     | glyceryl trinitrate |
| Hb      | haemoglobin |
| HIV     | human immunodeficiency virus |
| HME     | heat moisture exchanger |
| HPS METI| a brand (Human Patient Simulator) of fully automatic, high-fidelity patient simulator |
| HR      | heart rate |
| I:E ratio| inspiration-to-expiration ratio |
| ICF     | intracellular fluid |
| ICP     | intracranial pressure |
| INR     | international normalised ratio |
| IO      | intraosseous |
| IPAP    | inspiratory positive airways pressure |
| IPPV    | intermittent positive pressure ventilation |
| IV      | intravenous |
| LBBB    | left bundle branch block |
| LDH     | lactate dehydrogenase |
| LMA     | laryngeal mask airway |
| mA      | milliampere |
| MET     | medical emergency team |
| NBM     | nil by mouth |</p>
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NGT</td>
<td>nasogastric tube</td>
</tr>
<tr>
<td>NIMC</td>
<td>national inpatient medication chart</td>
</tr>
<tr>
<td>NIPPV</td>
<td>non-invasive positive pressure ventilation</td>
</tr>
<tr>
<td>NIV</td>
<td>non-invasive ventilation</td>
</tr>
<tr>
<td>NP airways</td>
<td>nasal prong airways</td>
</tr>
<tr>
<td>NSEACS</td>
<td>non-ST elevation acute coronary syndrome</td>
</tr>
<tr>
<td>NSR</td>
<td>normal sinus rhythm</td>
</tr>
<tr>
<td>OP</td>
<td>oropharyngeal airway</td>
</tr>
<tr>
<td>OTC</td>
<td>over-the-counter medications</td>
</tr>
<tr>
<td>PCA</td>
<td>patient-controlled analgesia</td>
</tr>
<tr>
<td>PCI</td>
<td>percutaneous coronary intervention</td>
</tr>
<tr>
<td>PEA</td>
<td>pulseless electrical activity</td>
</tr>
<tr>
<td>PEEP</td>
<td>positive end expiratory pressure</td>
</tr>
<tr>
<td>pH</td>
<td>the measure of the acidity or alkalinity of a solution</td>
</tr>
<tr>
<td>PICC</td>
<td>peripherally inserted central catheter</td>
</tr>
<tr>
<td>PIP</td>
<td>peak inspiratory pressure</td>
</tr>
<tr>
<td>PRVC</td>
<td>pressure regulated volume control</td>
</tr>
<tr>
<td>PS</td>
<td>pressure support</td>
</tr>
<tr>
<td>PTX</td>
<td>pneumothorax</td>
</tr>
<tr>
<td>QRS</td>
<td>wave form seen on electrocardiogram</td>
</tr>
<tr>
<td>RA</td>
<td>room air</td>
</tr>
<tr>
<td>RBBB</td>
<td>right bundle branch block</td>
</tr>
<tr>
<td>RIC line</td>
<td>rapid infusion catheter exchange set</td>
</tr>
<tr>
<td>RMO</td>
<td>registered medical officer</td>
</tr>
<tr>
<td>rPA</td>
<td>retaplace</td>
</tr>
<tr>
<td>RR</td>
<td>respiration rate</td>
</tr>
<tr>
<td>RSI</td>
<td>rapid sequence induction</td>
</tr>
<tr>
<td>rt-PA</td>
<td>alteplase</td>
</tr>
<tr>
<td>RV</td>
<td>right ventricular</td>
</tr>
<tr>
<td>SIMV</td>
<td>synchronised intermittent mandatory ventilation</td>
</tr>
<tr>
<td>SK</td>
<td>streptokinase</td>
</tr>
<tr>
<td>SR</td>
<td>Sinus rhythm</td>
</tr>
<tr>
<td>STEMI</td>
<td>ST elevation myocardial infarction</td>
</tr>
<tr>
<td>SVC</td>
<td>superior vena cava</td>
</tr>
<tr>
<td>TPN</td>
<td>total parenteral nutrition</td>
</tr>
<tr>
<td>UWSD</td>
<td>underwater seal drainage</td>
</tr>
<tr>
<td>V/Q mismatch</td>
<td>ventilation/perfusion mismatch</td>
</tr>
<tr>
<td>VF</td>
<td>ventricular fibrillation</td>
</tr>
<tr>
<td>VT</td>
<td>ventricular tachycardia</td>
</tr>
<tr>
<td>WCC</td>
<td>white cell count</td>
</tr>
<tr>
<td>WOB</td>
<td>work of breathing</td>
</tr>
<tr>
<td>WPW</td>
<td>Wolf-Parkinson-White syndrome</td>
</tr>
</tbody>
</table>
Chemical formulae

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CaCl₂</td>
<td>calcium chloride</td>
</tr>
<tr>
<td>CO₂</td>
<td>carbon dioxide</td>
</tr>
<tr>
<td>ETCO₂</td>
<td>end-tidal carbon dioxide</td>
</tr>
<tr>
<td>FiO₂</td>
<td>fraction of inspired oxygen</td>
</tr>
<tr>
<td>H₂CO₃</td>
<td>bicarbonate</td>
</tr>
<tr>
<td>MgCl₂</td>
<td>magnesium chloride</td>
</tr>
<tr>
<td>MgSO₄</td>
<td>magnesium sulphate</td>
</tr>
<tr>
<td>PaCO₂</td>
<td>partial pressure of carbon dioxide in arterial blood</td>
</tr>
<tr>
<td>PaO₂</td>
<td>partial pressure of oxygen in arterial blood</td>
</tr>
<tr>
<td>SaO₂</td>
<td>saturation of oxygen in arterial blood</td>
</tr>
</tbody>
</table>

Units of Measurement

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>mmHg</td>
<td>millimetres of mercury</td>
</tr>
<tr>
<td>L</td>
<td>litre</td>
</tr>
<tr>
<td>mL</td>
<td>millilitre</td>
</tr>
<tr>
<td>μg</td>
<td>microgram — one-millionth (10^-6) of a gram</td>
</tr>
<tr>
<td>mmol</td>
<td>millimole</td>
</tr>
<tr>
<td>J</td>
<td>joule</td>
</tr>
<tr>
<td>mg</td>
<td>milligram</td>
</tr>
<tr>
<td>cm</td>
<td>centimetre</td>
</tr>
<tr>
<td>m</td>
<td>metre</td>
</tr>
</tbody>
</table>
Clinical Skills in Hospitals Project

Chest tube management

Module 1: Intercostal catheters (ICCs)
Module 2: Pleurocaths
Module 3: Underwater seal drains
Module 4: Management scenarios