Pleural procedure complications
prevention and management
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Royal Brisbane and Womens Hospital

No relationships to disclose
Procedures

- Tap
- ICC
- Pleural Bx
- Tunnelled catheter
- Thoracoscopy

Complications include

- Pneumothorax
- Organ penetration/injury
- Haemothorax
- Infection
- Intercostal nerve injury
- Tube malposition

NHS National Patient Safety Report ICC - 2008

Table 2: Patient safety incidents involving chest drains by degree of harm

<table>
<thead>
<tr>
<th>Degree of Harm (severity)</th>
<th>Frequency</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Harm</td>
<td>1,372</td>
<td>64</td>
</tr>
<tr>
<td>Low</td>
<td>493</td>
<td>23</td>
</tr>
<tr>
<td>Moderate</td>
<td>260</td>
<td>12</td>
</tr>
<tr>
<td>Severe</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Death</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>2,152</td>
<td>100</td>
</tr>
</tbody>
</table>
**Table 1** Types of adverse incidents associated with chest drain use at 101 acute hospital trusts

<table>
<thead>
<tr>
<th>Nature of injury</th>
<th>No. of trusts</th>
<th>No. of deaths</th>
<th>No. of cases</th>
<th>Percent fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung or chest wall injury</td>
<td>35</td>
<td>8</td>
<td>47</td>
<td>17%</td>
</tr>
<tr>
<td>Wrong side</td>
<td>5</td>
<td>2</td>
<td>6</td>
<td>33%</td>
</tr>
<tr>
<td>Lost wire</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Wrong location</td>
<td>24</td>
<td>7</td>
<td>31</td>
<td>23%</td>
</tr>
<tr>
<td>Total</td>
<td>67</td>
<td>17</td>
<td>87</td>
<td>20%</td>
</tr>
</tbody>
</table>

**Table 2** Location of misplaced drains

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of cases</th>
<th>Number of deaths</th>
<th>Per cent fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver</td>
<td>10</td>
<td>1</td>
<td>10%</td>
</tr>
<tr>
<td>Intraperitoneal space</td>
<td>6</td>
<td>0</td>
<td>—</td>
</tr>
<tr>
<td>Spleen</td>
<td>5</td>
<td>1</td>
<td>20%</td>
</tr>
<tr>
<td>Heart</td>
<td>5</td>
<td>3</td>
<td>60%</td>
</tr>
<tr>
<td>Subclavian vessels</td>
<td>2</td>
<td>1</td>
<td>50%</td>
</tr>
<tr>
<td>Colon</td>
<td>1</td>
<td>0</td>
<td>—</td>
</tr>
<tr>
<td>Inferior vena cava</td>
<td>1</td>
<td>1</td>
<td>100%</td>
</tr>
<tr>
<td>Oesophagus</td>
<td>1</td>
<td>0</td>
<td>—</td>
</tr>
<tr>
<td>Drain inserted into wrong side</td>
<td>6</td>
<td>2</td>
<td>33%</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>9</td>
<td>24%</td>
</tr>
</tbody>
</table>
My top 10 tips

1. Do an on-line chest tube course
2. Do an Ultrasound course
3. Do the test/procedure which moves the problem forward- that may be nothing
4. Have someone watch you do your first 3 tubes (at least)
5. With any tap or tube do not continue if you cannot aspirate what you are after
6. Front hand on the chest stops any rapid inward movement of any needle or tube
7. With Seldinger watch the depth of the local anaesthetic needle- every placement step follows from that
8. At thoracoscopy only biopsy pleura that has rib underneath
9. Try to only use the triangle of safety, even for taps
10. Understand trapped lung

Tip 1 Do an on-line chest tube course

- https://www.sdc.qld.edu.au/myaccount
Some General learning points from online course

**Ask for help**

- Personnel
  - sedation (another pair of hands)
  - positioning
  - supervision, avoid after hours
- Ultrasound mark up

**Tip 2 Do an Ultrasound course**

<table>
<thead>
<tr>
<th>Ultrasound guidance</th>
<th>Operator</th>
<th>Frequency of post-procedure pneumothorax</th>
<th>Frequency that a chest drain was required post procedure</th>
<th>Frequency of dry tap/procedure failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Radiologist in training</td>
<td>2.7%</td>
<td>1.8%</td>
<td>2.7%</td>
</tr>
<tr>
<td>Yes</td>
<td>Senior physician</td>
<td>3.6%</td>
<td>0.9%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Yes</td>
<td>Radiologist</td>
<td>2.7%</td>
<td>0.5%</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Physician in training</td>
<td>15.0%</td>
<td>4.7%</td>
<td>12.9%</td>
</tr>
<tr>
<td>No</td>
<td>Senior physician</td>
<td>5.7%</td>
<td>1.4%</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

The calculations and references used in this table are shown in appendix 1 in the online supplement.¹²²–¹³⁴

Havelock et al. Thorax 2010
ASUM

- Certificate in Clinician Performed Ultrasound
- “Pleura” Logbook Requirements
  - Evidence of satisfactory completion of training sessions.
  - Logbook requirements need to be completed, and logbooks need to be submitted within 2 years of completing an accredited course.
  - Perform 20 examinations, to be compared with other imaging or clinical/pathological findings and signed off by a suitably qualified assessor (see above). NB the review may occur after the imaging has been performed, although it is recommended that direct observation occur for at least 3 examinations.
  - At least 50% of examinations must be clinically indicated, and at least 5 must be positive.

- “Lung”
Tip 3 Do the test/procedure which moves the problem forward - that may be nothing

Aspiration

- Can give result
- The fluid may not come back
- Post tap CXR may show space from trapped lung
“Death of the Garden Hose” Baumann
Editorial, Chest 2010

• no significant difference in the frequency of death or of required thoracic surgery in patients receiving smaller chest tubes (14F) vs larger tubes.
• the occurrence of moderate-to-severe pain is reduced by half when using smaller tubes.
• “Choosing to place a small-bore chest tube with image guidance and periodic tube flushing is well supported and accompanied by little if any risk to meaningful, positive patient outcomes.”

Tip 4

• Have someone watch you do your first 3 tubes (at least)
A new instrument to assess physician skill at chest tube insertion: the TUBE-iCOMPT.
Thorax. 2015 Feb;70(2):186-8

- 17 chest physicians
- No prior thoracoscopy experience
- 2 day course - didactic lectures + hands-on practice
- Assessment pre and post
  - 20 MCQ test pre and post
  - Dexterity skills

Use of Competency-Based Metrics to Determine Effectiveness of a Postgraduate Thoracoscopy Course
Henri G. Colt® Mohsen Davoudi® Silvia Quadrelli® Nazanin Zamanian Rohani®

Respiration 2010
Storz Thoracoscopy/Laparoscopy Simulation boxes

**Assessment task**

**MCQ Pre and Post**

Men score improved: 7.8 ± 1.3 points (p < 0.001)

**Dexterity Pre and Post**

Men score improved: 2.62 ± 0.33 (p < 0.001)
Tip 5 With any tap or tube do not continue if you cannot aspirate what you are after

Need to be able to aspirate air/fluid from the local anaesthetic needle – if not stop and rethink

• Wrong place
• Too deep (Thickened pleura, Obese patients)
• Too viscous
• Don’t go any further until this is sorted out

Tip 6 Front hand on the chest stops any rapid inward movement of any needle or tube

One hand for the patient, one for the needle/forcep/tube

• Patients move/cough
• Dorsum of one hand (left) flat on skin, fingers of that hand hold the needle
Tip 7 With Seldinger watch the depth of the local anaesthetic needle- every placement step follows that

Maskell et al 2010: “Seldinger chest drain insertion: simpler but not necessarily safer.”

- The sharp long dilator – caution viscera
- No blunt dissection - caution intercostal arteries

Tip 8 At thoracoscopy only biopsy pleura that has rib underneath

If bleeding
- local pressure with forcep,
- adrenaline soaked gauzes,
- external pressure over the site,
- diathermy around vessel( needs second port unless w Flex rigid),
- ICC and inflate the lung
TIP 9.
Try to only use the triangle of safety, even for taps

- 5th interspace usually at male nipple level; usually stay above this
- The lowest palpable rib in the mid axilla is number 10
- Stay in front of the Lat Dorsi

- Intercostal vessels!
- Lower = viscera


- the angiogram of an 81-year-old
- 3D-CT angiography revealed markedly tortuous intercostal arteries throughout the medial and lateral sites (arrowheads)
Physician-performed ultrasound can accurately screen for a vulnerable intercostal artery prior to chest drainage procedures. Matthew Salamonsen, Karen Dobeli, David McGrath, Craig Readdy, Robert Ware, Karin Steinke and David Fielding. *Respirology* Volume 18, Issue 6, pages 942–947, August 2013
Linear probe ultrasound to identify the intercostal vessel

Tip 10. Understand trapped lung

- It is common
- Recognising this prevents unnecessary additional procedures to try to resolve the “pneumothorax”
- Tunnelled catheter!
Can we anticipate trapped lung?

- Novel use of pleural ultrasound can identify malignant entrapped lung prior to effusion drainage.

Conclusion

- Preventing pleural complications is about
  - Hands on training
  - improved evaluation of operators technique
  - Pleural Ultrasound