BTS GUIDELINES FOR THE MANAGEMENT OF SPONTANEOUS PNEUMOTHORAX 2003
GRADING OF PRIMARY LITERATURE (The Bibliographies)

Ia  Meta-analysis of randomised trials

Ib  Randomised controlled trial

IIa  Well designed controlled study without randomisation

IIb  Another type of well designed quasi-experimental study
III Well designed non-experimental descriptive studies such as comparative studies, correlation studies, and case-control studies.

IV Opinion of expert committee reports or opinions and/or clinical experience of respected authorities.
Grading of Management

Recommendations ("Bullet Points")

- **A**: Ia or Ib
- **B**: IIa, IIb, III
- **C**: IV
Strong emphasis should be placed on the relationship between the recurrence of pneumothorax and smoking in an effort to encourage patients to stop smoking.
Expiratory chest radiographs are not recommended for the routine diagnosis of pneumothorax. A lateral chest or lateral decubitus radiograph should be performed if the clinical suspicion of pneumothorax is high, but a PA radiograph is normal.
CT scanning is recommended when differentiating a pneumothorax from complex bullous lung disease, when aberrant tube placement is suspected, and when the plain chest radiograph is obscured by surgical emphysema.

The clinical history is not a reliable indicator of pneumothorax size.
The previous classification of the size of a pneumothorax tends to underestimate its volume. In these new guidelines, the size of a pneumothorax is divided into “small” or “large” depending on the presence of a visible rim of $< 2\text{cm}$ or $>2\text{cm}$ between the lung margin and the chest wall.
TREATMENT OPTIONS FOR SPONTANEOUS PNEUMOTHORAX

- OBSERVATION

- Observation should be the treatment of choice for small closed pneumothoraces without significant breathlessness.
Patients with small (<2cm) primary pneumothoraces not associated with breathlessness should be considered for discharge with early OPD review. These patients should receive clear written advice to return in the event of worsening breathlessness.
If a patient with a pneumothorax is admitted overnight for observation, high flow (10l/min) oxygen should be administered, with appropriate caution in patients with COPD who may be sensitive to higher concentrations of oxygen.

[b]

Breathless patients should not be left without intervention regardless of the size of the pneumothorax on a chest radiograph.

[c]
SIMPLE ASPIRATION

- Simple aspiration is recommended as first line treatment for all primary pneumothoraces requiring intervention. [a]
- Simple aspiration is less likely to succeed in secondary pneumothoraces and, in this situation, is only recommended as an initial treatment in small (<2cm) pneumothoraces in minimally breathless patients under the age of 50 years. [b]
Patients with secondary pneumothoraces treated successfully with simple aspiration should be admitted to hospital and observed for at least 24 hours before discharge.
Repeated aspiration is reasonable for primary pneumothorax when the first aspiration has been unsuccessful (i.e., patient still symptomatic) and a volume of <2.5 L has been aspirated on the first attempt.
Catheter aspiration kits with an integral one way valve system may reduce the need for repeat aspiration.

Catheter aspiration of pneumothorax (CASP) can be used where the equipment and experience is available.
If simple aspiration or catheter aspiration drainage of any pneumothorax is unsuccessful in controlling symptoms, then an intercostal tube should be inserted.

Intercostal tube drainage is recommended in secondary pneumothorax except in patients who are not breathless and have a very small (<1cm or apical) pneumothorax.
A bubbling chest tube should never be clamped.
If a chest tube for pneumothorax is clamped, this should be under the supervision of a respiratory physician or thoracic surgeon, the patient should be managed in a specialist ward with experienced nursing staff, and the patient should not leave the ward environment.

If a patient with a clamped drain becomes breathless or develops subcutaneous emphysema, the drain must be immediately unclamped and medical advice sought.
The complications of intercostal drainage includes penetration of the major organs such as lung, heart, stomach, spleen & great vessels.

Pleural infection is another complication of intercostal drainage.

Surgical emphysema is a well known complication of intercostal tube drainage.
There is no evidence that large tubes (20-24F) any better than small tubes (10-14F) in the management of pneumothoraces. The initial use of large (20-24F) intercostal tubes is not recommended, although it may become necessary to replace a small chest tube with a large one if there is a persistent air leak.
Pneumothoraces which fail to respond within 48 hours to treatment should be referred to a respiratory physician.
CHEST DRAIN SUCTION

- Suction to an intercostal tube should not be applied directly after tube insertion, but can be added after 48 hours for persistent air leak or failure of a pneumothorax to re-expand.  

- High volume, low pressure (-10 to -20 cmH₂O) suction system are recommended.
Patients requiring suction should only be managed on lung units where there is specialist medical and nursing experience.
Chemical pleurodesis can control difficult or recurrent pneumothorax but should only be attempted if the patient is either unwilling or unable to undergo surgery.

Medical pleurodesis for pneumothorax should be performed by a respiratory specialist.

Surgical chemical pleurodesis is best achieved with 5gm sterile talc, side effects such as ARDS and empyema are reported but rare.
In case of persistent air leak or failure of the lung to re-expand, the managing respiratory specialist should seek an early (3-5 days) thoracic surgical opinion.

Open thoracotomy and pleurectomy remains the procedure with the lowest recurrence rate for difficult or recurrent pneumothoraces. Minimally invasive procedures, thoracoscopy (VATS), pleural abrasion, and surgical talc pleurodesis are all effective alternative strategies.
DISCHARGE AND FOLLOW UP

- Patients discharged without intervention should avoid air travel until a chest radiograph has confirmed resolution of the pneumothorax.

- Diving should be permanently avoided after a pneumothorax, unless the patient has had bilateral surgical pleurectomy.
Primary pneumothorax patients treated successfully by simple aspiration should be observed to ensure clinical stability before discharge. Secondary pneumothorax patients who are successfully treated with simple aspiration should be admitted for 24hrs before discharge to ensure no recurrence.
Early and aggressive treatment of pneumothoraces in HIV patients, incorporating intercostal tube drainage and early surgical referral, is recommended.
PNEUMOTHORAX AND CYSTIC FIBROSIS

- Early and aggressive treatment of pneumothoraces in cystic fibrosis is recommended. [c]

- Surgical intervention should be considered after the first episode, provided the patient is fit for the procedure. [c]
If tension pneumothorax is present, a cannula of adequate length should be promptly inserted into the second intercostal space in the mid clavicular line and left in place until a functioning intercostal tube can be positioned.
The incidence of iatrogenic pneumothorax is high, outnumbering spontaneous pneumothoraces.

Transthoracic needle aspiration (24%), subclavian vessel puncture (22%), thoracocentesis (22%), pleural biopsy (8%) and mechanical ventilation (7%) are the five leading causes.
AUDIT POINTS

- Proportion of patients treated by (a) simple observation, (b) aspiration, and (c) chest drains and their appropriateness (relative to the guidelines) and outcome (in terms of recurrence rates, complications, and lengths of stay in hospital)

- Number of chest drains clamped and the reasons for this.
Referral rates to physicians and surgeons and the timing of such referrals.

Use of analgesics and local anaesthetics.

Follow up rates.
FUTURE POTENTIAL AREAS FOR RESEARCH

- Prospective randomised controlled trials comparing:
  - Simple observation versus aspiration+tube drainage for primary pneumothoraces larger than 2cm on the chest radiograph;
  - Use of small catheter/Hemlich valve kits versus intercostal tube drainage following failed aspiration in primary pneumothoraces;
Small catheter aspiration (CASP) versus conventional aspiration or tube drainage;

VATS versus open thoracotomy for the difficult pneumothorax.

- Use of suction with regard to its timing and optimal mode.

- Comparision of “clamping” and “non-clamping” strategies after cessation of air leak.
PRIMARY PNEUMOTHORAX

BREATHLESS AND/OR RIM OF AIR > 2cm

ON CHEST RADIOGRAPH? NO

YES

ASPIRATION

?SUCCESSFUL

YES

NO

CONSIDER REPEAT ASPIRATION

NO

YES
INTERCOSTAL DRAIN

? SUCCESSFUL

NO  YES

REMOVAL 24HRS
AFTER FULL RE-
EXPLORATION/
CESSATION OF AIR
LEAK WITHOUT
CLAMPING

CONSIDER
DISCHARGE

REFERRAL TO CHEST
PHYSICIAN WITHIN 48HRS

? SUCTION

REFERRAL TO THORACIC
SURGEON AFTER 5DAYS
SECONDARY PNEUMOTHORAX

BREATHLESS + AGE > 50YRS + RIM OF AIR > 2cm ON CHEST RADIOGRAPH

YES

INTERCOSTAL DRAIN

? SUCCESSFUL

NO

YES

NO

YES

ASPIRATION

? SUCCESSFUL

NO

YES

ADMIT TO HOSPITAL FOR 24HRS
REFERRAL TO CHEST

REMOVE 24HRS

PHYSICIAN AFTER 48HRS

AFTER FULL

?SUCTION

RE-EXPANSION/

?SUCCESSFUL YES

CESSATION

OF AIR LEAK

NO

EARLY DISCUSSION

CONSIDER

WITH SURGEON AFTER

DISCHARGE

3DAYS
BRITISH THORACIC GUIDELINES FOR THE INSERTION OF A CHEST DRAIN-2003
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.
- Post operative-for example, thoracotomy, oesophagectomy, cardiac surgery.
PRE DRAINAGE RISK ASSESSMENT

- Risk of haemorrhage: where possible, any coagulopathy or platelet defect should be corrected prior to the chest tube insertion but routine measurement of the platelet count and prothrombin time are only recommended in patients with known risk factors.
The differential diagnosis between a pneumothorax and bullous disease requires careful radiological assessment. Similarly, it is important to differentiate between the presence of collapse and a pleural effusion when the chest radiograph shows a unilateral “whiteout”.

Lung densely adherent to the chest wall throughout the hemithorax is an absolute contraindication to chest drain insertion.
The drainage of a post pneumonectomy space should only be carried out by or after consultation with a cardiothoracic surgeon.

[c]
EQUIPMENT

- Sterile gloves, gown, sterile drapes, gauge swabs.
- Syringes, needles (21-25 gauge), scalpel and blade, instrument for blunt dissection.
- Skin antiseptic solution e.g. iodine or chlorhexidine in alcohol.
- Local anaesthetics, e.g. lignocaine 1% or 2%
- Suture (e.g. “1” silk)
Guidewire with dilators (if small tube being used).

Chest tube.

Connecting tubing.

Closed drainage system (including sterile water if underwater seal being used)

Dressing.
CONSENT AND PREMEDICATION

Prior to commencing chest tube insertion, the procedure should be explained fully to the patient. [c]

Unless there are contraindications to its use, premedication (benzodiazepine or opioid) should be given to reduce patient distress. [b]
PATIENT POSITION

- The preferred position for drain insertion is on the bed, slightly rotated, with arm on the side of the lesion behind the patient’s head to expose the axillary area.

- An alternative way is to sit upright leaning over an adjacent table with a pillow or in the lateral decubitus position.
A chest tube should not be inserted without further image guidance if free air or fluid cannot be aspirated with a needle at the time of anaesthesia.

Imaging should be used to select the appropriate site for chest tube placement.

A chest radiograph must be available at the time of drain insertion in the case of tension pneumothorax.
The most common position for chest tube insertion is in the mid axillary line, through the "safe triangle". This is the triangle bordered by the anterior border of the latissimus dorsi, the lateral border of the pectoralis major muscle, a line superior to the horizontal level of the nipple, and an apex below the axilla. This position minimises risk to underlying structures such as the internal mammary artery and damage to muscle and breast tissue resulting in unsightly scarring.
DRAIN SIZE

- Small bore drains are recommended as they are more comfortable than larger bore tubes [b] but there is no evidence that either is therapeutically superior.

- Large bore drains are recommended for drainage of acute haemothorax to monitor further blood loss. [c]
Aseptic technique should be employed during catheter insertion. [c]

Prophylactic antibiotics should be given in trauma cases. [a]
Local anaesthesia should be infiltrated prior to insertion of the drain.
INSERTION OF CHEST TUBE

- Chest drain insertion should be performed without substantial force. [c]
  - Small bore tube (8-14F)
    - Insertion of a small bore drain under image guidance with a guidewire does not require blunt dissection.
  - Medium bore tube (16-24F)
    - Medium sized chest drains may be inserted by a Seldinger technique or by blunt dissection.
• Large bore tube (>24F)

• Blunt dissection into the pleural space must be performed before insertion of a large bore chest tube drain.

• Incision

✓ The incision for insertion of the chest drain should be similar to the diameter of the tube being inserted.
Position of tube tip

- The position of the tip of the chest tube should ideally be aimed apically for a pneumothorax or basally for fluid. However, any tube position can be effective at draining air or fluid and an effectively functioning drain should not be repositioned solely because of the radiographic position.
Securing the drain

- Large and medium bore chest tube incisions should be closed by a suture appropriate for a linear incision.

- “Purse string” sutures must not be used.
Clamping Drain.

- A bubbling drain should never be clamped. [c]
- Drainage of a large pleural effusion should be controlled to prevent the potential complication of re-expansion pulmonary edema. [c]
- In case of pneumothorax, clamping of the chest tube should usually be avoided. [b]
If a chest tube for pneumothorax is clamped, this should be under the supervision of a respiratory physician or thoracic surgeon, the patient should be managed in a specialist ward with experienced nursing staff, and the patient should not leave the ward environment. [c]
If a patient with a clamped drain becomes breathless or develops subcutaneous emphysema, the drain must be immediately unclamped and medical advice sought.
Closed system drainage

- All chest tubes should be connected to a single flow drainage system e.g., under water seal bottle or flutter valve.

  Use of a flutter valve system allows earlier mobilisation and the potential for earlier discharge of patients with chest drains.
- **Suction**
  - When chest drain suction is required, a high volume/low pressure should be used. [c]
  - When suction is required, the patient must be nursed by appropriately trained staff. [c]

- **Ward instructions**
  - Patients with chest tubes should be managed on specialist wards by staff who are trained in chest drain management.
A chest radiograph should be performed after insertion of a chest drain. [c]

- Removal of the chest tube

- In case of pneumothorax, the chest tube should not be clamped at the time of its removal. [b]
AUDIT POINTS

- The presence and use of an appropriate nursing chest drain observation chart should be noted.
- The frequency of chest drain complications should be recorded.
- The use of premedication and analgesics and patient pain scores relating to chest drain insertion should be recorded.
- The duration of chest tube drainage should be recorded.
PATIENT REQUIRING ASSISTED VENTILATION

During the insertion of a chest tube in a patient on a high pressure ventilator, especially with positive end expiratory pressure (PEEP), it is essential to disconnect from the ventilator at the time of insertion to avoid the potentially serious complication of lung penetration, although as long as blunt dissection is carried out and no sharp instruments are used, this risk is reduced.
INDICATION TO INSERT CHEST DRAIN
CONSENT
PREMEDICATION
CONFIRMATION OF SITE OF INSERTION CLINICALLY AND ON RADIOGRAPHY
POSITIONING OF PATIENT

SIZE OF CHEST DRAIN

ASEPTIC TECHNIQUE

LOCAL ANAESTHESIA

BLUNT DISSECTION IF REQUIRED
SECURING DRAIN AND SUTURE

UNDERWATER SEAL

CLAMPING INSTRUCTIONS

DECISION RE SUCTION

REMOVAL OF DRAIN
All the best..