

BTS GUIDELINES

Introduction to the methods used in the generation of the British Thoracic Society guidelines for the management of pleural diseases

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Diseases of the pleura and pleural space are common and present a significant contribution to the workload of respiratory physicians. Despite their prevalence and clinical importance, there is limited consensus on their management. These guidelines attempt to integrate the available objective evidence with clinical experience relating to the investigation and treatment of these problems. The guidelines have been prepared using consistent methods and are presented in a broadly similar way.

STRUCTURE OF EACH GUIDELINE

The first section of each guideline consists of a brief introduction that sets an historical and clinical background for the management guidance itself.

The guidelines are then presented so that they can be read at three levels. The articles begin with a flow diagram that is intended to present a “thumbnail” sketch of management for the relevant area. These flow diagrams are brief enough to be used as a wall display in, for instance, an accident and emergency department or respiratory ward, or might be added to a junior doctor’s personal organiser.

At the next level, the reader can look at the bullet points presented after the flow diagram in each document. These are structured to follow the same order as the flow diagram and represent the “key facts” which underpin the flow diagram. These bullet points have been rated according to the strength of evidence that lies behind each point. This grading is laid out in table 1 and

ranges from grade A (based on good quality clinical trial evidence) to grade C (based on expert opinion alone).

Beneath each set of bullet points is a short paragraph detailing the literature and the rationale relating to that section’s bullet points. This text is intended to provide greater detail without requiring access to the primary literature. The text is referenced in detail and these references constitute the bibliography at the end of each guideline for the reader wishing to explore the data for themselves. This primary source literature has been individually graded for its methodology and the grading is given alongside each reference. The explanation of this grading system is presented in table 2.

METHODS USED IN GENERATING THE GUIDELINES

Each guideline was researched and drafted by a subgroup of the Pleural Diseases Group (itself a subcommittee of the BTS Standards of Care Committee). Members of the drafting subgroup of the Pleural Diseases Group are cited as the primary authors of each guideline area, a systematic search of the Medline database was performed using all identifiable key words relevant to the disease area of interest. Thereafter, a paper based exploration of the relevant literature was pursued from this core dataset. All English language literature including all clinical trials and all well formulated clinical case series were identified. Isolated case reports were excluded unless they seemed particularly relevant. Animal and basic science research was cited as needed, but no systematic review of this literature was performed.

All identified publications were reviewed by the drafting subgroup of the Pleural Diseases Group

Table 1 Grading of management recommendations (“bullet points”)

A	(Supported by paper(s) of levels Ia or Ib). Requires at least one randomised trial as part of a body of literature of overall good quality and consistency addressing the specific recommendation
B	(Supported by paper(s) of levels IIa, IIb, III). Requires the availability of well conducted clinical studies but no randomised clinical trials on the topic of recommendation (or poor/inadequate randomised trials not supported by sufficient other literature to achieve grade A).
C	(Supported by level IV evidence). Requires evidence from expert committee reports or opinions and/or clinical experience of respected authorities. Indicates absence of directly applicable studies of good quality.

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Table 2 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

responsible for that guideline and rated according to the standard criteria for the calibre of the methodology of the research published (table 2). An algorithm for clinical management based on a typical patient's diagnostic and therapeutic path was then drafted by the subgroup. This draft was based, where possible, on the published evidence but this was then combined with clinical expertise as required. The resulting draft is therefore a blend of published evidence and clinical experience. This first draft was reviewed in detail by all the members of the Pleural Diseases Guideline Group and thereafter refined by the subgroup. A second detailed review was then performed by the whole group, with further manuscript alterations as needed. These documents were then submitted to open review and we would like to thank those who contributed to this process. This open review process included acknowledged UK and international experts, the membership of the British Thoracic Society and the Standards of Care Committee of the British Thoracic Society. The individuals

contributing to this process are listed in the Acknowledgements section below. The manuscripts were then amended in the light of these comments before submission for blind peer review and publication.

CONFLICT OF INTEREST

All the members of the Pleural Guidelines Committee submitted a written record of possible conflicts of interest to the Standards of Care Committee of the BTS. These are available for inspection on request from the Chairman of this Committee.

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Abstracted bullet points from each of the BTS guidelines for the management of pleural disease

In this section the "bullet points" from each of the BTS guidelines for the management of pleural disease are presented together so that they can be easily reproduced and used for teaching, training, A&E handbooks, etc.

INVESTIGATION OF A UNILATERAL PLEURAL EFFUSION IN ADULTS

Clinical assessment and history

- Aspiration should not be performed for bilateral effusions in a clinical setting strongly suggestive of a pleural transudate, unless there are atypical features or they fail to respond to therapy. [C]
- An accurate drug history should be taken during clinical assessment. [C]

Pleural aspiration

- A diagnostic pleural fluid sample should be gathered with a fine bore (21G) needle and a 50 ml syringe. The sample should be placed in both sterile vials and blood culture bottles and analysed for protein, lactate dehydrogenase (LDH, to clarify borderline protein values), pH, Gram stain, AAFB stain, cytology, and microbiological culture. [C]

Pleural fluid analysis

- The appearance of the pleural fluid and any odour should be noted. [C]
- A pleural fluid haematocrit is helpful in the diagnosis of haemothorax.
- The pleural protein should be measured to differentiate between a transudative and exudative pleural effusion. This will usually suffice if the patient's serum protein level is normal and pleural protein is less than 25 g/l or more than 35 g/l. If not, Light's criteria (see box 5, page ii11) should be used. [B]
- Pleural lymphocytosis is common in malignancy and tuberculosis.
- Eosinophilic pleural effusions are not always benign.
- pH should be performed in all non-purulent effusions. [B]
- In an infected effusion a pH of <7.2 indicates the need for tube drainage. [B]
- Amylase measurement should be requested if acute pancreatitis or rupture of the oesophagus is possible. [C]
- Iso-enzyme analysis is useful in differentiating high amylase levels secondary to malignancy or ruptured oesophagus from those raised in association with abdominal pathology.
- Malignant effusions can be diagnosed by pleural fluid cytology alone in only 60% of cases.
- If the first pleural cytology specimen is negative, this should be repeated a second time. [B]
- Both cell blocks and fluid smears should be prepared for examination and, if the fluid has clotted, it needs to be fixed and sectioned as a histological section. [B]

Diagnostic imaging

- PA and lateral chest radiographs should be performed in the assessment of suspected pleural effusion. [C]
- Ultrasound guided pleural aspiration should be used as a safe and accurate method of obtaining fluid if the effusion is small or loculated. [B]
- Fibrinous septations are better visualised on ultrasound than on CT scans.
- CT scans for pleural effusion should be performed with contrast enhancement. [C]
- In cases of difficult drainage, CT scanning should be used to delineate the size and position of loculated effusions. [C]
- CT scanning can usually differentiate between benign and malignant pleural thickening.

Invasive investigations

- Pleural tissue should always be sent for tuberculosis culture whenever a biopsy is performed. [B]
- In cases of mesothelioma, the biopsy site should be irradiated to stop biopsy site invasion by tumour. [A]
- When using an Abrams' needle, at least four biopsy specimens should be taken from one site. [C]
- When obtaining biopsies from focal areas of pleural nodularity shown on contrast enhanced CT scans, image guidance should be used. [C]
- Image guided cutting needle biopsies have a higher yield for malignancy than standard Abrams' needle pleural biopsy.
- Thoracoscopy should be considered when less invasive tests have failed to give a diagnosis. [B]
- Routine diagnostic bronchoscopy should not be performed for undiagnosed pleural effusion. [C]
- Bronchoscopy should be considered if there is haemoptysis or clinical features suggestive of bronchial obstruction. [C]

Abstracted bullet points from each of the BTS guidelines for the management of pleural disease (continued)**Special tests**

- If a chylothorax or pseudochylothorax is suspected, pleural fluid should be sent for measurement of triglyceride and cholesterol levels and the laboratory asked to look for the presence of cholesterol crystals and chylomicrons. [C]
- If urinothorax is suspected, the pleural fluid creatinine level should be measured and will be higher than the serum creatinine level. [C]
- When pleural biopsies are taken, they should be sent for both histological examination and culture to improve the diagnostic sensitivity for tuberculosis. [B]
- There are no specific pleural fluid characteristics to distinguish those caused by pulmonary embolism. This diagnosis should be pursued on clinical grounds.
- Suspected rheumatoid effusions should have a pleural fluid pH, glucose and complement measured. [C]
- Rheumatoid arthritis is unlikely to be the cause of an effusion if the glucose level in the fluid is above 1.6 mmol/l (29 mg/dl).
- The pleural fluid ANA level should not be measured as it mirrors serum levels and is therefore unhelpful. [C]
- In patients with HIV infection, the differential diagnosis of pleural effusion is wide and differs from the immunocompetent patient.

Management of persistent undiagnosed pleural effusion

- In persistently undiagnosed effusions, the possibility of pulmonary embolism and tuberculosis should be reconsidered since these disorders are amenable to specific treatment. [C]
- Undiagnosed pleural malignancy proves to be the cause of many "undiagnosed" effusions with sustained observation.

MANAGEMENT OF PLEURAL INFECTION**Diagnostic pleural fluid sampling in parapneumonic pleural effusions**

- All patients with a pleural effusion in association with sepsis or a pneumonic illness require diagnostic pleural fluid sampling. [C]

Sampling small parapneumonic pleural effusions

- In the event of a small effusion or a failed previous attempt at pleural fluid sampling, an ultrasound scan and image guided fluid sampling is recommended. [C]
- Pleural effusions with maximal thickness <10 mm on ultrasound scanning can be observed, with pleural fluid sampling if the effusion enlarges. [C]

When to use chest tube drainage in pleural infection

- Patients with frankly purulent or turbid/cloudy pleural fluid on sampling should receive prompt pleural space chest tube drainage. [B]
- The presence of organisms identified by Gram stain or culture from non-purulent pleural fluid samples indicates that pleural infection is established and should lead to prompt chest tube drainage. [B]
- Pleural fluid pH should be assessed in all non-purulent, possibly infected effusions. [B]
- pH <7.2 indicates chest tube drainage is required. [B]
- Parapneumonic effusions that do not fulfil these criteria for chest tube drainage should be treated with antibiotics alone provided clinical progress is good. [B]
- Poor clinical progress during treatment with antibiotics alone should lead to prompt patient review and probably chest tube drainage. [B]

Other indications for chest tube drainage

- Patients with a loculated pleural collection should receive earlier chest tube drainage. [C]
- Large non-purulent effusions should be drained by chest tube for symptomatic benefit. [C]

Referral to a respiratory specialist

- A respiratory physician or thoracic surgeon should be involved in the care of all patients requiring chest tube drainage for a pleural infection. [C]

Antibiotics

- All patients should receive antibiotics. [B]
- Where possible, antibiotics should be guided by bacterial culture results. [B]
- Where cultures are negative, antibiotics should cover community acquired bacterial pathogens and anaerobic organisms. [B]
- Hospital acquired empyema requires broader spectrum antibiotic cover. [B]

Chest tube drainage

- There is no consensus on the size of the optimal chest tube for drainage.
- If a small bore flexible catheter is used, regular flushing and suction is recommended to avoid catheter blockage. [C]

Cessation of chest tube drainage in the presence of a residual pleural fluid collection

- If the chest tube becomes blocked or pus is unable to drain, it should be flushed with saline to ensure its patency. If poor drainage persists, a chest radiograph or CT scan should be performed to check drain position. [C]

Intrapleural fibrinolytic drugs

- Intrapleural fibrinolytic drugs (streptokinase 250 000 IU twice daily for 3 days or urokinase 100 000 IU once a day for 3 days) improve radiological outcome and, in children, hospital stay. Current best evidence favours their use [B], but it is not known if they reduce mortality and/or the need for surgery. Clinical trials are underway to address this question.
- Patients who receive intrapleural streptokinase should be given a streptokinase exposure card and should receive urokinase or tissue plasminogen activator (TPA) for subsequent indications. [C]

Persistent sepsis and pleural collection

- Patients with persistent sepsis and a residual pleural collection should undergo further radiological imaging. [C]

Abstracted bullet points from each of the BTS guidelines for the management of pleural disease (continued)**Bronchoscopy**

- Bronchoscopy should only be performed in patients where there is a high index of suspicion of bronchial obstruction. [C]

Nutrition

- Clinicians should ensure adequate nutritional support commencing as soon as possible after pleural infection is identified. [C]

Referral for surgical treatment

- Failure of chest tube drainage, antibiotics and fibrinolytic drugs should prompt early discussion with a thoracic surgeon. [C]
- Patients should be considered for surgical treatment if they have persisting sepsis in association with a persistent pleural collection, despite chest tube drainage and antibiotics. [C]

Patients not considered fit for surgery and not improving with chest tube drainage and antibiotics

- In cases of ineffective chest tube drainage and persistent sepsis in patients unable to tolerate general anaesthesia, re-imaging the thorax and placement of further image guided small bore catheters, large bore chest tubes, or intrapleural fibrinolytic therapy should be considered. [C]
- Local anaesthetic surgical rib resection should be considered in patients unsuitable for general anaesthesia. [C]

MANAGEMENT OF MALIGNANT PLEURAL EFFUSIONS**Clinical presentation**

- Massive pleural effusions are most commonly due to malignancy. [B]

Management by observation alone

- Observation is recommended if the patient is asymptomatic or there is no recurrence of symptoms after initial thoracentesis. [C]
- Advice should be sought from the thoracic malignancy multidisciplinary team for symptomatic or recurrent malignant effusions. [C]

Therapeutic pleural aspiration

- Repeat pleural aspiration is recommended for the palliation of breathlessness in patients with a very short life expectancy. [C]
- Caution should be taken if removing more than 1.5 l on a single occasion. [C]
- The recurrence rate at 1 month after pleural aspiration alone is close to 100%. [B]
- Intercostal tube drainage without pleurodesis is not recommended because of a high recurrence rate. [B]

Size of intercostal tube

- Small bore (10–14 F) intercostal catheters should be the initial choice for effusion drainage and pleurodesis. [B]

Lung re-expansion, fluid drainage and suction

- Large pleural effusions should be drained in a controlled fashion to reduce the risk of re-expansion pulmonary oedema (RPO). [C]
- Suction to aid pleural drainage before and after pleurodesis is usually unnecessary but, if applied, a high volume, low-pressure system is recommended. [C]
- In patients where only partial pleural apposition can be achieved, chemical pleurodesis should still be attempted and may provide symptomatic relief. [B]
- Once effusion drainage and lung re-expansion have been radiographically confirmed, pleurodesis should not be delayed while the cessation of pleural fluid drainage is awaited. [B]

Analgesia and premedication

- Lignocaine (3 mg/kg; maximum 250 mg) should be administered intrapleurally just prior to sclerosant administration. [B]
- Premedication should be considered to alleviate anxiety and pain associated with pleurodesis. [C]

Selecting a sclerosing agent

- Talc is the most effective sclerosant available for pleurodesis. [B]
- A small number of patients (<1%) may develop acute respiratory failure following talc administration. [B]
- Tetracycline is modestly effective, has few severe side effects, and is the preferred sclerosant to minimise adverse event rates. [B]
- Bleomycin is an alternative sclerosant with a modest efficacy rate but is expensive. [B]
- Pleuritic chest pain and fever are the most common side effects of sclerosant administration. [B]

Rotation following pleurodesis

- Patient rotation is not necessary after intrapleural instillation of tetracycline class agents. [A]

Clamping of intercostal tube

- The intercostal tube should be clamped for 1 hour after sclerosant administration. [C]
- In the absence of excessive fluid drainage (>250 ml/day) the intercostal tube should be removed within 12–72 hours of sclerosant administration. [C]

Malignant seeding at intercostal tube or port site

- Patients with proven or suspected mesothelioma should receive prophylactic radiotherapy to the site of biopsy or chest drain insertion. [A]

Intrapleural fibrinolytics

- Intrapleural instillation of fibrinolytic drugs is recommended for the relief of distressing dyspnoea due to multiloculated malignant effusion resistant to simple drainage. [C]

Thoracoscopy in malignant pleural effusion

- Thoracoscopy should be considered for the diagnosis of suspected but unproven malignant pleural effusion. [B]
- Thoracoscopy should be considered for the control of recurrent malignant pleural effusion. [B]
- Thoracoscopy is a safe procedure with low complication rates. [B]

Abstracted bullet points from each of the BTS guidelines for the management of pleural disease (continued)**Long term indwelling pleural catheter drainage**

- Chronic indwelling pleural catheters are effective in controlling recurrent and symptomatic malignant effusions in selected patients. [B]

Pleuroperitoneal shunting

- Pleuroperitoneal shunts are an alternative and effective option in patients with a trapped lung or failed pleurodesis. [B]

MANAGEMENT OF SPONTANEOUS PNEUMOTHORAX**Smoking**

- Strong emphasis should be placed on the relationship between the recurrence of pneumothorax and smoking in an effort to encourage patients to stop smoking. [B]

Clinical evaluation and imaging

- Expiratory chest radiographs should not be used for the routine diagnosis of pneumothorax. [B]
- A lateral chest or lateral decubitus radiograph should be performed if the clinical suspicion of pneumothorax is high, but a PA radiograph is normal. [B]
- 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. [C]
- The clinical history is not a reliable indicator of pneumothorax size. [C]

Size of pneumothorax

- 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 cm or ≥ 2 cm between the lung margin and the chest wall.

Treatment by observation alone

- Observation should be the treatment of choice for small closed pneumothoraces without significant breathlessness. [B]
- Patients with small (<2 cm) primary pneumothoraces not associated with breathlessness should be considered for discharge with early outpatient review. These patients should receive clear written advice to return in the event of worsening breathlessness. [B]
- If a patient with a pneumothorax is admitted overnight for observation, high flow (10 l/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 (<2 cm) 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. [C]

Repeat aspiration and catheter aspiration of simple pneumothorax

- 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. [B]
- Catheter aspiration of pneumothorax (CASP) can be used where the equipment and experience is available. [B]
- Catheter aspiration kits with an integral one way valve system may reduce the need for repeat aspiration. [C]

Intercostal tube drainage

- If simple aspiration or catheter aspiration drainage of any pneumothorax is unsuccessful in controlling symptoms, then an intercostal tube should be inserted. [B]
- Intercostal tube drainage is recommended in secondary pneumothorax except in patients who are not breathless and have a very small (<1 cm or apical) pneumothorax. [B]
- A bubbling chest tube should never be clamped. [B]
- A chest tube which is not bubbling should not usually be clamped. [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. [C]

Size of chest tube

- There is no evidence that large tubes (20–24 F) are any better than small tubes (10–14 F) in the management of pneumothoraces. The initial use of large (20–24 F) intercostal tubes is not recommended, although it may become necessary to replace a small chest tube with a larger one if there is a persistent air leak. [B]

Referral to respiratory specialists

- Pneumothoraces which fail to respond within 48 hours to treatment should be referred to a respiratory physician. [C]

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. [B]
- High volume, low pressure (–10 to –20 cm H₂O) suction systems are recommended. [C]
- Patients requiring suction should only be managed on lung units where there is specialist medical and nursing experience. [C]

Abstracted bullet points from each of the BTS guidelines for the management of pleural disease (continued)**Chemical pleurodesis**

- Chemical pleurodesis can control difficult or recurrent pneumothorax [A] but should only be attempted if the patient is either unwilling or unable to undergo surgery. [B]
- Medical pleurodesis for pneumothorax should be performed by a respiratory specialist. [C]

Referral to thoracic surgeons

- In cases 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. [C]
- 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.

Surgical chemical pleurodesis

- Surgical chemical pleurodesis is best achieved with 5 g sterile talc. Side effects such as ARDS and empyema are reported but rare. [A]

Discharge and follow up

- Patients discharged without intervention should avoid air travel until a chest radiograph has confirmed resolution of the pneumothorax. [C]
- Diving should be permanently avoided after a pneumothorax, unless the patient has had a surgical pleurectomy. [C]
- Primary pneumothorax patients treated successfully by simple aspiration should be observed for 4–6 hours before discharge. Secondary pneumothorax patients who are successfully treated with simple aspiration should be admitted for 24 hours before discharge to ensure no recurrence. [C]

Pneumothorax and AIDS

- Early and aggressive treatment of pneumothoraces in HIV patients, incorporating intercostal tube drainage and early surgical referral, is recommended. [B]

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]

Tension pneumothorax

- 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. [B]

INSERTION OF A CHEST DRAIN**Training**

- All personnel involved with insertion of chest drains should be adequately trained and supervised. [C]

Pre-drainage risk assessment

- Risk of haemorrhage: where possible, any coagulopathy or platelet defect should be corrected prior to chest drain insertion but routine measurements of platelet count and/or prothrombin time should only be performed in patients with known risk factors. [C]
- 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. [C]
- The drainage of a post pneumonectomy space should only be carried out by or after consultation with a cardiothoracic surgeon. [C]

Consent and premedication

- Prior to commencing chest tube insertion the procedure should be explained fully to the patient and consent recorded in accordance with national guidelines. [C]
- Unless there are contraindications to its use, premedication (benzodiazepine or opioid) should be given to reduce patient distress. [B]

Confirming site of drain insertion

- 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. [C]
- Imaging should be used to select the appropriate site for chest tube placement. [B]
- A chest radiograph must be available at the time of drain insertion except in the case of tension pneumothorax. [C]

Drain size

- Small bore drains are more comfortable for the patient 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

- Aseptic technique should be employed during catheter insertion. [C]
- Prophylactic antibiotics should be given in trauma cases. [A]

Anaesthesia

- Local anaesthetic should be infiltrated prior to insertion of the drain. [C]

Abstracted bullet points from each of the BTS guidelines for the management of pleural disease (continued)**Insertion of chest tube**

- Chest drain insertion should be performed without substantial force. [C]
- Insertion of a small bore drain under image guidance with a guidewire does not require blunt dissection.
- Blunt dissection into the pleural space must be performed before insertion of a large bore chest drain. [C]

Incision

- The incision for insertion of the chest drain should be similar to the diameter of the tube being inserted. [C]

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 its radiographic position. [C]

Securing the drain

- Large and medium bore chest drain incisions should be closed by a suture appropriate for a linear incision. [C]
- "Purse string" sutures must not be used. [C]

Clamping of chest drains

- A bubbling chest tube should never be clamped. [C]
- Drainage of a large pleural effusion should be controlled to prevent the potential complication of re-expansion pulmonary oedema. [C]
- In cases 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. [C]

Closed system drainage

- All chest tubes should be connected to a single flow drainage system e.g. under water seal bottle or flutter valve. [C]
- 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 system 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. [C]
- A chest radiograph should be performed after insertion of a chest drain. [C]

Removal of a chest tube

- In cases of pneumothorax, the chest tube should not be clamped at the time of its removal. [B]



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