

Policy for the Insertion and Management of Chest Drains

Thoracic trauma is a very common cause of morbidity and mortality, being the primary cause of death in 25% of trauma deaths, and contributing to a further 25-50%.

It should not be acceptable for a casualty to die from hypoxia or cardiovascular collapse resulting from pathology caused by trauma that can be treated emergently. Approximately 85% of chest trauma can be treated successfully without the need for surgical intervention, using techniques which are well described and taught in Trauma Life Support courses. It is important to remember, however, that Major Trauma patients are likely to have other injuries, especially head injuries, which need to be identified and treated appropriately by the Trauma Team.

Traumatic pneumothorax and Tension Pneumothorax, as well as haemothorax, are pathologies which can be treated by means of pleural decompression, using needle thoracocentesis, finger thoracostomy and/or chest tube thoracostomy. These procedures have a significant risk of morbidity and mortality if performed poorly, and must therefore be performed only when indicated, and either by an experienced and competent Trauma Team member, or under direct supervision.

Following successful pleural decompression, the chest drain position must be confirmed radiologically.

The patient must be admitted onto a ward with the required medical and nursing expertise to safely and expertly care for him/her until such time as the drain can be removed.

Thoracic trauma is believed to be the primary cause of death in 25% of all trauma deaths, and a significant contributing factor in a further 25-50%. Whilst such casualties are also likely to have other significant and possibly life-threatening injuries, it is essential that these injuries are identified as rapidly as possible, and life-saving procedures performed emergently to save the casualty's life. This is where the Team approach comes into its own. Less than 10% of blunt trauma and 15-30% of penetrating trauma requires operative intervention; up to 85% of thoracic trauma could be treated by Trauma Physicians/Surgeons using techniques that are now well-established and taught on Trauma Life Support Courses (like the Advanced Trauma Life Support Course and the European Trauma Course).

Traumatic pneumothorax and traumatic tension pneumothorax, as well as haemothorax, are potentially immediately life-threatening as a result of their effects on the lungs and cardiovascular system. Early recognition of these injuries, by clinical or radiological/sonographic means, could ensure immediate treatment and thus prevent further deterioration in the clinical course.

Tension pneumothorax is a result of a flap/valve-type injury to the pleura allowing for air to leak into the pleural cavity but not escape out of it. As a result of the increasing intra-pleural tension, the lung is compressed, eventually compressing the central mediastinum, and finally shifts the intrathoracic structures into the contralateral hemithorax compressing that lung as it does so. Ventilatory compromise is therefore the initial concern, later compounded by cardiovascular embarrassment as the increasing intrathoracic pressures prevent diastolic filling, impairing stroke volume and cardiac output. This condition can occur both in spontaneously-ventilating patients as well as those requiring intermittent positive pressure ventilation, though the onset is often much more rapid and precipitous in the latter case. In view of the frequently rapid deterioration in cardiorespiratory status, tension pneumothorax often requires a clinical diagnosis and immediate treatment, with no time for radiological confirmation (chest radiograph); sonographic confirmation might be possible if the equipment is immediately available. The immediate treatment of tension pneumothorax is finger thoracostomy, followed by open tube thoracostomy (chest drain insertion); whilst needle thoracocentesis was previously the technique of

choice for immediate relief of tension pneumothorax, concerns over its failure and possible complication rate has resulted in guidance on its use only in cases when thoracostomy is not immediately possible (due to lack of equipment or expertise). The technical details behind these three procedures can be found in Appendix 1: Procedural Guidance.

Traumatic pneumothorax can be the result of trauma to either pleura, either as a result of a breach to the chest wall creating an open pneumothorax with air being sucked into the pleural cavity (e.g. penetrating injury) or secondary to damage to the visceral pleura and underlying lung with air escaping from the lung (e.g. following displaced rib fractures). In case of an open pneumothorax, a wound that is greater than half the diameter of the trachea results in air being sucked into the pleural cavity via the chest wound rather than into the lungs via the trachea with each respiratory effort, resulting in significant respiratory compromise. The immediate management consists of an Russell chest seal or an occlusive dressing secured on three sides to provide a flutter-type valve effect. The pleural cavity will also need to be drained as soon as possible.

Traumatic haemothorax is an accumulation of blood in the pleural cavity, often as a result of a laceration to intercostal or internal thoracic vessels. "Massive haemothorax" is diagnosed if >1500ml of blood is drained, or >200ml/hr for >2 hours. A haemothorax is often identified clinically, in the context of external signs of chest trauma associated with signs of an effusion, and confirmed radiologically or sonographically. Drainage of a haemothorax often requires a large-bore chest drain; evidence is limited with respect to the ideal drain size, and guidance often recommends inserting as large a drain as can fit in the intercostal space. Previous belief in the tamponade effect of a haemothorax has never been evidenced, and thus this should be drained as much as possible with urgent involvement of a cardiothoracic surgeon if concerned about blood loss, whilst infusing tranexamic acid and blood.

Whilst tube thoracostomy is undoubtedly a life-saving procedure, it is also associated with significant risks. In 2008, the NPSA issued a rapid response report following reports of 12 deaths and 15 cases of serious harm relating to chest drain insertion between 2005 and 2008. The report made the following recommendations:

- Chest drains only inserted by staff with relevant competencies and adequate supervision
- Ultrasound guidance strongly advised when inserting a drain for fluid
- Clinical guidelines are followed and staff made aware of the risks
- Identify a lead for training of all staff involved in chest drain insertion
- Written consent obtained from patients before the procedure, wherever possible
- Local incident data relating to chest drains reviewed
- Staff encouraged to report further incidents

Admittedly some of these recommendations are not wholly relevant in the context of this policy. Trauma teams in the MTC and TU should always be led by a senior physician/surgeon, ideally of Consultant level, and as such should always have the required expertise available during insertion. Adequate supervision would also imply close monitoring of the patient's vital signs. These procedures are generally required as an emergency in critically-unwell patients and cannot therefore be postponed. Written consent is often not possible in major trauma patients, though verbal consent is advisable if possible.

Following insertion of a chest drain, the drain position must be confirmed radiologically, not only to confirm the position of the tip, but also to ensure that all the drain holes are within the pleural cavity: if one or more chest drain holes are outside of the pleural cavity, the drain will need to be reinserted as otherwise air/fluid will leak into the chest wall tissue, and result in severe emphysema. The chest drain should not simply be pushed in but should be replaced all together so as not to increase risk of infection; the same chest wall hole can be used however, following appropriate cleaning and draping of the site. Following satisfactory confirmation of drain position, the patient should be transferred to a clinical area

that has the required medical and nursing expertise to care for the patient and the drain, as well as manage any possible complications until the time of drain removal.

Chest drain fixation

All personnel inserting drains should use a method for drain fixation that minimises the risk of a drain falling out. This will be reviewed in future audit to be carried out across the Trust.

Chest drain documentation and patient management

1. **Patients with chest drains should be managed on wards familiar with chest drains and their management.**
2. Written consent should be taken by the competent medical personnel wherever possible before the insertion of the chest drain.
3. **Drains should be checked daily for signs of wound infection, fluid drainage volumes and documentation for swinging and/or bubbling.** Accurate daily recordings of the drain and bottle readings, any changes instituted to the drain and any microbiological swabs taken should be documented appropriately on a dedicated chest drain chart.
4. **Monitoring and Review** All incidents, accidents or near misses related to the insertion and management of chest drains should be reported through the Trust Incident reporting system. These incidents will be reviewed by the working party.
5. **Patient information leaflet.** The patient information leaflet relating to chest drain insertion produced by the British Thoracic Society (BTS)⁴ should be available to patients undergoing chest drain insertion.
6. **All doctors expected to be able to insert a chest drain should be trained using a combination of didactic lecture, simulated practice and supervised practice until considered competent.**
7. Chest drain insertion is a core competency expected of doctors doing core accident and emergency, anaesthetic, intensive care, medical, radiology, respiratory and surgical training. There is a hierarchy of competencies; see Appendix 1.

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Version: 2.0

Date: June 2017

Review date: June 2019

Appendix 1

Chest drain insertion competencies Stage 1 competency	CT1, CT2, or equivalent in core accident and emergency, anaesthetic, intensive care, medical, radiology, respiratory, and surgical training	Can perform chest drain insertion with supervision by an operator (level 2 or greater) who has recent experience of chest drain insertion.
Stage 2 competency	Accident and emergency, anaesthetic, intensive care, medical, radiology, respiratory, and surgical trainees ST3/equivalent and above	It is expected that doctors within this grade will have undertaken a number of chest drain insertions and have been directly supervised undertaking the procedure on at least 2 occasions in each year. Following such assessment they may carry out the procedure independently.
Stage 3 Competency	Any senior medical personnel experienced at performing these procedures, preferably with experience in ultrasound assisted drain insertion.	These doctors are experienced and independent operators and may undertake the observation and assessment of other operators carrying out the procedure.