CHIRURGIE THORACIQUE / THORACIC SURGERY

CLOSED PLEURAL DRAINAGE AFTER CHEST TRAUMA AT BOUAKE TEACHING HOSPITAL, BOUAKE, COTE D'IVOIRE

MENEAS GC [1, 2], ABRO S [1], YANGNI-ANGATE KH [1].

1- Department of Cardio-vascular and Thoracic Diseases, and Anatomy Unit, Bouake Teaching Hospital, Bouake, Cote d'Ivoire
2- Abidjan Heart Institute, Abidjan, Cote d'Ivoire

Correspondence: Koffi Herve Yangni-Angate, Chairman
Department of Cardio-Vascular and Thoracic Disease and Anatomy Unit,
Bouake Teaching Hospital, Bouake, Cote d'Ivoire.

Introduction: Pleural drainage is the most common surgical procedure performed in thoracic surgery. It has become the care standard for the management of pleural effusion. The aim of this study was to report our experience on pleural drainage at Bouake Teaching Hospital,Bouake Cote d'Ivoire. **Patients and Methods:** This is a retrospective study from January 2010 to September 2017 of 90 pleural drainage performed in 81 men and 9 women. Mean age was 35.14 years (range: 9 months-83 years). The procedure, indications and results of pleural drainage were analyzed. **Results:** Among 115 chest trauma received, 90 (78,26%) needed closed pleural drainages Traumatic hemopneumothorax was the most frequent indication of closed pleural drainage (n=67; 93.05%) and we used the British Society of Thorax (BTS) procedure to perform all closed pleural drainage. Eleven failures (15.27%) of closed pleural drainage required a thoracotomy. There was no hospital mortality and overall morbidity rate was 1.21%. The drain was removed after 6.14 days (range 3-17 days). **Conclusion:** Traumatic hemopneumothorax remains the first indication of pleural drainage with good results and low failure rate.

Keywords: Pleural drainage, Thoracic surgery, Chest trauma.

Introduction

Pleural drainage consists of evacuating, by a chest tube, the pleural effusion[1]. It is the most commonly performed surgical procedure in thoracic surgery[2]. The first description of a closed tube was done in 1867 by Hewett[3]. After the second world war, it has become the standard of care for management of chest trauma[4]. The aim of this study was to report our experience on pleural drainage at Bouake Teaching Hospital, Bouake, Cote d'Ivoire.

Patients and methods

This is a retrospective study from January 2010 to September 2017. We reviewed 90 pleural drainages performed in 81 men and 9 women. Mean age was 35.14 years (range: 9 months-83 years). Procedure, indications and results of pleural drainage were analyzed.

Results

Procedures

Equipment

Before commencing the procedure, we have listed and obtained all the equipment required to insert a chest tube. The necessary equipment was: sterile gloves and gown, skin antiseptic solution, e.g. iodine, sterile drapes, gauze swabs, syringes and needles (21–25 gauge), local anaesthetic, e.g. lignocaine (lidocaine) 2%, scalpel and blade, suture (e.g. “1” silk), instrument for blunt dissection (e.g. curved clamp), chest tube, connecting tubing, closed drainage system (including sterile water if underwater seal being used), dressing.

Patient consent

Prior to commencing chest tube insertion, the procedure, we explained fully to the patient and consent recorded

Patient position

The patient was lied on the bed, slightly rotated, with the arm on the side of the lesion behind the patient’s head to expose the axillary area.

Site of chest tube insertion

We inserted the chest tube in the mid axillary line, through the “safe triangle” of British Thoracic Society (BTS) [5] illustrated in **Figure 1**. 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. Before insertion the chest tube, we aspirated air or fluid with a needle at the time of anaesthesia to confirm the site of drain insertion

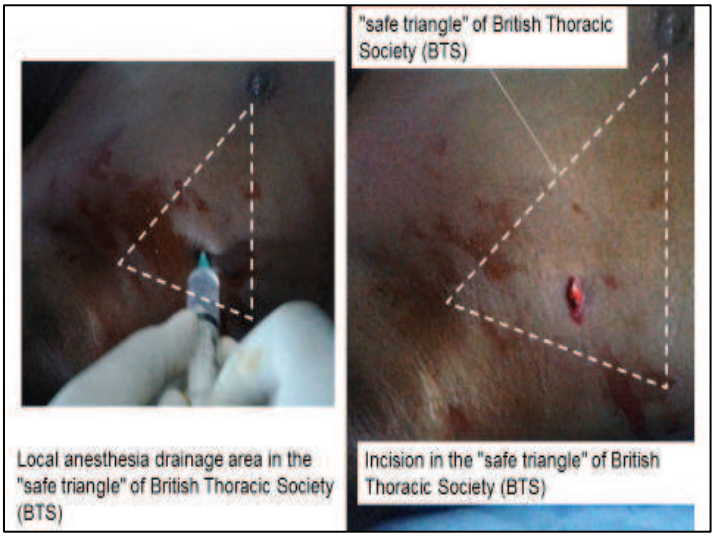

Figure 1: Picture to illustrate the "safe triangle"

Chest tube size

We used 24-28 F chest tube in pneumothoraces and 24-28 F chest tube in the case of acute haemothorax.

Aseptic technique

• We employed during chest tube insertion, rigorous Aseptic measures and prophylactic antibiotics to avoid infection complications.

Anaesthesia

• We infiltrated ocal anaesthetic prior to insertion the drain **(Figue 1).**

Figure 2: Wound dressing after chest tube inserted

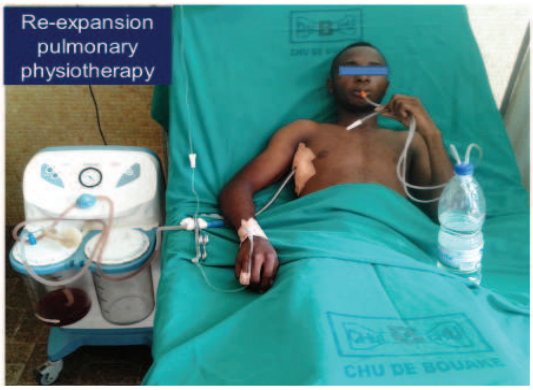

Figure 3: Picture of the patient doing the pulmonary re-expansion physiotherapy session

Insertion of chest tube

Incision

Once the anaesthetic has taken effect a skin incision is made. After a skin incision whose diameter is similar to the diameter of the tube being inserted. The incision was made just above and parallel to a rib.

Blunt dissection

We performed Chest drain insertion without substantial force by blunt dissection through the chest wall and into the pleural space before chest tube insertion.

Chest tube position

Any chest tube intrathoracic position confirmed on radiographic was considered satisfactory.

Chest tube security

We inserted two sutures: the first to assist later closure of the wound after drain removal and the second, a stay suture, to secure the drain. Using non-absorbable (e.g. “1” silk).

Management of drainage system

Closed system drainage

In all cases the chest tube was connected to a suction pump. In all cases, the dressing is done **(Figure 2)** and the chest tube was connected to a suction pump **(Figure 3)**.

Suction

In all cases we performed a non-continuous suction via the underwater seal at a level of 25 cm H2O.

Removal of the chest tube

The drain was removed once: 1) a reduction in the daily output of the drain less than 1-2 ml / kg / day for 48 to 72 hours, 2) a lack of bubbling or spontaneous, neither at the cough nor after a test of clamping of the drain 3) Pulmonary re-expansion is achieved with the return of the lung to the wall at the standard chest X-Ray. Re-expansion pulmonary physiotherapy was systématic in all patients **(Figure 4)**.

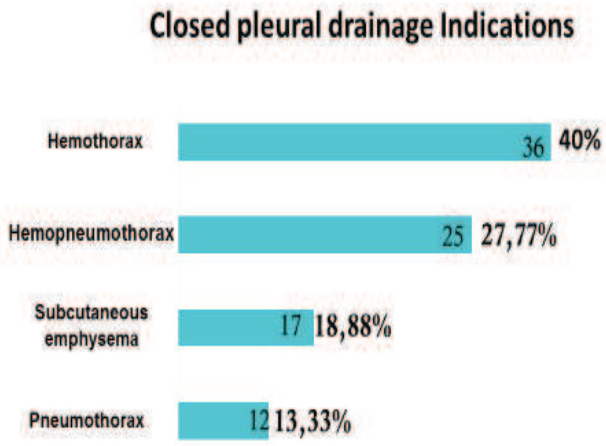

Figure 4: liste of closed pleural drainage indications

Indications

Figure 4 lists the closed pleural drainage indications. The main indications were Hemothorax (n=36; 40%), Hemopneumo-thorax (n=25; 27,77%), Subcutaneous emphysema (n=17; 18,88%), Pneumothorax (n=12; 13,33%),

Post-drainage results

Immediate Results

Immediate results were good (n=76; **84,44%**) with 4 failures cases 4,44which required a thoracotomy. There no hospital mortality. Drainage average length was **6.14 days** (range 3-17 days).

Discussion

Indications in pleural traumatic effusions

Hemothorax

According to an Eastern Association for the Surgery of Trauma guidelines[12] From the Department of Surgery in Wake Forest University in USA in 2011, pleural drainage by chest tube is the primary mode of treatment for hemothorax. large-bore chest tubes, usually 36 F to 42 F, is the traditional means used to achieve adequate drainage in adults. However, surgeons debate how large a hemothorax can be safely observed. Eastern Association for the Surgery of Trauma guidelines suggest tube thoracostomy (TT) be considered for all traumatic hemothoraces. However, previous research has suggested that some traumatic hemothoraces may be observed safely. Demetri L et Al[13], in 2018 in USA have conducted a study to determine the safety of selective observation for traumatic hemothorax and to identify predictors of failed observation.

They found that (66%) of traumatic hemothorax were successfully observed and according to the result, four independent predictors of failed observation were identified: older age, fewer ventilation-free days, large hemothorax ie ≥300 cc based on chest computed tomography (CT) scan measurements, concurrent pneumothorax. We think that the debate remains open. Otherwise, Eastern Association for the Surgery of Trauma guidelines[12] suggest that Persistent retained hemothorax, seen on plain films, after placement of a thoracostomy tube should be treated with early VATS, not a second chest tube (Level 1).

Pneumothorax

There is a paucity of literature regarding the traumatic pneumothorax optimal management, including the role of conservative treatment[14]. Current guidance by the American College of Surgeons Advanced Trauma Life Support[15] advises chest tube placement for any traumatic pneumothorax and it suggests that asymptomatic pneumothoraxes can be managed with observation and aspiration at the treating physician's discretion. Eastern Association for the Surgery of Trauma guidelines defined Occult pneumothorax as a pneumothorax that is seen on chest CT but not on plain films. It suggests that occult pneumothorax may be observed in a stable patient regardless of positive pressure ventilation (Level 3). Walker et al. In 2017in England, treated 46% of traumatic pneumothorax initially

conservatively. They found that 90% did not require subsequent chest tube insertion. Only the presence of a large hemothorax was associated with an increased likelihood of failure of conservative management. Here too, we think that the debate remains open. Otherwise, Eastern Association for the Surgery of Trauma guidelines[12] suggest that a chest drain is required in patients receiving either general anesthesia or positive pressure ventilation (PPV) to avoid a life-threatening pneumothorax.

Presumptive antibiotics and chest tube insertion

Do presumptive antibiotics reduce the incidence of empyema or pneumonia in TT for traumatic hemopneumothorax?

1. There is insufficient published evidence to support any recommendation either for or against the use of presumptive antibiotics to reduce the incidence of empyema or pneumonia in TT for traumatic hemopneumothorax.

Most authors have used the estimated volume of 500 mL, the amount needed tobe seen on plain X-ray, as the entry point into studies looking at evacuation of retained hemothorax. It is unknown whether complications of retained hemothorax including empyema and fibrothorax could be decreased by a more aggressive approach. After tube thoracostomy is performed, a repeat chest radiograph should always be obtained. This helps identify chest tube position, helps determine completeness of the hemothorax evacuation, and may reveal other intrathoracic pathology previously obscured by the hemothorax. The presence of retained hemothorax on postplacement CXR has been shown to be an independent predictor of the development of an empyema in 33% of patients. If drainage is incomplete as visualized on the postthoracostomy chest radiograph, placement of a second drainage tube should be discouraged. In a prospective randomized trial, Meyer et al[17]. showed that patients who had retained hemothorax on plain films 72 hours after initial chest tube output benefited from early VATS instead of a second chest tube. Patients undergoing VATS had significantly shorter duration of chest tube drainage, fewer days in the hospital after the procedure, and lower hospital costs than putting in a second chest tube. In addition, 10 of the 24 patients who underwent a second chest tube required surgical intervention later in their hospital stay.

Procedures

British Thoracic Society (BTS) has published guidelines[5,6]concerning chest tubes insertion training, indications, procedures. BTS has recommended the “Triange of safety” (*Figure 1*) as the site for insertion for intercostal drain. Some surgeons propose an alternative site. Thus, Kuhajda [7], in Serbia, in 2014 affirmed that for evacuation of an apical pneumothorax apical access can be used through the first intercostals space in scapular line without trocar anteriorly, due to large subclavian vessels. For him, this access is quite comfortable for the patient and easy to handle but it requires experienced thoracic surgeons to perform. in addition, it is accepted that in loculated pleural collection, the

position of insertion will be dictated by the site of the locule as determined by imaging[5]. There are three techniques to place a chest tube. The standard technique employs blunt dissection to access the pleural space. The Seldinger technique uses serial dilatation over a guide wire and third technique is by using trocar[7]

Suction system

Since the last years, the necessity of the succion in pleural drainage is controversial question. Some authors showed that applying suction to chest tubes should be avoided. Because in trauma and postoperative patients, suction has been shown not to improve pneumothorax resolution times or chest drain duration[8,9] and, in some cases, may potentially be detrimental.[10,11]. However, there is no evidence to recommend or discourage the use of suction in chest tube drainage[6].

References

1. HEWETT FC. "Thoracentesis: the plan of continuous aspiration," *The British Medical Journal, vol. 1, no. 793, p. 317, 1876.,*

2. GEORGE RS., PAPAGIANNOPOULOS K. Advances in chest drain management in thoracic disease J *Thorac Dis 2016;8:S55-64*

3. MONAGHAN SF AND SWAN K G., "Tube thoracostomy: the struggle to the 'standard of care'," Annals *of Thoracic Surgery,* vol. 86, no. 6, pp. 2019–2022, 2008

4. KESIEME EB., DONGO A., EZEMBA N., IREKPITA E., JEBBIN N., KESIEME C. Tube Thoracostomy: Complications and Its Management.*Pulmonary Medicine*. 2012; 2012:256878

5. ***D LAWS., E NEVILLE., J DUFFY.,*** *BTS guidelines for the insertion of a chest drain., on behalf of the British Thoracic Society Pleural Disease. Thorax 2003;58(Suppl II): ii53–ii59*

6. HAVELOCK T., TEOH R., LAWS D., GLEESON F., Pleural procedures and thoracic ultrasound: British Thoracic Society Pleural Disease Guideline 2010.Thorax. 2010; 65 Suppl 2: 61-76

7. Ivan Kuhajda., Konstantinos Zarogoulidis., Ioanna Kougioumtzi., Haidong Huang., Qiang Li., Georgios., Dryllis et al. Tube thoracostomy; chest tube implantation and follow up. *Thorac Dis* 2014;6(S4):S470-S479

8. Alphonso N., Tan C., Utley M., et al. A prospective randomized controlled trial of suction versus non-suction to the under-water seal drains following lung resection. Eur J Cardiothorac Surg 2005 ;27:391e4. (1+)

9. Marshall MB., Deeb ME., Bleier JI., et al. Suction vs water seal after pulmonary resection: a randomized prospective study. Chest 2002; 121:831e5. (1L)

10. Bar-El Y., Ross A., Kablawi A., et al. Potentially dangerous negative intrapleural pressures generated by ordinary pleural drainage systems. Chest 2001; 119:511e14

11. Ayed AK. Suction versus water seal after thoracoscopy for primary spontaneous pneumothorax: prospective randomized study. Ann Thorac Surg 2003 ;75:1593e6. (1L)

12. Mowery NT., Gunter OL., Collier BR., Diaz JJ Jr., Haut E., Hildreth A, et al. Practice management guidelines for management of hemothorax and occult pneumothorax. J Trauma. 2011;70(2):510-8

13. Demetri L., Martinez Aguilar MM., Bohnen JD., Whitesell R., Yeh DD., King D., de Moya M. Is observation for traumatic hemothorax safe? J Trauma Acute Care Surg. 2018; 84:454-458

14. Walker SP[1], Barratt SL[1]., Thompson J[2]., Maskell NA[1]., Conservative Management in Traumatic Pneumothoraces An Observational Study Chest. 2017 ; S0012-3692 :32917-3

15. ATLS Subcommittee; American College of Surgeons' Committee on Trauma; International ATLS working group. Advanced trauma life support (ATLS®): the ninth edition. *J Trauma Acute Care Surg*. 2013; 74: 1363

16. Moore FO[1], Duane TM, Hu CK, Fox AD, McQuay N Jr, Lieber ML, et al. Presumptive antibiotic use in tube thoracostomy for traumati hemopneumothorax Eastern Associati on forthe Surgery of Traumapractice management guideline.J Trauma Acut e Care Surg. 2012 Nov;73(5 Suppl 4):S341-4

17. Meyer DM., JESSEN ME.,Wait MA., Estrera AS. Early evacuation of traumatic retained hem thoraces using thoracoscopy. A prospective, randomized trial.Ann Thorac Surg 1997;64:1396-400.